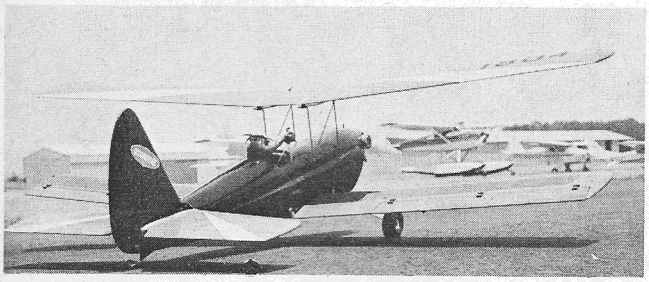
Fully recovered from his recent illness, our author poses with his slick bird. Very functional, the Duster also has all the excitement of a Bipe.

THE DUSTER

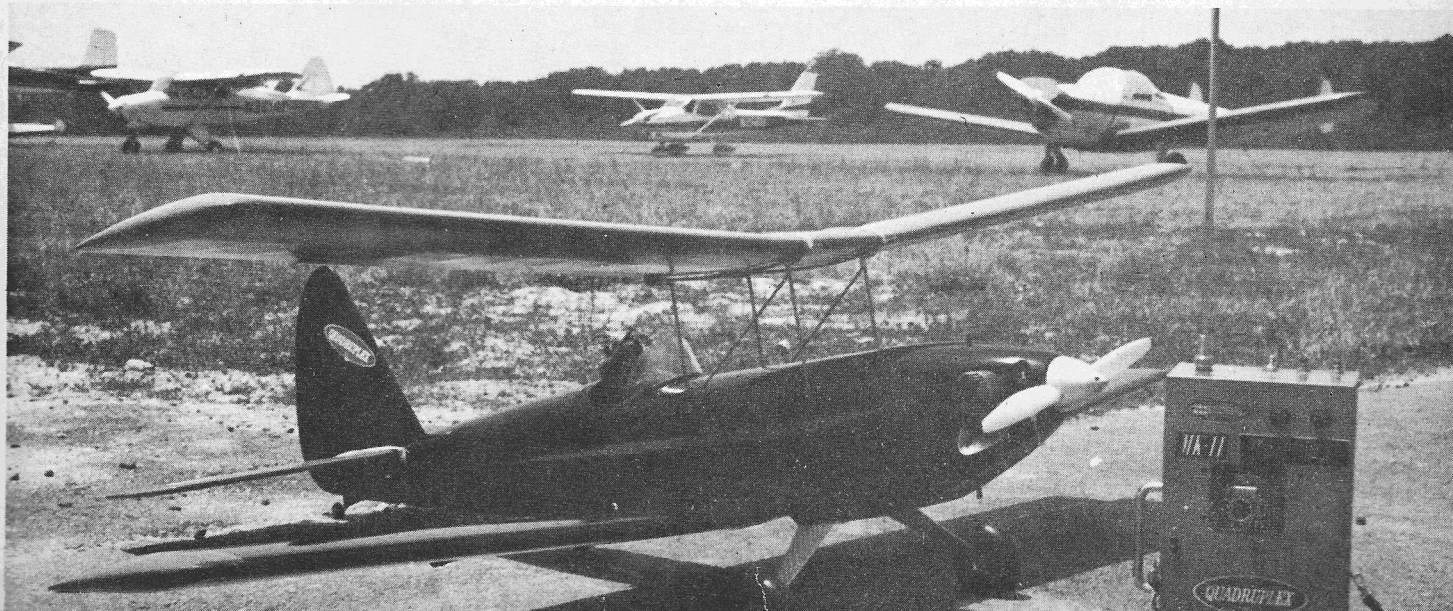
By BILL NORTHROP . . . WHO CAN RESIST THE APPEAL OF A BIPE, EVEN MORE SO WHO CAN RESIST THE APPEAL (?) OF THE PILOT SO FIRMLY ENSCONCED AT THE CONTROLS. IF YOU HAVE HAD THE DESIRE FOR A BIPLANE, THEN YOU JUST HAVE TO BUILD THE DUSTER.



