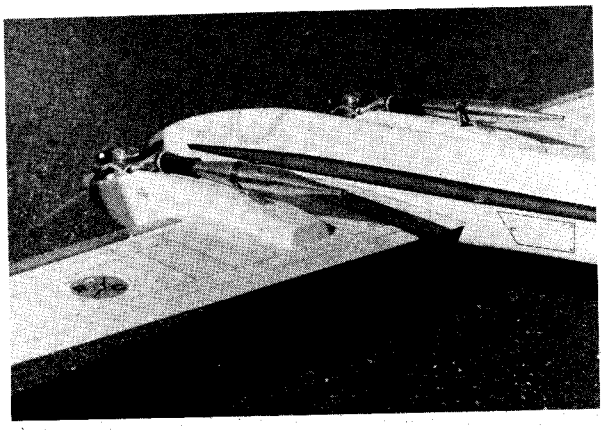
MAGNUM 80

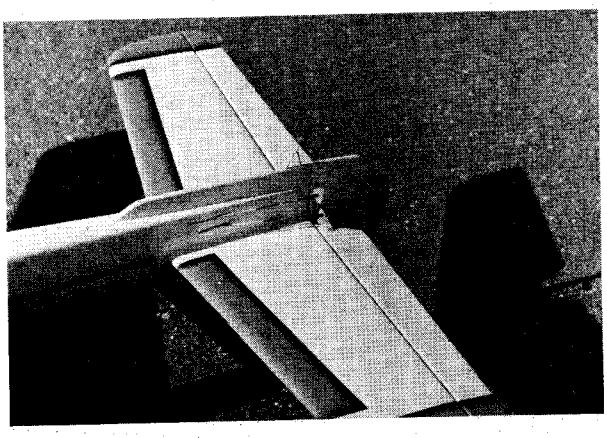
A competitive twin-engined ship that goes straight up out of sight. Two K&B .40's, new Perry carbs supply the incentive. Design meets AMA rules, a spirited performer/**Dick Sarpolus**

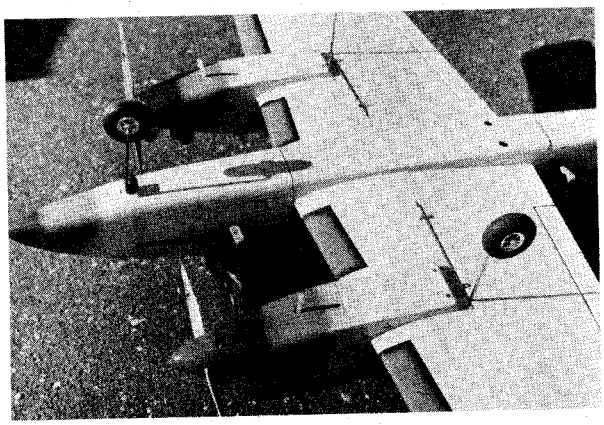
PHOTOGRAPHY: DICK SARPOLUS

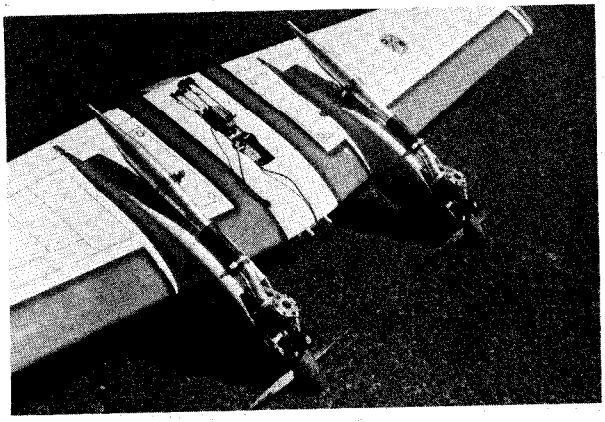
Twin engined models, although always intriguing, are not often seen on the flying field. There's no denying that they are more difficult to build and have more potential problems - but the sound and appearance of a twin are enough reward for the problems involved. I have wanted to build a twin for years but always put it off on one pretext or another. Trying to justify a twin for its performance improvement in a competitive pattern aircraft was hard due to the pattern category power limit of .60 - most .30 and smaller engines did not offer the power, idle, and reliability of .40 and larger engines. This is not true lately with the advent of better carbureted and better built more powerful smaller engines. I feel in general the larger the pattern aircraft, the better it will fly. When the Magnum .80 design was begun in 1977, the pattern engine limit was still .60, but I had decided to build a twin .40 powered large model just for my own amazement. In late 1977 the AMA announced rules changes permitting twin engined pattern aircraft to have a total of .80 displacement, with one engine limited to .60. (A .60 and .20 twin?) So now the Magnum .80 would be legal for competition.

