# BEECH STAGGERWING

**BY RAY DEHN**

To almost anyone with a strong interest in aircraft, the Beechcraft Staggerwing is a fascinating and very appealing airplane. Although I cannot claim to have had an all-consuming dedication to this subject in the beginning, I have come to appreciate the ageless beauty of this airplane, particularly after flying it and seeing it in the air.

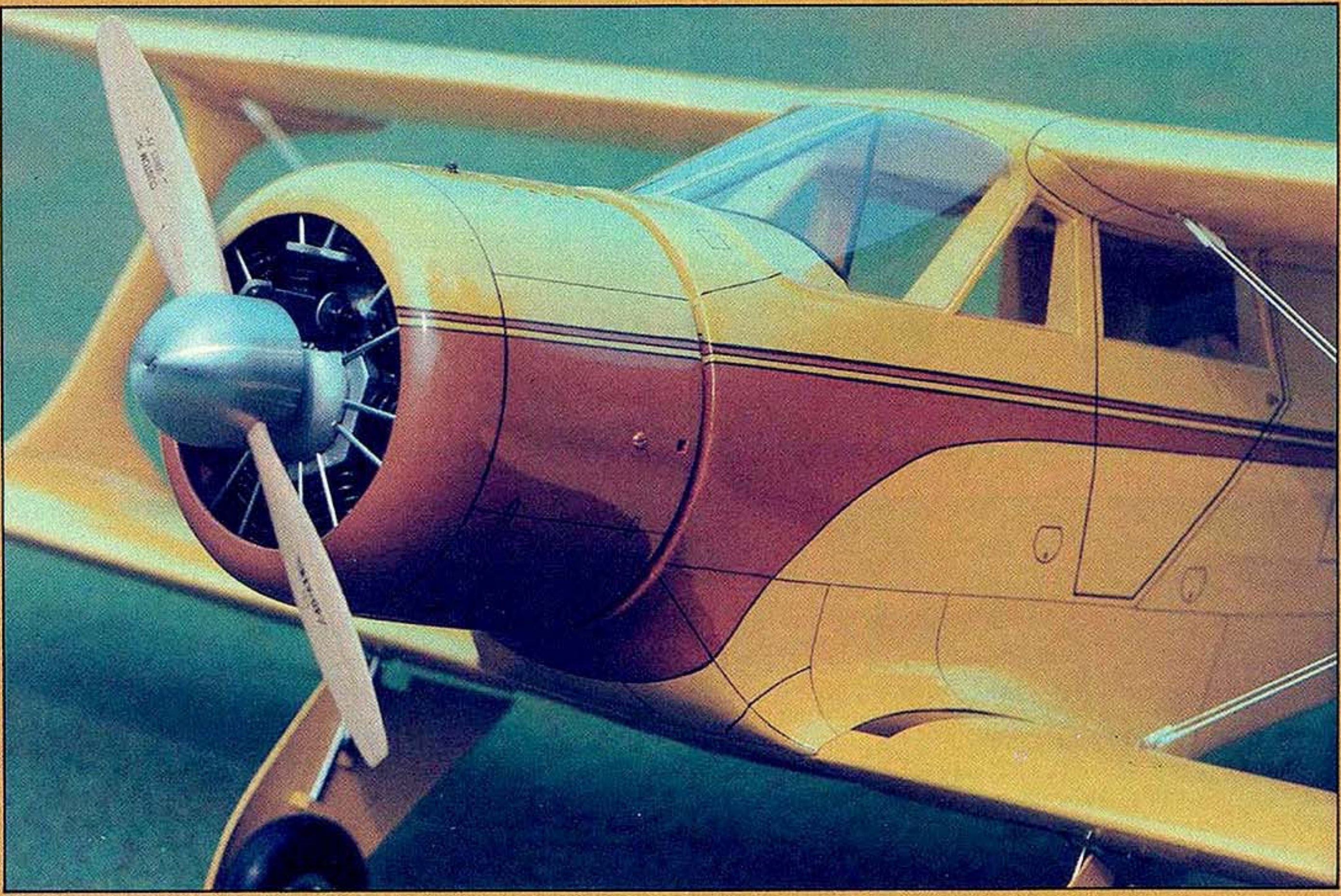
The Staggerwing marked the introduction to the marketplace of the Beech Aircraft Corp., as it is known today. Designed in 1932, and modified to essentially its final configuration by 1934, the airplane was very advanced over anything available at that time and for a long time to come. Even military aircraft could not compete with it, and its performance is still quite superior in some areas.

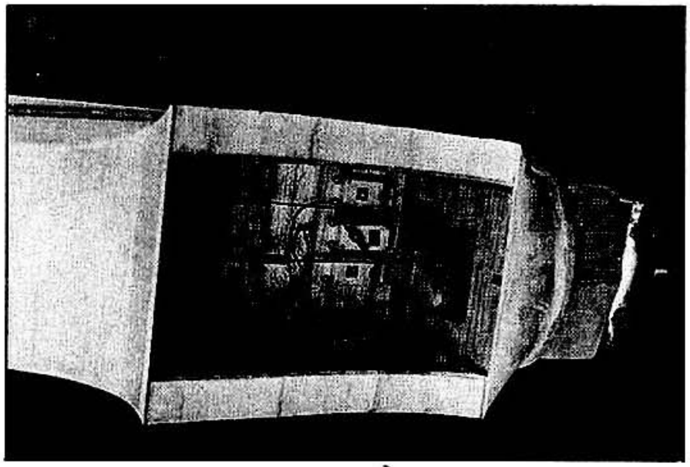
Flown by many of aviation's most illustrious pioneers, the Staggerwing became famous and has endured over the years. It was tough, fast and very stable and is a much sought after airplane today. Of the 781 manufactured, including those supplied to the military, estimates of active airplanes range from about 135 known to the Staggerwing Club to over 250 worldwide and more are in the process of being restored whenever they can be found.