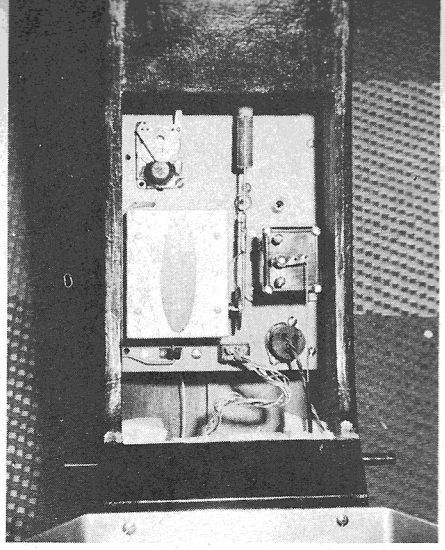
► Most of us, ahem, older fellows have a mania for biplanes, stemming from some pleasant association in the dim, dark ages of pre-war (II) aviation. If it makes you wince to hear someone identify a bipe as a "double-winger" or a "plane-with-a-wing-up-top-too," then you know what I mean.

As a kid, I came away from visits to the local airports with my memory compartment full of Wacos, Fleets, Eaglerocks, Travelaires, Great Lakes, etc. Each one was a thing of functional beauty. (*Continued on next page*)

On the tarmac, even at rest it has that quality look long associated with aircraft of the era prior to our present sleek, rocket-type aircraft.



Slow and steady, also reliable is best way to describe the Duster's flight characteristics.



A look inside, plenty of room to get your fingers and even your hands at the radio equipment.

Here we have the pilot, don't know why Herbert the quiet, was substituted for good old Yogi Bear.

Its fabric-covered surfaces gave off glistening, symmetrical reflections as the covering stretched tautly from rib to rib or from stringer to stringer. The beautiful solid colors of black, orange, yellow, red, white and blue weren't chopped up with meaningless, angular, jagged, multi-colored "decorations." The engines, usually sticking out in the breeze, were big, gusty, slow-revving, fire-breathing monsters which ran with a deep, throaty, chest-thumping, ear-bursting sound; not much bhp, but having tremendous torque with which they could push a big wooden prop around as if it were a yardstick.

On the ground a bipe might rock and bump and stumble around in its two-wheel gear like a wounded duck, but that's only while taxing to and from the flight strip. Once it was storming and high-tailing down the runway for its long, smooth, gradual climb-out into its proper element, it became a thing of graceful beauty. And who could have lived in that era without remembering, as a biplane maneuvered for a landing, the haunting sound of taut flying wires, as they sang above the whispering chug of the idling engine, interrupted now and then by an occasional burst of the throttle to keep the plugs clear. As the biplane slowly drifted and slipped to a smooth touchdown, its bow-legged wheels would spread as the big bird rather reluctantly settled its full weight on the bungee shocks, and the wings relaxed on the tension of the landing wires——

(*Continued on page* 39)

The Duster

(*Continued from page* 12)

brother, you had to be there, no one short of a Hemingway could even begin to describe it.

Well, that's the main reason for my building bipes, but there are two other more concrete motives. One is the challenge. Many people say they like bipes, but they haven't seen one that flies well. That's enough to make any self-respecting model designer head for the drawing board. The other reason is really an extension of the first. After all a bipe is designed to fly well, why shouldn't it qualify as a contest type airplane? Of course, some of us realize that nine-tenths of a winning combination is the flyer. Most people, and our manufacturers seem to bank heavily on this, feel that they're nine-tenths of the way toward being ace flyers if they have a duplicate of the champion's plane, engine, and radio. I hope some red-hot contest flyer will latch on to the Duster and give it a try. Unfortunately, not being part Checker Cab, the Duster will have a difficult time with the exaggerated importance of ground handling now called for in the AMA rules. As to its performance in the air, though, think of what type of airplane has won most all major world aerobatic championships since Wilbur and Orville quit fixing bicycles; what kind of airplane is used for low-level crop dusting, particularly of small fields surrounded by tall trees and power lines where immediate control response is so important? You bet your boots, buddy. Bipes!

Show me a man who loves bipes, but won't build one, and I'll show you a guy who hates cutting out ribs and/or building wings. Before we go any further, let's clear up this situation. There are several cures for these problems. As for the ribs, use the sliced bologna method, as follows: trace the rib pattern on a light balsa block around 3½" thick. Cut out the rib blank, including the spar notches, on a band saw, and sand smooth. Now set gate on band saw to the rib thickness required and make like the local delicatessen! A block this thick will give you around 30 ribs 3/32" thick, enough for one Duster wing. A complete set of ribs for two wings shouldn't take more than an hour to produce, and man, they're uniform!

The wing construction is of such rugged and simple design that it's difficult to resist the temptation to build more units than are necessary. One R/C modeling friend of mine from Pennsylvania, who wishes to remain anonymous, even went so far as to build *four* complete wings for just *one* Duster! Ain't that right, Herby?