Quite a few twin engined designs have appeared over the years, scale, sport type, and a small number of pattern types. My goal was to make a large, good looking model, utilizing powerful engines, and end up with a really competitive twin. Did I achieve the goal? Well, this model hasn't been flown in competition yet, but I believe it will be competitive with any existing pattern aircraft, and will offer the interest and thrill









Torsion type main gears soak up the jolts. All well tested design concepts, clean in planform, adequately beefed up. It could be modified for retracts. **At top:** Dick is wondering about a slightly enlarged nacelle for bigger tank? Tuned pipes add something wild to it all. Nothing tough to build on Magnum.

It's really a simple design, yet exotic in line and color. Nacelles build up quickly, soak up the vibration and stress. It's performance is astonishing. **At top:** Pushrods to the rudder and elevator exit neatly, transmit the motion without snaking around and losing servo power. Note ample tail area.

which can only come with a twin. In the end, it will always be the pilot, not the aircraft, which will win in competition.

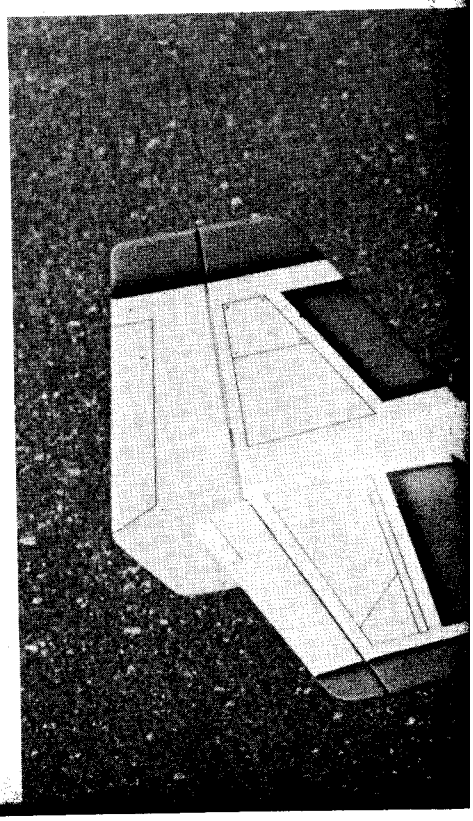
I'd like to discuss the rationale behind this design. Powerplant choice was first, and for plenty of power, the K&B front rotor Schnuerle ported 6.5s were picked. The rear exhaust naturally led to the use of tuned pipe exhaust systems, and honestly the tuned pipes were used as much for their appearance as for any power gains. No attempt was made to cowl the tuned pipes, again for appearance. A complication was the necessity for the custom pipe adapters; of course the model could be built with any type of engine, the more standard side exhaust mufflers, or side mounted engines. It was felt that the K&B 6.5s would certainly provide plenty of power.

With that much power available, the wing was sized at a 6′ 4″ span and 790 square inches area. The wing is tapered of course, with an equal leading edge and trailing edge taper planform. The engine nacelles were placed fairly close to the center fuselage with adequate prop clearance, and were made with as little overhang as possible for more strength. The nacelles would be added to a built-up wing, with the leading edges notched for the fuel tank location. The nacelle's length worked out well with the fuselage for appearance and the completed model balanced perfectly with no added ballast required. Airfoil is full symmetrical naturally, 14% thick. Built-up conventional construction was used although I believe a foam cored wing would be equally suitable.

