
NR18932

the waterman ARROWBILE

A SPORT SCALE MODEL OF WALDO WATERMAN'S UNUSUAL AIRCRAFT. ADD OR DELETE SCALE DETAILS AS YOU LIKE, AND IT WILL STILL ADD UP TO A GENTLE AND STABLE MODEL THAT WILL STOP THE ACTION AT ANY FIELD.

BY EARL WITTE

Photos by BILL CRAME

With the advent of the new lighter and more reliable equipment, it was bound to happen. This happening is Sport Scale, and why not? Now the radio doesn't restrict the airplane's design like it did in the past. Let's face it, we all like to fly planes that look like their big brothers. Check the Goodyear racers, since they are good examples of sport scale designs that look and move like their bigger twins. Maybe you are already an expert builder and flyer – maybe not. Either way you have a great choice in this hobby. Perhaps you have been reading Dave Platts inspiring scale articles and you're hot to go scale. Good. You might try one of the more tried and true models or maybe something different.

In my case, my bag is always "something different." It seems like I can never build the same model twice. I am always scrounging around for details of unusual designs, either vintage or modern.

A while back when I was at the

Lou Waterman (l), and Charlie Litzau (r), assist author-designer, Earl Witte, in putting the wing on the Arrowbile.

library – I mean hobby shop – I picked up one of the Historical Aviation Albums. You can really find some gems in these magazines. The first time I read through this book, nothing really caught my eye. However, after reading the article about Waldo Waterman's Arrowbile for about the sixth time, I had it! Something about this plane really grabbed me. The more I looked at it, the more I thought – it can't fly – but it does fly and well, too. This Waldo Waterman had to be a genius. Just study the design carefully and you'll see he really built an engineering masterpiece.

Take the rudders for example. Look simple, don't they – they are. But only one works at a time. For example, when turning left, only the left rudder moves outward. This efficiently works as a combination of drag and deflection. My model actually turned better on rudder than aileron before I coupled them together (via wiring harness). How about the combination of constant chord, sweep and 4° washout to give the wing safe and stall free flying characteristics? There are many more goodies built into this design, not even mentioning that it makes into a lousy racing car.

Complete information on this plane can be found in Historical Aviation Album, Volume III, available from Paul Matt, P.O. Box 33, Temple City,

California 91780. I would like to take this opportunity to thank Mr. Matt for helping me to obtain the approximate C.G. from Mr. Waterman. More about this C.G. problem later. Did you notice the beautiful photos? That's what I call close-ups. These photos were taken by our club lens genius, Bill Crame. Bill is one of the unsung heroes of our club – The Signal Chasers of St. Louis. Bill takes thousands of club publicity photos for gratis only.

Back to the Arrowbile. This plane makes for an excellent model subject. It could be built by the very serious scale modeler as 100% scale. With all of the small details – radiator, handles, grilling, etc. – a real scale builder could go the limit. My version is more the sport scale type, although I tried to make the plane as close to scale as practicable. The main outlines of length, span, and height are scale. The main gear tread is widened from scale, and I had to add some non-scale engine cooling scoops. Being an experimental model, I also chose painted-on windows and pantless wheels for strength and simplicity. If you decide to build the Arrowbile, you can add or delete details as you prefer. The version I built was NR 18932 featured on the Historical Album plans. I finished it in scale red and white, and it is a beautiful ship. The Historical Album can be used for a scale presentation, however, there are no actual color photos of the plane.

To me, flying wings were always the great mystery posing many unanswered questions. How can they be stable without a tail? How do the controls react? What type of controls are used? Will it tip stall? How does it glide without power? How about takeoff and landings?

Maybe you had the same thoughts yourself about flying wings. Reading about the Arrowbile's gentle and stable flying characteristics was not

Earl attaches the wing struts before flying the R/C version of Waldo Waterman's Arrowbile.

The Arrowbile, engine revving, prepares for takeoff.

enough, I had to build it and find out myself.

