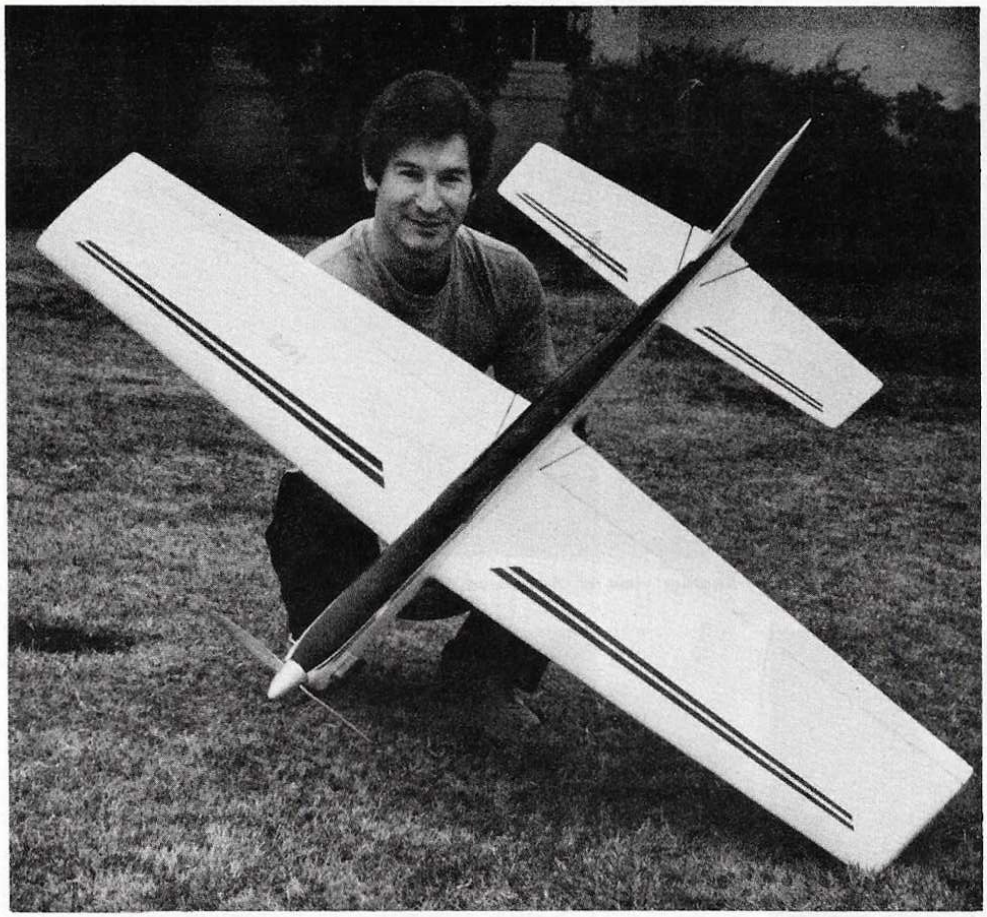


Our author with his .46 Supertigre-powered version of the Avanti. This shot shows the size of the bird.