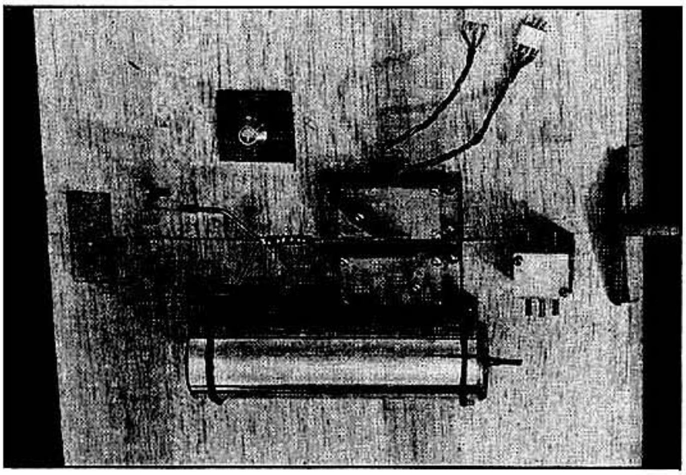
As a scale model, the Staggerwing has many virtues. Among these are retractable landing gear, flaps, plenty of radio room and, of course, the biplane configuration but without cabane struts. In addition, it is uniquely and significantly different in design from any other production airplane ever built. It also has some difficulties. The most obvious is the large radial cowl, and the fuselage, with its multiple stringers and very extensive wing fillets, is rather complex.

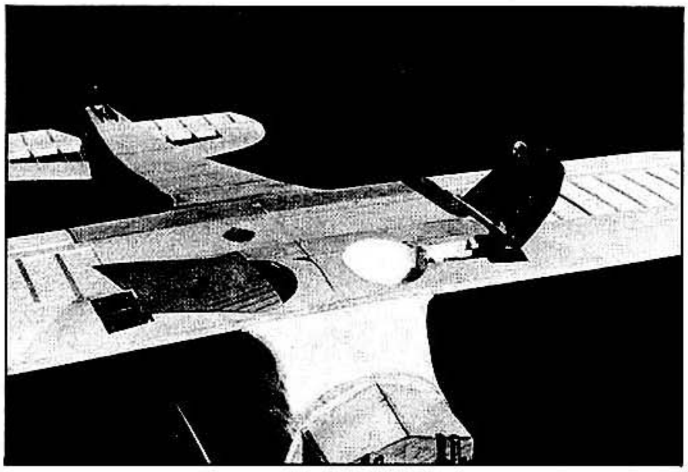
Weighing these and many other factors, I decided to go ahead with the project, especially since I could not recall any serious effort of note to create an RC model of the Beechcraft Model 17. The basic plans were drawn in September 1974, and details of the difficult areas were puzzled out as construction progressed.

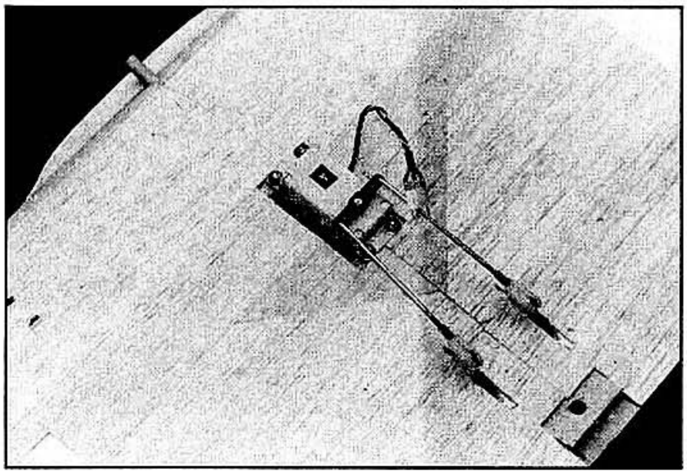
Most exact scale models are fragile in their airworthiness and marginal in their flying capabilities. Thus they get very little use, either because the builder's nervous system is not up to the task, or the airplane doesn't survive long enough to accumulate very much air time. Furthermore, at least in my case, I recognize that I have neither the patience nor the ability to build models in the class of those produced by a Claude McCullough, a Dave Platt, or any of the











other well known, true scale builders.

My goal, therefore, was to design a tough fly-a-day airplane that was reasonably practical to build from lumber yard materials where possible, and that would appear full scale or life-like in flight. With these considerations in mind, the model was drawn as a Stand-Off Scale "G" series aircraft at 2" equals 1 foot. This ratio provides a wingspan of 64" and produces a final weight including fuel of 12 pounds. It's big and it's spectacular.

A number of concessions to scale were made where I felt that the change would contribute to a better model without significantly altering or degrading its appearance. Scale diameter for the engine cowl would be 8". For several reasons, this figure was reduced to 7⅛" toward the front to 7¼" at the rear. Of course the first concern was to get as much working prop blade as possible and, in addition, to get the inside surface of the cowl reasonably close to the cylinder head so as to force cooling air through the fins. A final advantage of the smaller cowl is a "not quite so fat" fuselage which, even still, is large by any standard.

Since the cowl was slightly reduced and, of necessity, a scale diameter prop (16½") was out of the question, a spinner diameter of 2¼" was deemed to look about right as opposed to the 3" diameter that would be scale for a "G" series airplane.