I wish I could say that it flew off the board but it didn't. The first trip to the field was uneventful. All we accomplished was to put about 8 miles of taxiing on the speedometer. We did manage to flip it upside down testing the durability I claimed it had! Unscathed, but unflown, I trudged back home.

My test pilot, Crash Litzau, and I talked this non flying problem over. The violent ground oscillations we had on the first attempts were thought to be caused by tail heaviness. As a consequence I added many ounces of nose weight.

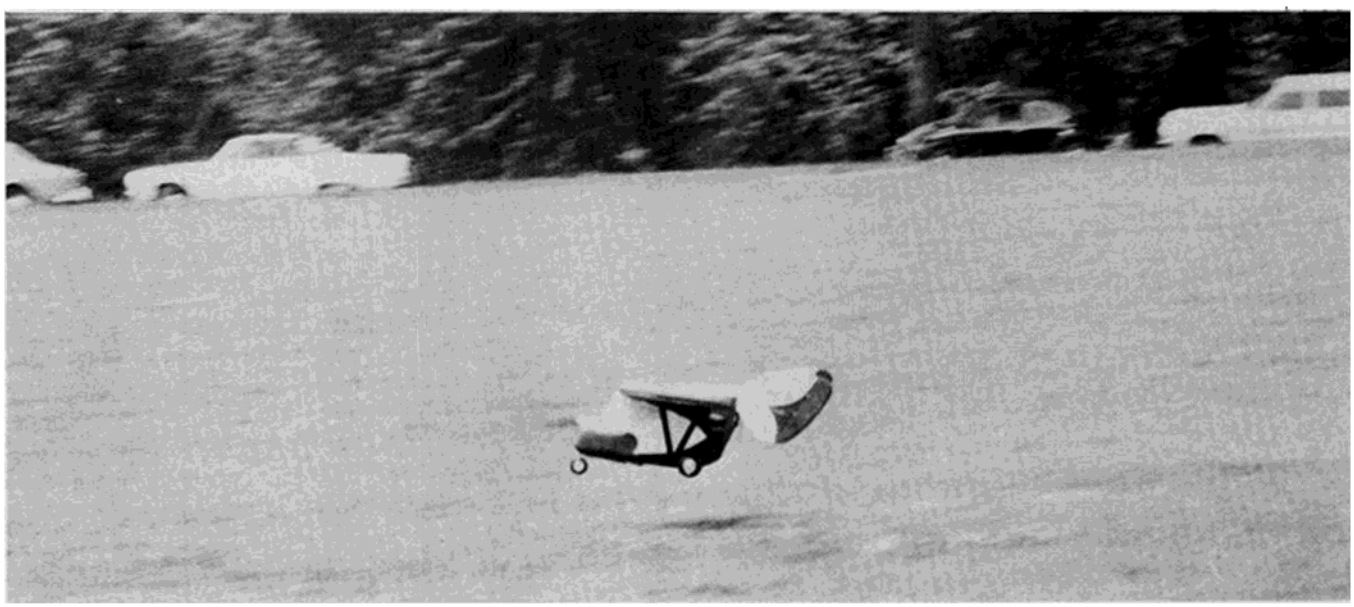
The second attempt was similar to the first, except with all that lead even the nose didn't bounce. Obviously, this was a step in the wrong direction. Needless to say, these unsuccessful attempts were discouraging. Even Crash looked a little shaken.

Back home again, and I knew I had a basic problem with the C.G. I decided on a most drastic measure – what I call the "Einstein mind link." I accomplished this by carefully consuming 3 to 4 containers of foaming beverage while listening to Country Western. *Flash* – it happened. The answer was clear. It was nose heavy, but how much? I referred back to Paul Matt's letter from Waldo Waterman. He stated the C.G. was around the fuel tanks on his full-sized plane. My model balanced about ½" in front of this point. I added tail weight to move the C.G. back about ¾" and cooling scoops to the engine compartment. Engine overheating was also a problem.

Now full of confidence, I called Charlie for a flying date. After telling him about my latest modification, he regained some of his initial enthusiasm.