The fuselage is constructed typical of most pattern aircraft; balsa sides, plywood doublers, balsa blocks on top to permit streamlined shaping. The fuselage sides are curved somewhat toward the top to reduce the shaping work. Designwise, average moments were used to suit the large wing, the fuselage shape and canopy placement suggests the European style, and the frontal area is kept to a minimum. Side area is felt adequate for good pattern performance. The wing is located up into the fuselage, with the engines' thrust lines and horizontal stabilizer located fairly close above the wing. The rudder and particularly the fin area is large; this was felt desirable to insure good single engine performance. Anhedral is used in the stabilizer; being honest again, this feature was used primarily for its appearance, not because I was sold on any aerodynamic benefits.

I have seen so many good flying aircraft designs with different approaches and aerodynamic features that I would hesitate to say any particular design or feature was best or even better than any other; if the design suits the pilot and the pilot is good, he is going to win.

This plane is quick and easy to build. To



rush the project along, retractable landing gear was not used, although retracts could certainly be built in. Now I wish I had taken the time to do so. It is also designed for the easiest possible equipment installation. Engines were mounted on the new Kraft aluminum mounts and since the nacelles and engine cowls are small and only 2" dia. spinners used, the engines are easily accessible. The exhaust adapters on the engines are made from stock aluminum tubing and an ⅛" aluminum mounting flange, drilled and filed to shape. A friend heliarced the pieces together for me. The tuned pipes, by International Products, their .40 size pattern style, are mounted with an automotive hose clamp to an aluminum bracket, and connected to the adapter with rubber tubing. The stock K&B cross mufflers could be used for much less work.

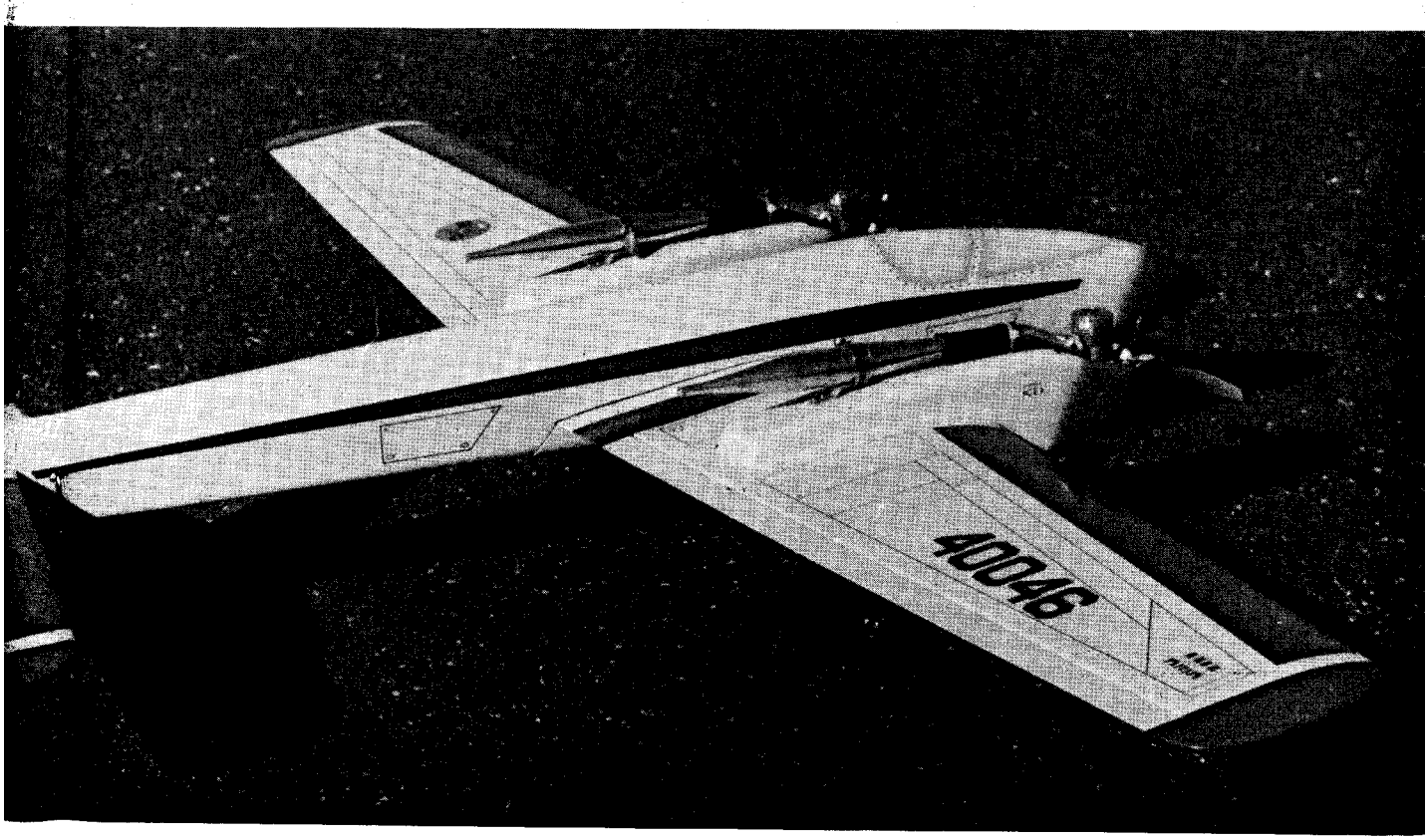
The throttle linkages are flexible cables in nylon tubing, built into the wing. The throttle and aileron servos are mounted in the wing, ailerons hooked up with the usual strip aileron linkages. Access hatches are on the bottom of the nacelles for the fuel tanks; the tanks are removable and the hatches being on the bottom result in a cleaner appearance. The fuselage houses the elevator and rudder servos. The elevator pushrod is a Y-configuration due to the stabilizer anhedral and swept forward hinge line. The batteries are packed ahead of the wing for balance. The wing is mounted with the usual two dowel pins and two ¼" dia. nylon bolts. Picking up the completed wing, with both engines and all equipment installed, is a shock due to its weight; it seems that something is wrong. But the fuselage, with so little equipment in it, is very light - the total model weighs about 8½ pounds.