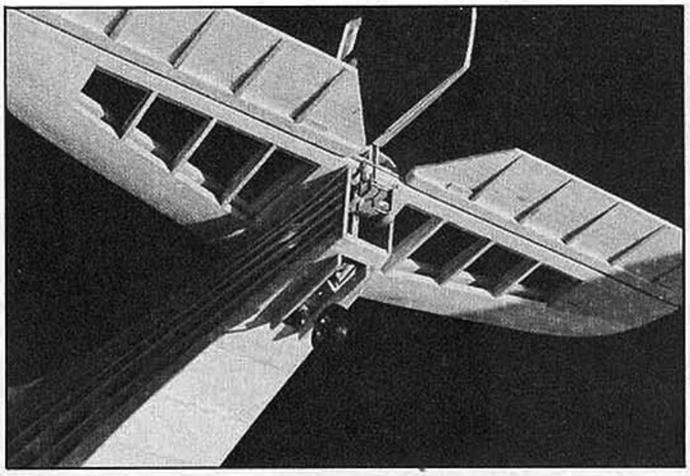
The wings were changed from a flat bottom to a semi-symmetrical section and increased in thickness by the bottom surface difference between the two sections. Bear in mind that the wings of a real Staggerwing are rather thin and are rigged or held in their proper position by the landing and flying wires. In the model, on the other hand, the wings must sustain themselves without any meaningful structural support. The semi-symmetrical section effectively minimizes the ballooning characteristic of a flat bottom airfoil, and the added thickness provides just enough wheel well room to accept a standard 3⅛" Goldberg or Du-Bro wheel.

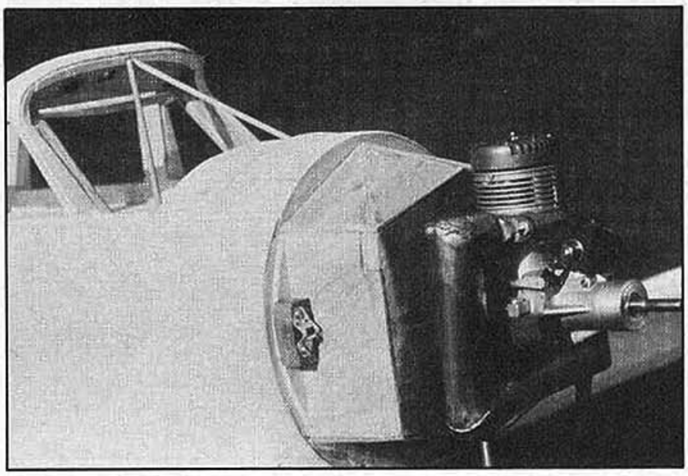
In this regard, fillet size was reduced to both top and bottom wings, and the Rom-Air retract gears were mounted sufficiently off-square to assure that the wheels would retract entirely within the lower wing planform. This arrangement makes possible a conventional lower wing attachment, thereby avoiding the problem of retracting wheels into the fillet area forward of the wing leading edge, as in the life-size Beechcraft. While still on the subject of wheels, the lower half main gear wheel doors were omitted, and the tail wheel does not retract — particularly in view of the complication presented by the fact that the pivot axis of the rudder and that of the tail wheel are separated by 3½". Actually, some restored versions of this airplane flying today have this feature removed in favor of a permanently extended wheel.

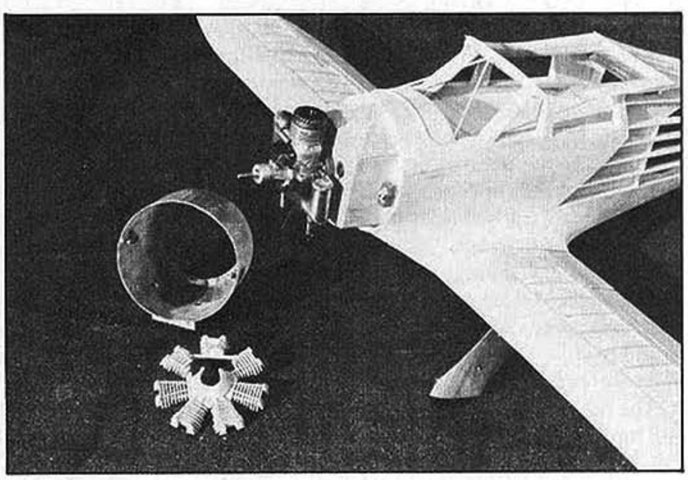
Note that the full scale Beechcraft has very extensive lower wing fillets that stretch the full length of the fuselage from cowl to tail and extend out to include the landing gear structure. As mentioned above, these fillets were shortened but, at least in my judgment, still preserve the basic appearance of the airplane. In keeping with the fillet modification, the stringers used on the model were fewer in number than those shown by Beech. If anything, less stringers on the model make the effect of the stringers more convincing in that there is a more distinct change of surface to each side of a stringer than would otherwise be the case. The bottom surface from Former F9 to the rudder post is simply cross grain sheeting with no stringers. True cross sections of the airplane show very little curvature forward of the tail wheel area and I felt that a straight surface was adequate.

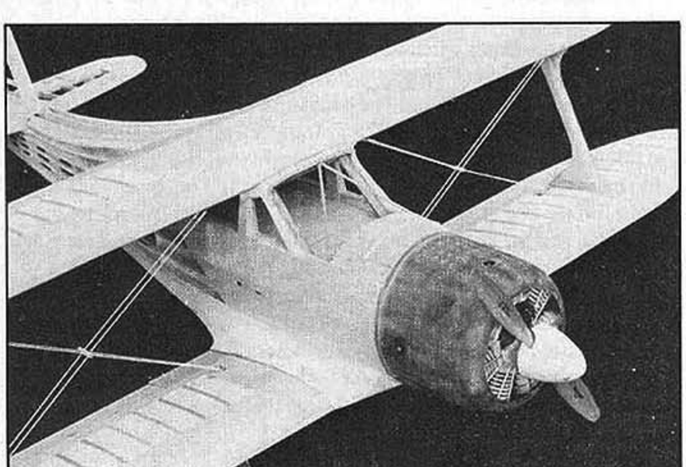
Now we come to the question of incidence angles which are unusual and present an interesting story; 2°-30' downthrust in the engine, a positive 3° in each wing and a negative 3°-40' in the stabilizer. As I understand it, the first Staggerwings were short coupled, squirrely, and rather nose heavy. A full flared landing was not possible unless the CG was moved rearward by adding a full complement of passengers and baggage. To improve this situation the tail moment was lengthened, and substantial up-incidence was added to the stabilizer. These features then required down thrust in the engine and a down trim elevator to maintain a level flight attitude. The down elevator position can be seen clearly on in-flight pictures of the airplane.