The third attempt was now at hand. The engine was all fired up. Charlie signaled OK, and let it go. At first it waddled slowly, but soon it was rolling faster and faster. Charlie hits full up – look, it's breaking ground. Up and up it climbs. It's no longer the ugly duckling on the ground. Now it's at home in the air like a soaring eagle. Shortly after, the engine quit and jolted me back into reality. The glide

After the flight, Earl lands the Arrowbile with a slightly nose high attitude.



is beautiful – twice as far as one would expect. Safely down in the grass, I let out an Indian moose call that they still talk about in Canada. With the pressure off, we got in two more flights that day. Later in the article I will discuss flying the Arrowbile in more detail. However, I will say again – it does fly, and well, too. It's a real challenge for you avid RC enthusiasts.

I am going to deviate from the usual step by step construction sequence. Instead, I will just hit the main points of the craft.

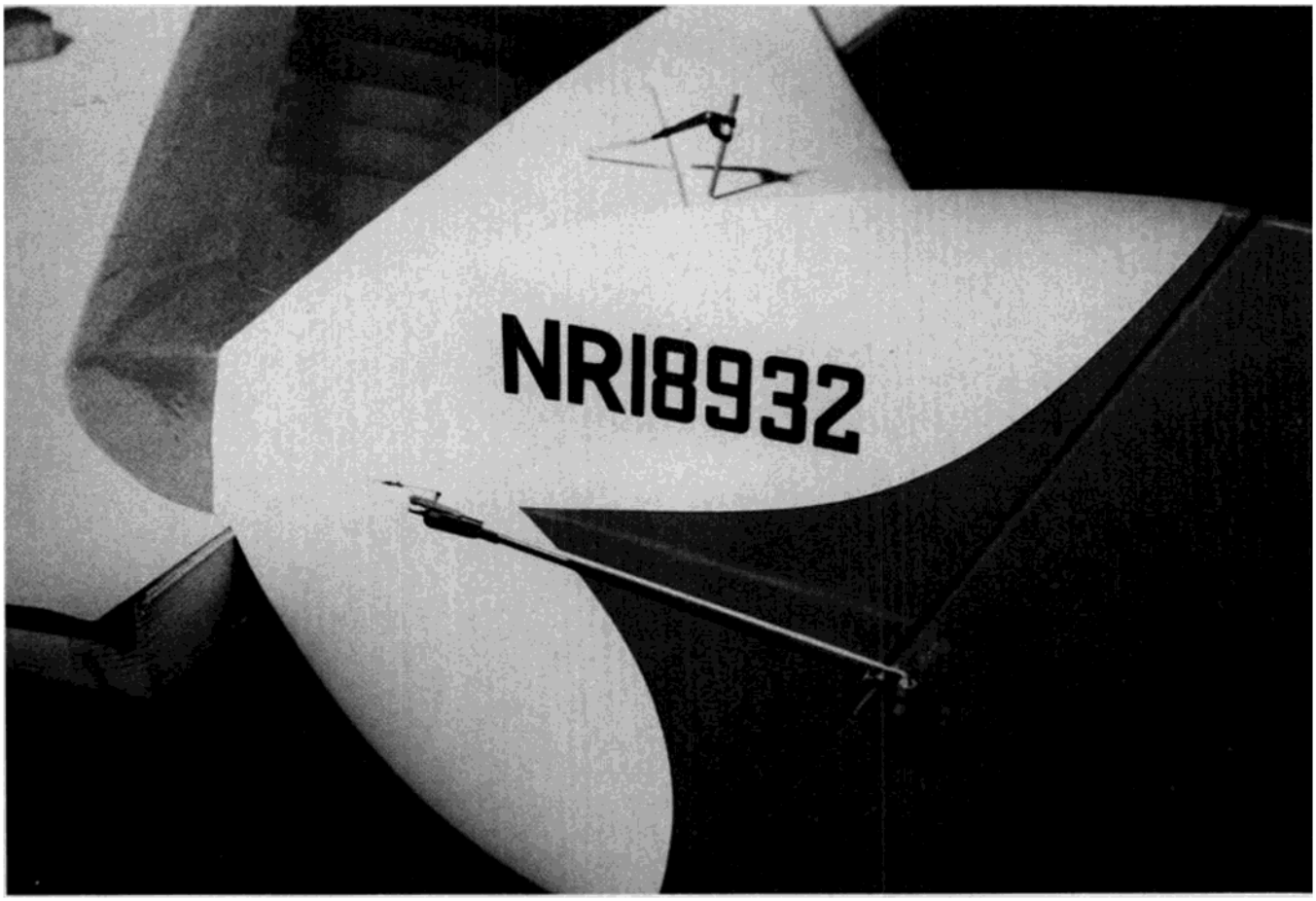
FUSELAGE

The fuselage on this type of ship has to be very strong and robust. You will notice plenty of plywood and balsa blocks. This makes the fuselage almost indestructible. There is room for equipment installation, also