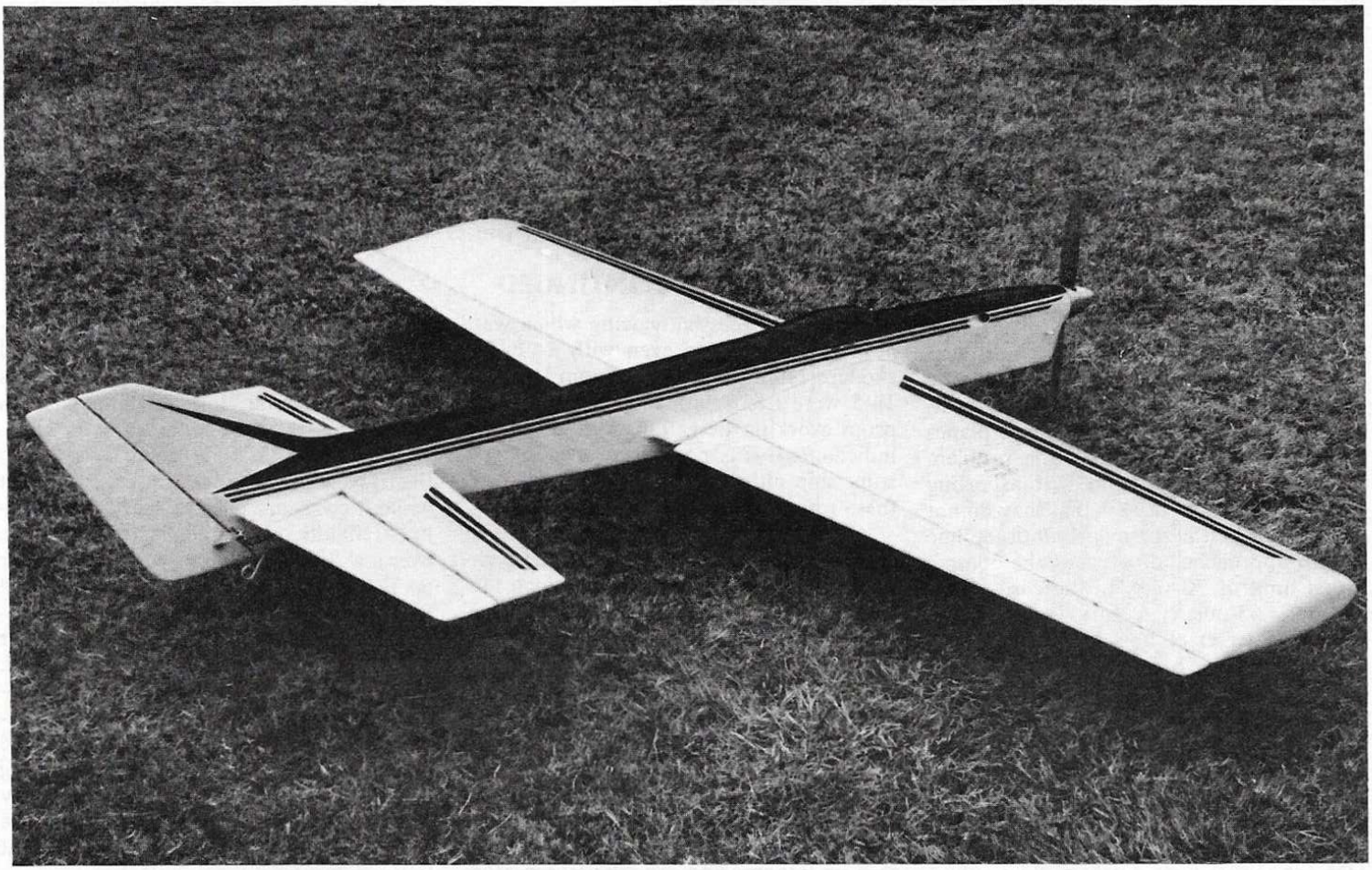
AVANTI

BY ROBERT BARON . . . With the decreased emphasis on appearance points in Control Line Stunt competition, there has come a resurgence in the flying aspects of stunt performance. Now we combine both of these features for a good-looking and fine-flying machine that does it all well!

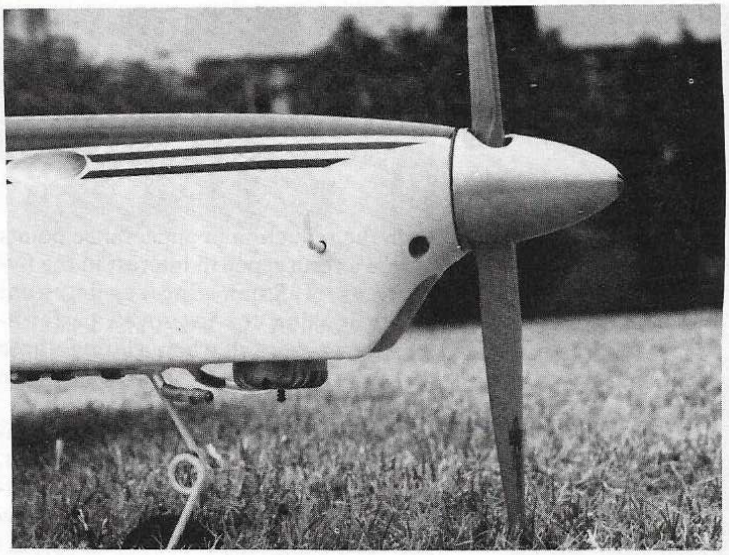
• With the reduction in appearance points has come a resurgence in interest in the flying aspects of Stunt. Once again, stunt fliers are looking for improved performance, after a period when getting those extra points on the ground seemed to be taking precedence over the flying.