The model has a 0° engine mounting, approximately 2½° positive









incidence in both wings (1/4'' at the leading edge) and 0° stabilizer incidence. I prefer starting with 0° alignment and making subsequent modification of linkages as required. However, previous experience with biplanes indicates that 0° wing incidence is not a good idea, therefore, the 1/4'' leading edge compromise with the semi-symmetrical section.

According to information contained in the January '67 issue of ''Plane & Pilot,'' a different incidence angle for each wing, so as to effect a gradual and controlled stall characteristic, is apparently not necessary with this design. Due to the negative stagger of the two wings, '' - - *in stalls, the center of pressure on the wing panels moves backwards, instead of forward, at high angles of attack. This has a stabilization effect in stalls.*'' The article also makes the following statement. ''*At about 60 mph, the lower wing stalls first, and being in front of the center of gravity, the nose lowers a little bit before the upper wing has a chance to stall. In the meantime the upper wing retains its lift, and because of its position above the Center of Gravity, provides pendulous stability at all speeds. The ailerons remain effective in the stall because they are on the upper wing which has never stalled. Gradual turns can actually be made with the wheel all the way back and power off.*'' Actual flights of the model seem to confirm these statements, and it can be slowed to the point where it seems almost motionless in the air.

There are additional minor differences with scale that are evident when inspecting the plans but do not merit further space here. I'm sure that many will question or take exception to the changes I have made and that they will have good supporting reasons — reasons that, perhaps, just did not occur to me. I should be delighted, and I would hope that their results would be even better than those I have had.

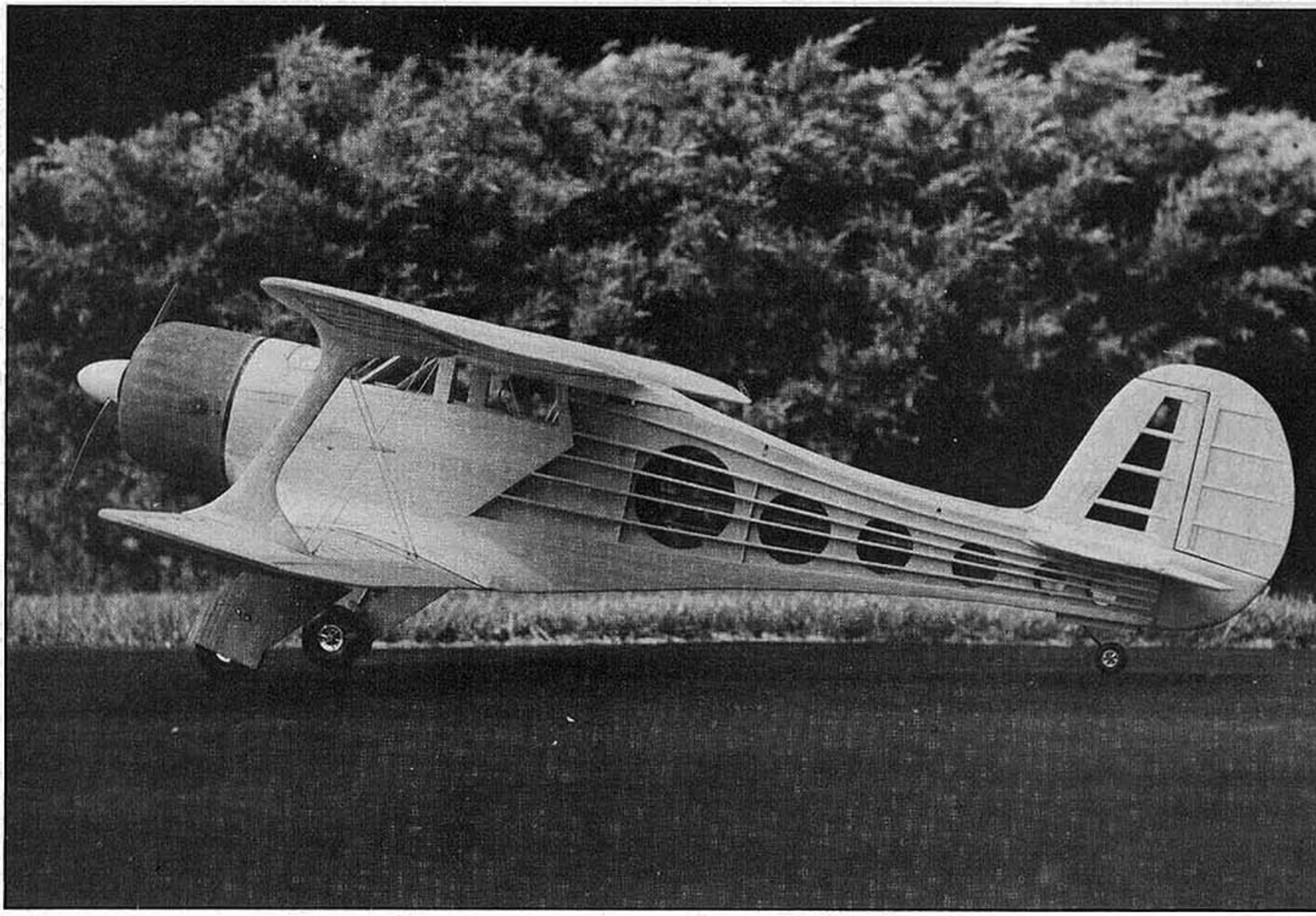
**Construction Notes**

Preliminary plans were now sufficient to start construction of the airplane which would most certainly be heavy, probably in the area of 10 to 12 pounds. I decided to go with a Super Tigre ST-G60 ABC Bluehead engine. My main concern was to avoid, if possible, a 12 pound biplane going dead stick in the air under adverse circumstances. This engine is unusually tolerant of heat, due to its metallurgy and, since it would be totally cowled from practically all directions, I felt that reliability under less-than-optimum cooling conditions was all important. To this I added very high power, dimensions that placed the cylinder head close to the cowl inside diameter as previously noted, and the fact that, as I look back, I can't say that I have ever been able to really wear out a Super Tigre engine!