Now that we've cured this extra-wing-to-build phobia, let's get down to the whys and what-fors of R/C biplanes. The Duster is the eleventh in a string of biplanes which I have built and flown with varied amounts of success since 1956. The first one was my second R/C model, and was a development of the late Jack Luck's "Faultless Chick," a free-flight design published in the Feb. 1959 issue of M.A.N. The next one was my first "own design" and was a modified scale bipe called the "Great Lake Strainer." The structural design was based on Jack's ideas and probably this alone has been the main contributing factor to its still being flyable today. A brief history might be of interest.

This plane, of two inch to the foot scale (about 53-inch span), was completed in 1957 and equipped with a Bonner Varicomp working from Jack Port's famous old SM-1 receiver. The third position on the escapement actuated a Mighty Midget motor which turned a crank, which, in turn, kicked the elevator up with each revolution. This device because of the sound produced when operating, was called the "machine-gun elevator." Retired for one season, the G.L.S. was sold at a club auction and subsequently outfitted with Galloping Ghost by its new owner. Without casting aspersions on this fellow's efforts (the control surface movements were only enough to "suggest" a change of direction or pitch), it must be said that the plane's ability to take punishment was becoming evident. One flight ended in a full bore lunge into, and near the top of, a wooded area of 100- to 150-foot high trees completely devoid of leaves in the late fall season. Both wings slithered to the ground, and our club mascot and "monkey" had to climb up and lower the fuselage, with the tail still attached, by rope. There were scratches on the finish! It was retired for the winter to make necessary improvements.

The following spring my old faithful but wandering WAG again took off in search of a mate, and I was suddenly armchairing it. Approaching the purchaser of my G.L.S. with fidgeting hands and tear-rimmed eyes, I begged to buy "Old Plysides" back into the fold. I must have overacted, because the generous soul gave it back to me free of charge, *including* a new K&B .29 (I had used a Fox .19 on it originally) and four rechargeable pen-cell nicads.

After enlarging control surfaces and increasing movement of same, we were out of the armchair squad for a while. During this phase and the one following, the G.L.S. established a cartwheel record that I'm sure could never be duplicated. It was mostly a case of an underpowered plane being jerked off the ground too soon, followed by the inevitable stall and "over we go again." Soon came a 10-channel Deans rig, my first good multi equipment, and naturally its first assignment was the old

test-bed, G.L.S. An early style Super Tigre .35 with Bramco throttle and a home-made exhaust baffle was used for power, but with the added weight of multi gear, the ship was still marginal, particularly at take-off. Credit must be given to Graham Lomax's good left arm which unless the wind was sufficient and right down the runway, was the only way I could get any "toggle time." Credit must also be given again to Jack Luck's structural design, because here was a plane built for single channel, originally flying at about 4 pounds all up, and now it weighed a healthy 6 pounds, and, in addition to the cartwheels, it was going through G forces in the air that would have folded the average wing.

The history of the Great Lake Strainer more or less chronicles my development in R/C, from the carrier type SM-1 on up to my present Don Brown's Quadruplex rig which is going into its second year of operation. It, too, had its first ride in the old "Stable Mable," at last sufficiently powered by a plain-bearing S.T. 45 R/C.

During the adventures of G.L.S., other biplanes rolled, fell, and sometimes flew off the Northrop production line. One that aroused considerable interest was the Forster .99 powered (?), 7½ foot, 15 lb., Gipsy Moth which was seen at the 1961 Willow Grove Nationals. This airplane still exists, and it is hoped that with the R/C knowledge and flying ability acquired in the past three years, the Quadruplex gear, and the new .60 engines gradually appearing on the market, it may exceed its present record of being airborne for 10 seconds. (Any .60 manufacturers care to have a testimonial on their engines' ability to fly a 15 lb. bipe?)

The most successful biplane prior to the Duster was Big John, which made its first appearance at the 1963 Toledo symposium. By this time the aeronautical design requirements for a bipe were pretty well firmed up in my mind, and combined with a desire to get the Forster 99 in the air, the 6'-4", 10-lb. Big John came to be. Fortunately, Duke Fox also attended that symposium, and so did Fuzzy (sometimes called John Schroder's Old Man). You see, M.A.N. Went-To-Work on Duke Fox and then W.C.N. Went-To-Work on M.A.N,. the result was that I took home a Fox .59 R/C just in case the old 99 groaner didn't haul the mail. It didn't, so in went the Fox.