Good flying stunt ships are a combination of good design *and* good adjustment. Without both, the flier will have to be satisfied with less than the best. While a low weight and wing loading are very important, a solid design coupled with careful adjustment can be a formidable combination, even if heavier than the competition. Proof of the pudding is that a very obese Avanti (82 ounces) was successful in beating the competition in Southern California.

Consistency under varying weather conditions and ease in accurate placement overcame its inability to corner sharply. Present versions weigh 60 to 63 ounces, and are now competitive in turning while

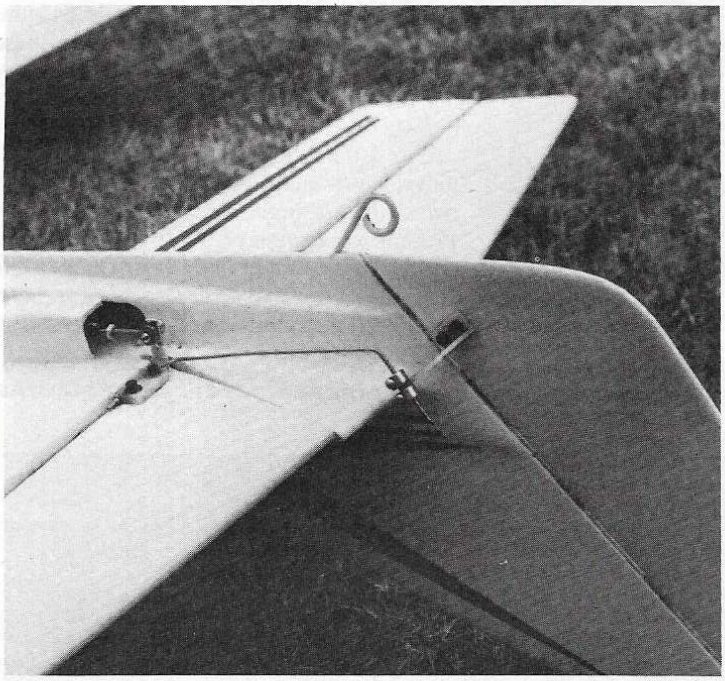


Still another view of the well-finished Stunter—as seen in photos above it is large. Here we can see the full-length flaps and note number of hinges used.