At some point then, one steps back — looks at it all and wonders — will it fly? Searching my memory and, finally, my stack of R/C Modeler magazines, I re-read Dave Platt's article on his original T28B in the December '66 issue, following his win at the British Nationals. I concluded that his was the more difficult problem. An even larger cowl (8½'' dia.), somewhat less power (a McCoy .60 with silencer) and a higher wing loading. Dave commented that his model came off easily with a 13/6 prop but had somewhat impressive left rudder and elevator trim problems. I can only say that the first flight of my Staggerwing was remarkably similar. In comparison, I calculated a total wing area of 1185 square inches which at 12 pounds yields a wing loading, excluding biplane effects, of 19.44 oz./ft$^2$ — not really out of line. I decided it would fly.

About this time (November 1974) I discussed the possibility of collaborating on the project for publication with my friend Jerry Smith, and, in what I'm sure he has come to regard as one of his weakest moments, Jerry agreed. Since then he and I have discussed many differences of opinion both before the fact and after the fact. Jerry, a Contributing Editor to this magazine, prevailed most of the time — he is very, very good — and his final inked drawings reflect the best of ''how it is'' and ''how it ought to be.''

Construction surged and waned through the Winter and Spring months. Club members would ask about it and occasionally traipse over to view the proceedings. It was all very flattering. Each month the assorted pieces made the pilgrimage to the Indianapolis West Side Club meeting for commentary by the benevolent membership. Such remarks as ''lead sled'' and ''backward blimp'' did not go



unnoticed. Well just wait, I thought! He who cries last cries best.

Of serious concern at this time was the proper location of the CG, and it proved to be somewhat elusive. There are no CG notations on any plans or 3-views I have seen. I talked with two people who have owned and flown Staggerwings, and the best I could do was that they really didn't know, but it was "somewhere around where you sit." A fellow club member called Beechcraft in Wichita but to no avail. It seems that the plant was closed for vacation at this particular time, and the people minding the store were not too sure what a CG was, let alone where it ought to be!

There are hoisting hooks that, on the model, would be approximately 1½" back of the leading edge of the top wing, but this would seem to be too far to the rear. Furthermore, I was not at all sure that conventional methods of determining CG location for conventional biplanes would apply to a negative stagger design without some modification. Jerry and I talked, and even argued. Finally, taking these and other factors into account, we settled for a position about 1" back of the leading edge of the top wing. More about this later.

### The First Flight

Eventually, toward the end of June, the consequences of it all added up to a whole aircraft that, if I may be allowed the word, could only be described as "staggering." Paint and trim added to the Permagloss Coverite (again, more about this later) were patterned after "Big Red," considered by many to be the most beautiful Staggerwing flying today. This airplane (N44G) is a G17S s/n B-3 owned by W.C. Yarbrough who was a founder and past President of the Staggerwing Club. His aircraft is all red with maroon trim and black pin striping. Since I prefer yellow to red, I decided on basic yellow with gold trim and black striping. I feel that this combination turned out rather well and is highly visible. Actually, as far as paint schemes are concerned, various examples now in use sport almost every combination of design and colors that can be imagined.

The radio, a new World Engines Expert 7 channel with S-11 servos, was test flown some 10 or 12 times in another airplane before being finally installed in the Beechcraft. Its performance could not have been better, so I was confident that I need not expect trouble from this direction.

Following a short engine break-in period during the week, static pull tests were run on Friday the 4th of July in an effort to determine optimum prop diameter. The model was tied to a fixed post through a spring scale. Generally 5 pounds thrust with a .60 powered model is reasonable. Our average readings, with all parts in place including cowl, dummy engine, spinner, rigging wires, etc., were as follows:

11/7 — 4 lbs.; 12/6 — 5 lbs.; 13/6 — 6 lbs.; 14/6 — 5 lbs. 8 oz.

The choice was obvious, and the engine was then given extended full throttle runs just slightly rich with the indicated 13/6 prop to check for adequate cooling. All seemed well and the word went out that "Big Yellow" would break ground about 4 p.m. in the afternoon on the following day, Saturday, the 5th of July.

These are the times when you wonder why you ever get into these things. There were many people and many cameras. I tried to contrive what I thought would be a reasonable flight procedure and tried it out on Doc Griffin and Tom Mooney, immediate Past Club President. Our field has two hard pan runways approximately 30 ft. wide by 300 ft. long that cross in the center, and I reasoned that, from a full throttle start, if the Staggerwing was not airborne by the time it reached the crossing runway (160 ft. on the east-west runway — I paced it off), I would kill the throttle. Actually my problem was psychological and, really, rather simple. The more I looked at it, the more I became convinced that this 12 pounds of unusual airplane and fuel could not possibly fly. Nevertheless, Doc and Tom along with several others, nodded a sort of concerned agreement with my "strategy," but I got the impression that they were thinking, "I'm glad it's his airplane and not mine."

In my favor, it was apparent from the gathering clouds that a storm was fast approaching and I thought, "If I can dilly-dally long enough I might delay and re-group another day."

Nothing worked! The damned Super Tigre was choked and started on the very first flip, and full throttle just plain would not sag off and so, reluctantly, it was time to fly.