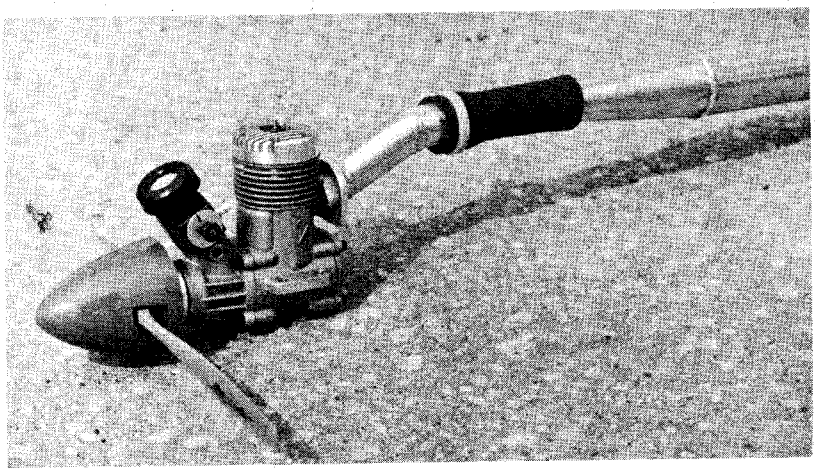
The power available is, to say the least, ample. Those K&B 6.5s are fantastic; the Perry carbs give a good, dependable idle and the power output is excellent. I have been using Zinger 10-6 props and Fox Missile Mist fuel with good results. I have not yet attempted to do any serious tuning of the exhaust setup; my thought is that mufflers must naturally be used, and any reasonably quiet muffler is going to cause some power loss - use of the tuned pipes, even if they aren't giving a power increase, should at least result in no power loss compared with unmuffled operation. The tuned pipes do give reasonably quiet operation, possibly quieter than many conventional mufflers. A comment on mufflers in general - I have spoken with several muffler manufacturers whom I find resent comments that really quiet mufflers are not available commercially. These manufacturers have offered mufflers that do an excellent quieting job, at the expense of some power loss, only to find that the modelers will not buy those mufflers. Any manufacturer, to stay in business, must produce what the customer will buy - so the most popular mufflers, which are believed to cause the least power loss, are the best sellers - and are not the quietest. Many modelers still seem to equate noise with power.