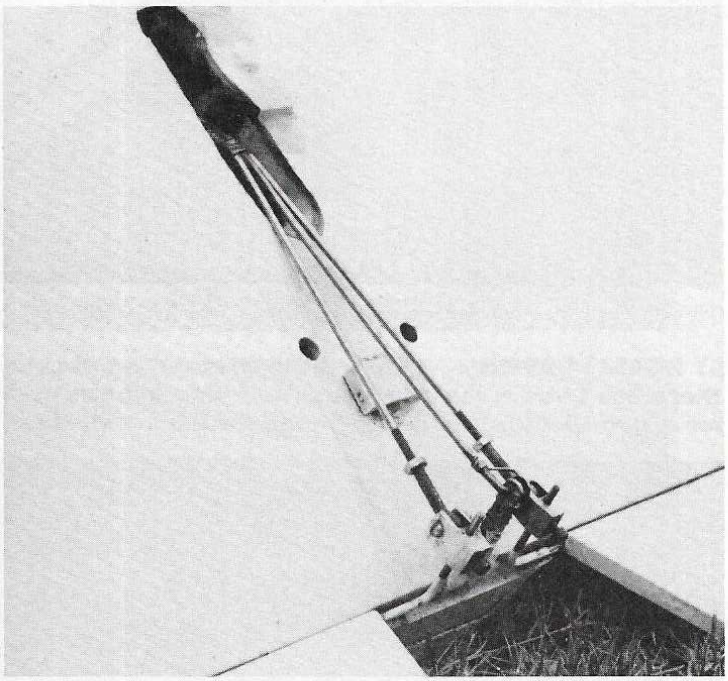


Close-up of nose, with inverted engine, head and exhaust vent showing.

Another view of nose area, showing engine and nose gear installation.



Aft end of fuselage, showing elevator push rod, with coupling to rudder horn.



The flap push rod arrangement in the bottom of the wing; note flap trim rods!

AVANTI

still retaining ease in flying.

The Avanti, like most ships, has resulted from numerous versions, each with subtle changes in an effort to improve performance. All things being equal, large planes fly better than small ones. The problem with large planes (besides transporting problems and expense) is that they do not reach their best performance until the line length approaches or exceeds the competition limit of 70 feet. In the case of the 65-inch, 63-ounce Avanti, it was flying well on 72 feet of line with a .46 Tiger, and could have handled even more line. For this reason, I have reduced the ship to a size that is suited to 70 feet or less.

One interesting experiment was to take an Avanti that was flying with a .46 Tiger, and modify the nose to accept a .60 Tiger. Although this plane was trimmed out again, the substantial increase in power did not appear to improve its flying characteristics, and in fact seemed to cause problems of excessive yawing which were never fully removed even with a "Rabe" rudder. Numerous props from 12-6 to 14-5 were tried, with the lower diameter props working best. This would tend to indicate that it is possible to overpower a stunt ship although I would not consider these results definitive.

Another area of experimentation was trying various tail moment arms. Near-identical Avantis, one with a 16-inch moment hinge to hinge (the commonly used reference point among stunt fliers), another with an 18-inch moment arm, and a third with a 20-inch moment arm were built. The longer the tail moment, the smoother the plane, but the slower the corner. The 18-inch moment arm to me was a good compromise of smoothness and quickness. While corners are important in stunt flying, you have to remember that smoothness and consistency can score lots of points. Takeoffs, landings, inverted flight, all rounds and eights, and the impression of a ship "flying on rails"—all contribute to a winning pattern. For this reason, a relatively long tail moment was kept in the latest version.

Most stunt fliers are going away from the tricycle gear to save weight. I feel that while it costs an ounce or so, it buys absolute reliability on takeoffs and landings over a wide variety of conditions. The gear on the Avanti is adjusted until in actual use it is a two-wheeled gear, i.e., the landings are made on the main gear, and after it is rolling for a while, the nose is dropped. To me, this is as pretty to watch as a two-wheeled landing, while retaining the security of the full-down panic button should weather conditions require it. After seeing the results, I have noticed, some of my competitors are going back to the trike gear. It does hurt to lose a meet on that last maneuver.

Avanti

As I am a staunch believer in the importance of adjustments on a stunter, the plane has adjustable tip weight, leadout guide, "Rabe" rudder, removable gas tank, and removable (hence adjustable) landing gear. In addition, this design incorporates a novel control system which permits an infinite adjustment of the control system over a usable range. The elevator-to-flap ratio is infinitely adjustable from 1:1 to 2:1, the flaps can be moved higher or lower to correct for roll in level flight, and can be made to move faster or slower to provide differential movement. While this idea was explored in Bob Palmer's Thunderbird, this system permits the degree of differential to be changed at will on a given ship.