At the moment I motioned to Tom to let it go, all the various schemes and mental devices which you had neatly pre-arranged in your mind so as to assure success became non-existent. You do what you have to do.

And you do it quickly! The take-off roll was certainly less than 50 feet, and it was hard left and nose high. Each time I view the film footage, I realize how fortunate I was to have avoided a snap roll. But, somehow, the airplane became sufficiently level in time, and I had at least enough horsepower to pull it through. While holding in the necessary corrections, altitude was gained to allow me to catch my breath.

Full right rudder, right aileron and down elevator trim helped but were not nearly enough. The throttle was reduced to about half and then to one quarter to offset the tendency to climb, and a few lazy circles and figure eights were flown. After perhaps 4 or 5 minutes, sombody said, "I wonder how it would look with the wheels up?" Wheels? Wheels up? Oh! Well, I believe I'll try that, and it certainly looked very good indeed.

Trying to get the nose down for the landing was the only real problem left, particularly since it was apparent very early in the proceedings that elevator response was much too quick. But I did get it down, and the storm was upon us, and the rains came, and I must admit that I was very, very pleased.

**Some Conclusions**

First and foremost, the airplane, if constructed according to the plans, is very strong and will sustain rough treatment. On two later flights, I have had to ditch into soybeans due to loss of power. In the first instance, the clunk line had become wrapped around the vent line in the fuel tank and eventually uncovered the clunk — at the worst possible time. This condition resulted from a snaproll from about 6 feet on the previous attempted take-off when I tried to get it airborne much too soon. In the second case, being overly concerned about engine heat, I had idle mixture too rich. The flight plan was low and slow for picture taking, and after an extended time, the engine died rich, again with no place to go.

Soybeans are excellent "grabbers" and offer no real support to a 12 pound airplane. After these three confrontations, two with the beans and one with the runway, damage was confined to the lower wing; leading edge dowel broken twice, nylon bolt anchor block pulled out twice (no damage to the nylon bolt, of course), and mounting blocks for each main landing gear have been broken. These blocks were designed in essentially a break-away fashion, the theory being that if the gear is to part company with the wing, the wing will at least remain intact. The theory works well.

After the second up-ending in the soybeans, a fellow club member viewed the lack of damage to this very large airplane and commented, "That is some tough bird." In general, the lower wing, being placed well forward, will suffer the brunt of a poor or forced landing. Cowl construction seems adequate since it has sustained only scuff marks to the paint. The flexibility of Jerry Smith's hold-down design is also a contributing factor. The cowl will move and even pop loose under stress.

## CONSTRUCTION

It seems certain that anyone who might undertake to build this airplane will be proficient and will probably have their own way of doing things. Therefore, step-by-step construction procedures would be, I'm sure, rather boring, almost endless, and of little value. In addition, Jerry Smith and I, and particularly Jerry, have tried to make the plans as self-explanatory as we could while limiting ourselves to three sheets. In this regard then, only certain areas will be given detailed treatment.

**Engine, Cowl & Muffler**

A 7¼" diameter empty cowl on the front of a large, mostly scale airplane would certainly be lacking in appearance. With all that room inside the cowl, it was decided that a muffler design consisting of four basic "legs" would be an excellent arrangement. While looking for a suitable material from which to fabricate such a muffler, I hit upon a standard 1" shower curtain rod which, at the time, cost about three dollars for a 6 foot length — enough for many mufflers. This tubing is chrome plated thin-wall brass. It's light and strong and takes silver solder extremely well. As noted on the plans, a 1" dowel was inserted into the tubing for support when making miter cuts.

A flange was added at the vent end of the muffler that fits under the rear engine mounting screw. This tie-down provides a solid, vibration resistant and therefore long-lived installation. The final configuration is effective, and the large volume of the expansion chamber does not detract from engine performance. The sound level could be even further reduced by wrapping each leg with asbestos paper secured with silicone glue or wire or both.

Many Staggerwings have installed, or have been refitted with the 9 cylinder, 450 h.p. Pratt & Whitney 985 engine. In search of a good scale appearance, and in keeping with my admittedly low level of ambition, I decided on a 7 cylinder version. A further concern was to build as porous a structure as I could so as to reduce drag and to permit adequate cooling to the ST-G60 cylinder head. In this respect, the dummy engine actually serves a constructive purpose beyond the obvious advantages of concealing the muffler and filling the cowl. The fins on the top center cylinder were deflected upward to direct cooling air at the Super Tigre cylinder head, and an additional deflector baffle was mounted to the back side of each adjacent cylinder to again focus air to the head. Finally, a pattern of twenty-five 3/16" diameter holes were drilled in the cowl behind the head to increase the exit area.

Perhaps not all of these precautions are necessary, but proper cooling is preferable to overheating. The heat that flows from the hole pattern and from the rear cowl gap is most impressive, and the engine can be run through a full tank at full throttle without sagging. Of course, the icing on the cake was when Jerry remarked, "I can't get over how real that engine looks."

The dummy engine is free floating rather than being fastened in place in any way, and centers itself on the front bearing structure of the real engine. The cowl, in turn, centers itself on the outside circle of the dummy engine. The Kraft-Hayes nylon motor mount was trimmed to length (3-5/16") equal to the distance from the firewall to the front surface of the real cylinder head. When assembled, the dummy engine seats firmly against the motor mounts and cylinder head as the cowl snaps into its hold-down clips. In fact, the dummy cylinders are bent backward slightly by the cowl when all parts are in place. A real virtue of this system is that the cowl and dummy engine do not seem to deteriorate due to the effects of prolonged engine vibration.

**Windshield & Cabin Windows**

This area of construction could be best described as tedious. Each window, as well as the windshield opening, was constructed with an indented border, or sill, approximately 1/16" wide by 1/16" deep. Plastic window panels were cut to fit snugly into each recess.