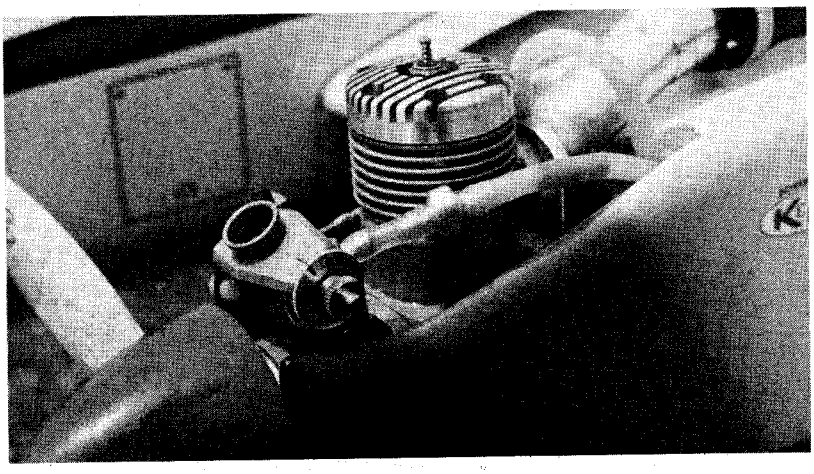
The first flight of this model was a real "kick" for me. After too much waiting for a reasonably calm day, we test flew it on a really windy day. I have test flown so many models that it's really not a nervous activity anymore, but must confess to some knee-knocking when the Magnum .80 left the ground. As hoped, it flies very well. A surprise is the ease with which it does four point and slow rolls; very little top rudder is required during these maneuvers. Another surprise was the very tight, quick snap rolls it is capable of. It will snap and spin very tightly, and will come out of a spin very quickly upon neutral control. With all the power available, it will climb vertically indefinitely - so maneuvers can be performed as large as you care to make them. The first two flights ended with single engine landings; no problem controlling the model, it came in like any typical single engine aircraft. The K&B 6.5/.40 Schnuerle, piped engines are so powerful and the model is so fast that I am sure it would fly fine with two average .40 or smaller sized engines. With the great sound of a twin engine installation and the performance available with this much power, again it makes it a real "kick" to fly.

Additional experience with the Magnum .80 has demonstrated it's single engine flying characteristics; it will fly very well on either engine. Turns can be made in both directions, I have done loops with one engine running, and the plane is docile on the landing pattern approach with either engine out. I attribute this to the large amount of fin/rudder area used and the fairly close together location of the engines. Both engines are mounted straight, no offsets used.

I did have a problem with the two engines used not coming up to speed at the same rate when the throttles were opened; one of the carbs seemed to be causing this difficulty. I spoke with K&B about this and obtained two new Perry carbs from them, unlike any I had seen before. The main carb housing has been enlarged and the needle valve has a new retention method which holds a setting positively; vibration does not back it out at all. With the new carbs, both engines come up in speed at the same rate. At the same time, I added a pressure tap to the exhaust manifolds, close behind the engines, to permit muffler pressurization of the fuel tanks. The engines do run very steady throughout an entire flight. I also obtained two Perry carbs with smaller throat diameters, which I intend to try to see if an even lower idle can be maintained. These powerful engines do burn a lot of fuel and if two .40s like this are used, the nacelles might be enlarged slightly to permit fuel tanks larger







Dick and his Magnum 80 opened eyeballs at the recent WRAM's show. And it flies better than it looks. There is no shortage of power aboard, good one-engine out performance. No offset in nacelles. **Top right:** The K&B mill with a tuned pipe, need a pair. Electric starters make it all practical. **Lower right:** The new Perry carburetor provided a smoothing touch, low speed idle and reliability.

than ten ounce capacity to be installed.