B.J. turned out to be a really great bird, and not only because of its size. It was absolutely the most realistic thing in the air, or during take-offs and landings, that can be imagined. It flew at just about scale speed. The first 30 or so flights were made on the Deans reed outfit, and unless you really stomped on a toggle and held it, anyone would swear it was on proportional. The roll rate was slow but pretty to watch. Three rolls took it from horizon to horizon. After the Quadruplex arrived and had been checked out (along with the pilot) aboard G.L.S., it was dropped, and I mean dropped, into Big John. With that space, the transmitter could have been thrown in too. An appropriate sized Yogi Bear was put in the cockpit, and together we toured the flying sessions throughout the 1963 season. The "Dumb B'ar" took the blame for any wrong thing that B.J. happened to do. At the Dahlgren altitude record trials, Big John and Yogi struggled to 7,470 feet. You wouldn't exactly say we *broke* the Russian record of 7,380, but we did sort of bend it.

At another small flying session also attended by Don Brown, I had just taken off for my second flight when I felt a presence at my right shoulder. T'was Don himself, and he who usually refuses any invitation to fly someone else's plane was hinting for stick time. What at first was quite an honor became a bit much after a while, because I didn't get to fly very often the rest of that day. As soon as I'd take off for another flight the presence would be there again. I'll say one thing though, me and Yogi got quite a flying lesson that day.

Late last fall Yogi pulled his worst boner. While flying inverted to dump a parachute from the cockpit, he drifted sort of low to the ground, panicked, and instead of shoving down elevator and rolling out, he tried to pull half an inside loop. Harold Goldklank would have called it a Figure "7". Big John was realistic to the last. It hit on the other side of the road bordering our field. The top wing flew off and landed on our side of the road. The engine stopped in the middle of the road. The fuselage looked like an incomplete banana split just waiting for the ice cream, and to complete the realism, the 1.2 AH Nicad's lead wires shorted out, and as we approached the wreckage a wisp of smoke was coming up from the burning insulation. Yes sir, sob, it sure was realistic. That stupid bear was just sitting alongside the wreckage, grinning!

All of which, at long last, brings us to the main subject of this article. The Duster is an exact 7/8 copy of Big John. It was felt that this size would put it in the range of most engines from a .45 on up. Though enough to make the purist snort with disgust, the rather extreme thrust offset was found to be the correct amount for both ships.

Being a designer from the eye-ball school, there is not much I can honestly say about such things as the choice of rudder area vs. dihedral, the location of the CG, the amount of stagger, incidence, etc., except that all these things have been ascertained on a trial and error basis. In my opinion, the only difference between this method and the use of aerodynamics is that it takes less time to explain why you did something a certain way if you just say you tried it and it worked. This, and the search for an easily built, yet sound structure, pretty much dictated the design. The only other rule to follow is, "If it looks good, it will fly good." Of course everyone has a different idea of what looks good, so——

CONSTRUCTION NOTES

The construction of the Duster is pretty much straight forward and only a few points peculiar to this ship need be detailed.

In order to keep the weight down, Sig Contest balsa should be used where light wood is practical. Sig is specified because it is noted that several brands are labeling their standard weight balsa as "Contest." White glue should be used for all major construction joints. Where joining sheets with white glue, wet the side opposite the glue with water to prevent curling during the drying process. Avoid, where possible, having white glue joints on the outside surface. It has a nasty tendency to swell up from moisture, thus leaving a raised line.

WINGS: The quickest and most accurate method of making a big batch of ribs has already been described. If you cannot beg, borrow, or steal a band saw then you will have to make an aluminum template and whack them out one at a time. Punch about three holes through the template with a small brad. The flash around the holes will provide a grip on the balsa while you are making the cuts. Don't leave out the webbing between spars. It adds tremendous strength with negligible weight penalty. The ply dihedral gussets may be two-piece, since they are glued to the center-section spars. If you plan to build the Duster as a Class II airplane, add about two more degrees of dihedral to each wing panel.

EMPENNAGE: The stabilizer and fin may be permanently fixed, or strapped on, depending on your transportation facilities. It is suggested, in the interest of keeping the tail light, to fill the grain and finish without any covering material. As the original was to be finished with Hobbypoxy, all surfaces, both covered and uncovered, were filled with Hobbypoxy "Stuff." Thinned one part "Stuff" to two parts Hobbypoxy thinner, this. . . er, stuff makes about the easiest sand filler I have ever used. Regular butyrate dope may be used over it, if preferred.