The windshield was definitely a cut-and-try procedure, and the outline shown on the plans will fit my model but can only be used as a place to start when trying to fit another version. All window panels were fixed in place with adhesives such as Hot Stuff or Zap.

**Landing Gear**

In keeping with the really excellent instructions provided with Rom-Air retract gears, all parts were located on the lower wing. When installed in this fashion, pneumatic connections are permanent, and the Freon charge is not lost when removing the wing from the fuselage. As mentioned previously, the mounting blocks are hefty enough to cope with almost any reasonable landing but will give way on abrupt impact without tearing out lower wing internal structures. The strength required is a matter of judgment, but the arrangement shown seems to be about right.

Since the only external access to the Freon fill valve would be through the bottom of the wing, the valve was recessed to the inside surface, and a removable cover plate was constructed so as to keep engine exhaust oil from entering the system.

After the plywood wheel doors were bolted and screwed to the main gears which had been fitted in place, the doors were curved to fit the bottom surface of the wing as described on the plans. Lightweight fiberglass cloth was then applied to the outer surface with polyester resin to provide a base for finishing. It was necessary to fit a small pine wedge between the landing gear spring coil and the wheel door just below the bolt in order to properly align the wheel door tangent to the wing surface at the landing gear pivot line. This wedge was then glued to the wheel door.

**Wings & Tail Surfaces**

The wings, like the rest of the airplane, are of very sturdy construction, I suppose because it's just my way of doing things; pine leading edge and spar, plywood tips and even plywood sheeting in high stress areas. Perhaps I am unlike other people in even more ways than I realize, but I do as much damage to airplanes in one season transporting them through doorways and in and out of automobiles as I do flying them, and the bigger the airplane the worse the problem becomes.

About once a year I go to the lumber yard and purchase an eight foot clear pine 1 x 6, making sure to get one that is straight or, at most, has only a small curve in the center leaving two relatively straight four foot sections. A year's supply of spars (1/4" x board width), leading edge stock (approximately 5/16" x 1/4") and sticks for many other uses such as servo rails are cut on my table saw. Wings seem to wear well when built with these harder materials around the edges. For example, I have an old biplane with hardwood wing construction that has been flown and knocked around on a regular basis for 8 years and still looks good enough to show.

The wing templates provide a basis for construction back to the hinge line only. I made two additional small templates to generate the foam cores necessary to build the center areas between the ailerons and between the flaps. The main cores were first joined in the center, the 1/4" x 3/4" balsa "spar" that establishes the hinge line glued in place and then the bearing blocks and trailing edge cores were fitted to their proper positions.

Two sections of the lower wing main spar were removed to clear the wheel well area but plywood sheeting effectively bridged the gap. Moreover, the Coverite, which is very strong, was applied with a 4" overlap in the center panel.

The capstrips show up in the finished airplane as realistic ribs and are made from leftover 1/16" sheet. A further advantage to this method of covering foam wings is a saving of both weight and good balsa sheet.

Experience shows that lower wing damage as a result of bad landings occur in two places. The leading edge dowel will shear flush with the plywood dowel support, and the nylon bolt will pull through the wing and take the 1/4" ply reinforcing block with it. Getting the broken dowel out of the wing is difficult when it is glued in with excessive enthusiasm. Therefore, after removing one servo, the new dowel was put in position flush with the front servo rail and epoxy applied at this joint and to the leading edge support so that the glue joints are accessible. Of course the rear plywood block was just glued back in place.

The tail surfaces were constructed starting with a flat surface framework (stab and fin) or sheet (elevator and rudder) then building up one side after which the assembly was turned over and the other side added to match.

**Fuselage**

Before sheeting the forward section of the fuselage, a reasonable pattern of spacers fashioned from scrap balsa was glued in place to bridge the gap between stringers and provide support for the 3/32" sheet. This step was particularly helpful in supporting the rear edge of the sheeting such as is defined by the aft cabin door outline. Since the grain of the sheeting is necessarily parallel to the stringers, these vertical fill-ins between stringers prevent sagging and offer resistance to damage from handling.

Because the airplane is large, it was decided to adhere to scale and keep all control horns within the structure especially since the fuselage sides are separated by 1-5/16" at the rear. There are probably several good ways to construct the control linkage to the tail wheel and rudder. The arrangement shown seemed easiest to me short of moving the tail wheel back to the rudder hinge line. A spacious compartment behind Former F9 was built to house the receiver which makes for an optimum radio installation.

**Covering — Finishing**

Permagloss Coverite is a rather interesting material that requires somewhat different application techniques than are used with plastic films. Mike Corbett, who writes our club newsletter and is an occasional contributor to these pages, offered the following comments in a recent issue of the club paper.

*"When something really good comes along I just have to say something. This time it's Permagloss Coverite. I've covered two planes with it and must admit it is very good stuff.*

*ADVANTAGES*

*- - more realistic looking airplane.*

*- - wood grain doesn't show through.*

*- - easier than plastic to work with.*

*- - strength superior to plastic film.*

*- - trims easily with dope.*

*- - covers curves better than film.*

*- - doesn't sag or lose tension after a while.*

*- - does not show scuffs or scratches.*

*DISADVANTAGES*

*- - seems slightly more visible.*

*- - slightly more expensive.*

*- - sealing iron tends to catch rather than slide.*

*"Ray Dehn shoots a coat of clear dope over the plane after covering (only if trim paint has been used). Here's something they don't tell you in the directions--this stuff has grain, that is, it shrinks more in one direction than the other. The direction of greatest shrinkage is parallel to the selvage edge, which is the edge that first comes off the roll. Cover the wing with this edge parallel to the span of the wing and the material will stay flat after it shrinks down. For a finish that swoops in-between the ribs and shows off structure like a good old silk and dope job, cut your wing panels at 90° to the selvage edge. Whatever you do, be sure to cut all wing panels lined up the same way on the material."*

The finished airframe was first sprayed in a matching color, acrylic lacquer in areas that would not be reached with the Coverite. In addition to the cowl, these areas included the cabin and nose section forward of F2 and F3, the wheel wells and inside surface of the wheel doors, the inside of the wing access areas and matching wing center panels, tail openings, and, of course, the interplane struts.