Regarding the speed of this model, it was timed once by the cooperative local police with their radar unit. On a level pass, into the wind, the speed was 109 mph. We tried some passes with a slight dive first, out of a split S; the plane was moving much faster, but the radar didn't lock on so we couldn't get another reading. Estimates are 120 mph plus; at any rate, it is quick. So far, I have had no problems with vibration, structure, linkage, etc. Control is responsive and smooth at all speeds.

Enough conversation; we'll get into construction of this aircraft. Start with the wing; when that is done, the rest is easy. If you wish to go with a foam core, I suggest as a source, Control Specialties Co., 205 Wood Ave., Box 268, Middlesex, N.J. 08846. Due to the weight on the wing, I would skin a foam core with 3/32" or even 1/8" balsa and possibly use a full depth plywood spar from the root out to the nacelles. Going with the built-up version, the ribs must be cut out first; the tabs on several of the ribs make it much easier to assemble them. The ribs are set up over the bottom spar, trailing edge, top spar, and leading edge added. Trailing edge and leading edge planking are added before removing the wing from the building board. On the other side, the trailing and leading edge planking are now added. The fixed landing gear blocks are reinforcements, or the retract mounts, should be installed now.The bottom planking is left off until the throttle linkages are installed.

Work on the wing stops until the nacelles are built. They are easy, simply 1/8" balsa sides with 1/16" plywood doublers, 1/4" plywood firewall and 1/8" plywood bulkhead. The nacelle sides are parallel, the firewall square to them for alignment. The engines are installed on the aluminum radial mounts, bolted to the firewalls. The cowl blocks are added and faired around the engines. The nacelle top blocks are added and rounded, and a channel scooped in the tops for the tuned pipes if they are to be used. The bottom hatches are 1/8" plywood, keyed in place. The wing leading edge planking is now cut back to the spars for the nacelle installation. The nacelles are epoxied in place, and the throttle cables can be routed through the ribs to the center-section for the throttle servo. I did plank the wing completely to the tip, rather than end the center-section planking past the nacelles. The center-section joint is reinforced with 6" wide fiberglass cloth and epoxy; I also ran a reinforcing piece of 6" fiberglass cloth around the leading edge between the two nacelles.

The fuselage parts should be cut before starting construction; make your own kit. The plywood doublers are contact cemented or epoxied to the sides, and the triplers by the wing opening are epoxied in place. Since the fuselage sides are to be curved in along the top, I epoxy all the bulkheads in place first, attached only along the flat lower sections. Then the sides can be curved to meet the bulkheads, held in place with tape or rubber bands for gluing. The top and nose blocks are added and shaped. The nose gear, steering linkage, and rudder and elevator pushrods must be added before the fuselage bottom planking is attached.

The fin pieces are simply 1/4" balsa sheet, epoxied in place. The stabilizer is built up and sheet covered, the halves joined with the anhedral angle reinforced with fiberglass cloth and epoxy, then epoxied into the fuselage.

I completely assemble the entire plane, with all linkages, hardware, etc., before starting any of the finishing procedure. All hardware and linkages are then removed for finishing. On this model, all faces were covered with Silkspun Coverite, followed by several coats of clear dope, sanded, then gray automotive lacquer primer was sprayed on. Any dents or scratches were filled with spot putty and the entire model was well sanded. Another coat of primer, lightly fine sanded, and the plane was ready for the color coats. I used Sig butyrate for the colors, sprayed on. The trim and canopy were airbrushed, using a Bass unit which I am very pleased with after trying three or four other airbrushes. The panel lines were inked on with a number 3 drafting pen, followed with several coats of clear dope for protection.

That wraps it up; an exciting project for me and I hope for the interested reader. Try a twin for some real flying thrills!