FUSELAGE: There is nothing particularly off-beat about the construction of the body. First, the doublers, longerons, diagonals, uprights, and plywood doodads are added to the 3/32" sides. The basic structure is then blocked and squared up, using bulkhead "B", the ¼ x ½ inch hardwood crosspieces that fit in the 3/32" plywood sockets, bulkhead "D", and the two ¼" square, crosspieces just aft of the bottom wing trailing edge. The ⅛" balsa cockpit floor should be put in at this time to help alignment. The forward deck can be sheeted in two pieces, but remember to make the birdcage (cabane struts) first.

When gluing up the nose blocks, follow this procedure: glue the ⅛" sheets to the front of bulkhead "B" and to the inside of the fuselage sides. Next come the ¼" sheets that go inside of the ⅛" sheets. However, at this time the length of the engine you are going to use must be determined so that bulkhead "A" will be located at the proper distance from the front ⅛" ply ring. Resist the temptation to decrease the engine offset shown. Bulkhead "A" is not detailed since it is a simple rectangle with its height determined by the engine length and its width as shown in the top view of the nose section.

The tank is made from a soft drink can and provides about 10 to 11 oz. of fuel. This was necessary for the ST56 used on original ship, but an 8 oz. DeBolt clank will do for most .45's and .49's.

LANDING GEAR: A Sig 2 x 18 inch aluminum alloy blank was used on the original because a tread of around 15 inches was desired, and to the best of our knowledge, no preformed gear this size is available. A word of warning . . . this stuff is HARD and will take the skill of an expert metal-bender to put it into shape. The bends must be radiused at *least* a half inch. It would be worth an additional 50 to 75 cents to the average consumer to have these available pre-bent.

CABANE STRUTS: The so-called "birdcage" is usually considered a big pain to make. This one is easier than most for the simple reason that is perpendicular to the body. Several years ago, I came across a handy little gadget which, with some experience, takes the sweat and swearing out of the wire-bending task. It's called the "Handi-Bender' (wonder how they ever thought of that), and consists of an aluminum block with various common sized slots (1/16, 3/32, etc.) and five holes to take ¼" dia. steel pins which can be shifted around to suit the situation.

The whole operation should be performed before the forward cowl sheeting is glued in place. Bend, bind, and solder the whole thing into one unit as follows: for alignment sake, mount the front and rear struts to the body using spade bolts. Bind on the saddle pieces next, then the diagonals. This is the time to make your alignment check, while the whole thing can be pushed and pulled into shape. When everything checks out, solder the entire mess together with a high tensile solder such as Willoughby. Loosen spade bolts and re-

move birdcage from the body. Cut apart in the middle. Later, when the fuselage is completed, the struts can be inserted from each side and joined with 5/32" O.D. tubing as shown on the drawing.

FLYING NOTES

It seems a shame to close off without saying something about flying the Duster. I won't waste words trying to tell anyone *how* to fly it. If you go so far as to build the ship and install reed or proportional multi equipment, you've probably already logged enough air time to tell *me* how to fly it. If you're nuts enough to build the Duster as your first multi ship, or even worse, your first R/C job, there's no use trying to tell *you* anything either.

It might be helpful, however, to mention a few flight characteristics of the Duster. The most notable difference from the average C1.III stunt ship is the roll rate. It's slow. On the other hand, it's a much prettier and realistic maneuver when done this way. Don't come roaring down wind, on the step, and expect to whip up three fast axial rolls. The rate could undoubtedly be quickened by chopping ailerons in the top wing, but it seems pointless. I can get the same results if I chop the throttle slightly instead, shove the stick to full aileron, and by alternating up and down while keeping it there, can roll continuously around the circumference of our flying field.

With the original Duster, vertical eights are a piece of cake. The ship weighs an even 8 pounds, and the ST .56 is actually more than enough power. The maneuver can be done as tight as a Ukie stunt pattern, or opened up. In either case, it is possible to do consecutive verticals, limited only by the pilot's ability to keep a heading.

Take-offs are point-getters. There is no noticeable breakaway. With neutral stick, the Duster simply bores tail-up down the runway and leaves the ground at some unknown moment. There is absolutely no tendency to ground-loop.

Landings in windy weather are best made by flying right down to the ground for a two-point wheel landing. In calmer weather it is a little safer to attempt a three pointer.

One more suggestion. When you go to the local field with your Duster, take some poles, barbed wire, and a Model T coil. *Everybody* wants to get a close look at "that there double-winger."