In covering the Staggerwing, I felt that I could make the visible seam problem actually work in my favor by locating these seams so as to correspond to the panel seams of the real aircraft wherever possible. An inked line would then be drawn along the seam to simulate the pattern of the actual panels. This could be considered a proper approach to planning the covering procedure because metal panel limits, as determinted by Beech when the aircraft was designed, are not unlike the limits that should be observed when covering the model. All overlaps were directed rearward or downward which meant that the covering sequence was from back to front and from bottom to top.

When covering a concave, compound surface such as wing fillets, the instructions supplied with the Coverite work well. Starting in the center area of the panel with the sealing iron in one hand and a pad of Kleenex in the other, it was a fairly rapid process of heat and press — heat and press. The rounded top surface of the iron was helpful here, and only short touches were required. I have also found the pad of tissue to be handy in holding down any troublesome seam during the cooling cycle.

Coverite adheres best to a doped or lacquered surface. I used vinyl spackling compound to fill in some fillet areas, and the Coverite would not stick to it. A quick coat of clear dope solved the problem nicely.

After covering, the trim color was added using conventional masking and spraying techniques. Another thing not mentioned in the Coverite instructions is the advisability of using plenty of plasticizer in the paint. Apparently Coverite has a different thermal expansion coefficient than lacquer and is also very pliable. Without sufficient plasticizer such as Southern Products' "Flex-All," the painted surface will craze and spiderweb rather quickly.

All surface details and panel lines were applied with a standard technical or drafting pen (I used a Koh-I-Noor model 3060 No. 3). The ink is the type used for working on mylar (Pelican T) and is **not** waterproof. Errors can be wetted and erased easily, and this ink, while not fuel proof, will stand up to a sealing coat of clear dope or acrylic lacquer. Standard waterproof inks available from most drafting supply houses will not "take" to the Coverite, are not fuel proof, and will run like wet mascara when hit with lacquer.

Inked details included fuel tank vents and caps, access panels, trim tabs, doors and handles, oil tank cover panel, flare locations, all metal panel parting lines, cowl seams and latches, etc. In addition, the black pin striping around the borders of the trim color were done with ink as well as the Beechcraft fin insignia and registration numbers on the rudder.

**Flying Characteristics**

This is an airplane I fly carefully. I doubt that I could do otherwise, and I readily admit to being the victim of psychology. Its size and weight would assure substantial damage in an out-of-control crash, and I would hate to have it happen as a result of pilot error.

Following the first two flights I was forced to conclude that the CG was still too far back. Since there were no significant weight shifts available, an 8 oz. lead nose weight measuring 3½" x 1" x 3/8" was cast and bolted to the firewall below the motor mount. This addition moved the CG to a point 1/2" back of the top leading edge and increased take-off weight including fuel to approximately 12½ pounds. Under these conditions, the Staggerwing comes off in a normal fashion, and elevator response is quite smooth with good flare capability for landing.

The model looks real in the air, and its flying "feel" is rather majestic, perhaps not unlike driving a limousine. It obviously will not win any pylon races, and it cannot be horsed around. The airplane does all the things expected of it, but due to its size and inertia it takes more time and air space than usual for things to happen, and it is often further away from me than I think it is.

True to its real life counterpart, stability is excellent, and I have noticed that the nose does not seem to drop in the turns. With more than the slightest amount of up elevator, the whole turn can be made in what almost seems a stall condition but with no evident instability. The take-off requires some steering and rudder deflection to counteract P-factor and torque effects, and I have learned to let it run until it just about comes off by itself, a distance of about 150 feet on short grass. Right rudder trim of 1/2" is required on my model for straight, hands-off flight.

The flaps work very well and, again, point out the stability of the Staggerwing configuration. When checking for equal left and right flap deflection, it was found that the output arc of a rotary servo causes the two flaps to track differently. The horn of the flap with the least deflection was shortened by drilling additional holes until both flaps achieved the same maximum deflection.

Lowering the flaps seems to noticeably slow the airplane without otherwise affecting its flight characteristics. With plenty of altitude to work with and about 1/3 throttle, I tried 10° of flap with no problem; then 20° and still no problem; then full flaps and all was well. This procedure was repeated at low altitude to closely observe any deviations of flight trim. At the very least, I expected a small nose-down pitch change, but none could be detected. With full flaps, the airplane simply flew at reduced speed but with normal stability. When landing the Staggerwing, I now lower the landing gear and full flaps, usually on the down-wind leg, and it's just slow and easy to flare and touch down.

**Conclusions**

The negative stagger biplane configuration is obviously a superior design. It would seem to me that a .40 to .60 size quickie kit that would approximate the appearance of the Beechcraft Model 17 would have marketing possibilities that might be profitably explored. Certainly such a model would be appealing and well suited to the sport and Sunday flyer who would like to try a stable, easy-to-fly biplane. Moreover, the design is perfectly suited to the addition of retracts as an option.

This has been a rather extensive project for me, and I can well imagine how involved it would become if the airplane were to be built to compete in full scale competition. I'm quite pleased with my results, but this is as far as I shall go with it.

What I am leading up to is this: In the event that anyone should desire to build this model, I would be happy and delighted to know about it and to correspond with the builder. However, I must decline to supply any special parts such as cowls, spinners, wing cores, etc. My reasons are simply that I have neither the time nor the ambition to do so.

I suspect that if I were to build another Staggerwing I would construct a fiberglass fuselage using the foam techniques described by John Woods in the April, May and June '75 issues of this magazine. There might be several areas of difficulty, but I'm sure they could be resolved.

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