My experiments to date indicate that an elevator-to-flap ratio of 1:1 has worked best. A 1:1 ratio, for some reason, makes the ship easier to fly through the corner than ratios higher than 1:1. Perhaps the additional drag created by extra flap movement dampens the control response, and makes it easier to modulate the ship. A 2:1 ratio made the ship fly somewhat like a flapless stunter in that the corners were smooth, but not abrupt enough for competitive flying. Naturally, the optimum ratio depends on center of gravity, moment arms, weight, pitch inertia, flying surface dimensions and other variables. Since most planes are relatively similar in layout, it is worthwhile to note that better performance was realized with an elevator-to-flap ratio approaching 1:1. I must admit to being surprised, as I had expected a ratio of 1.5:1 or 2:1 to be more efficient. On several ships, however, changing from 1.5:1 to 1:1 improved the performance and flyability. Since the ratio is so difficult to determine theoretically, the fully adjustable control system was incorporated to circumvent this problem. In adjusting roll trim for level flight, this control system is particularly suited, as you only have to turn the clevis on the push rod going to either flap, a turn or two.

The differential travel worked surprisingly well. By increasing the effective horn length 1/32 inch on the outside flap, it slowed the outboard flap about 6 percent. This small change was enough for me to notice a definite improvement in line tension on the triangles in near dead-calm weather. Unfortunately, I was not able to fully explore the effectiveness of this system, as the ship was destroyed in a freak accident, involving a collision with the tow cable of a person flying in a parachute, towed by an automobile. It has not been the fate of all the Avantis to grow old gracefully. A previous one was lost when an aluminum push rod went into resonance with the engine and vibrated apart, resulting in a

crash. Several others have escaped close calls with birds and spectators. The safest time of a stunt plane's existence continues to be when it is being flown through a pattern.

Another area of experimentation has been in the cooling of the engine. This plane has no removable cowl, although the engine is fairly well covered. This was done to increase the strength of the nose while eliminating the nuisance of a cowl. Bill Netzeband has found, in his test work at Testors Corporation, that the crankcase temperature significantly effects the rpm of an engine, and will override the needle-valve setting. We have all noticed that once an engine goes lean, it seldom returns to its original rpm. Once the case gets hot, the mixture is apparently more vaporized before it gets to the head, causing the engine to run lean. Once the engine goes lean, the resulting heat prevents the engine case from cooling down to a point where it will run rich again. To counteract this, cooling ducts were installed to force air over the case. This apparently has a significant effect, as I am now able to set the engine 300 rpm faster on the ground, and still get a good 2 to 4 cycle run. Prior to the crankcase ducting, I had occasional problems with overheating. The ducting would seem to be worthwhile, as any adverse effects could be eliminated by fully or partially plugging the exhaust vent. In a recent contest, the speed at the end of the pattern had increased only 1mph over the initial speed, compared to 5 to 8 mph for planes not equipped with crankcase cooling ducts.

Construction Notes for Two-Piece Planes. To date, most of the Avantis have been two-piece planes. While these are very convenient for transportation and painting, they are more difficult to build and are about four to five ounces heavier than one-piece planes. With a hatch over the flap horn and an external elevator horn, it is possible to make all necessary adjustments to the controls. The two-piece planes were held together with four aluminum ¼-20 bolts going into engine bearers, that were drilled, tapped, and helicoiled to prevent stripping. The fit between the wing and the fuselage at the front and rear was accomplished by putting trim MonoKote on an IBM card and using this as a spacer. Microballoons and resin were forced into the cracks on both sides of the card, to get a good edge at the wing/fuselage joint. The MonoKote prevented the microballoons from adhering to the spacer card. I used three cards at each joint to give adequate spacing for easy assembly. The ⅝-inch wing dowels are first drilled on a lathe (¼-inch I.D.), and epoxied inside the wing. The wing must have the center four inches covered with ¾-ounce cloth and resin. The fiillet base over the wing is 1/32″ plywood, as is the custom with R/C ships. A balsa block with 1/32″ plywood is positioned in the fuselage, to hold the elevator push rod in the flap horn after the ship is bolted together. The wing/fuselage seam at the fillet is sealed with Dow silicone rubber compound.

The various control adjustments were built in more as basic research and not as a necessity for competitive flying. Should you build this plane for competitive flying, and not build in all the adjustments, the controls should be set at 1:1 and the differential eliminated, as this is a rather subtle point. A finished weight of 55 to 60 ounces makes the Avanti fully competitive and a pleasure to fly. ■