your lunch, TX, and tools! The receiver and battery pack locations should be left to last. Try to use them to balance the ship instead of using lead weight. Needless to say the C.G. location should be exactly as shown on the plans. My ship weighed over 12 lbs. Some of the overweight was my fault; I built some weight into the leading edge of the wing that I did not need.

The landing gear incidence is very important. Double check this against the plans. Too much of a nose high attitude will cause porpoising. I had to shorten my original nose gear to eliminate this. I recommend two coats of Sig Epoxy brushed on with a solder acid brush. This eliminates filling the grain and adds strength. Also, I would recommend using some type of internal ducting for engine cooling. Air scoops work fine but they are not scale.

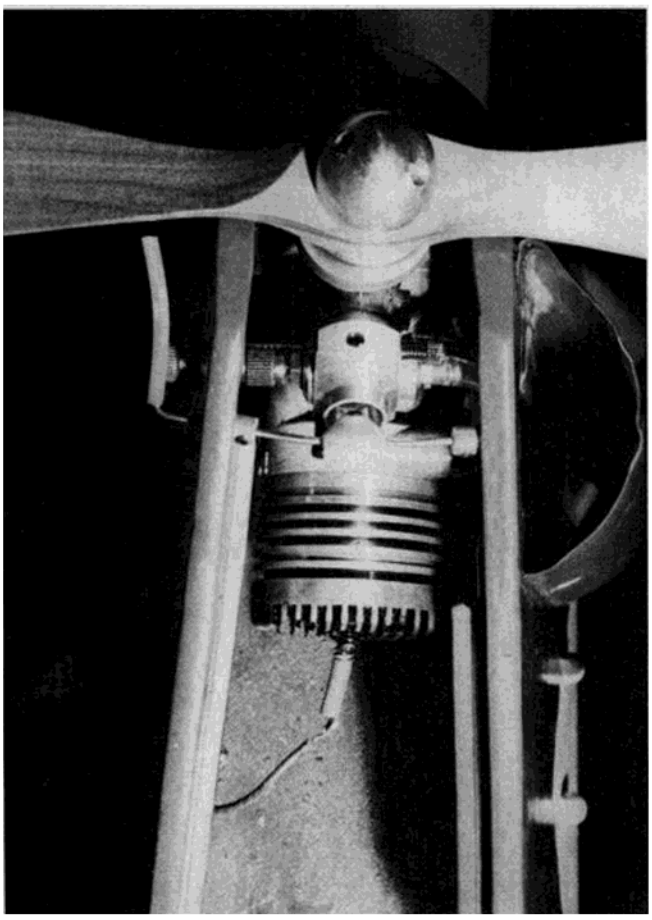
ENGINE

The engine for this size plane must be at least a sixty, well broken-in. Converting a motor over to a reverse crankshaft is not too difficult. I am using a Merco .60. However, I recommend an Enya .60 because you can convert it to a left hand crankshaft with main bearing in less than 5 minutes. This way you can switch it back and forth at will. Efficient engine cooling is a must. If you want to

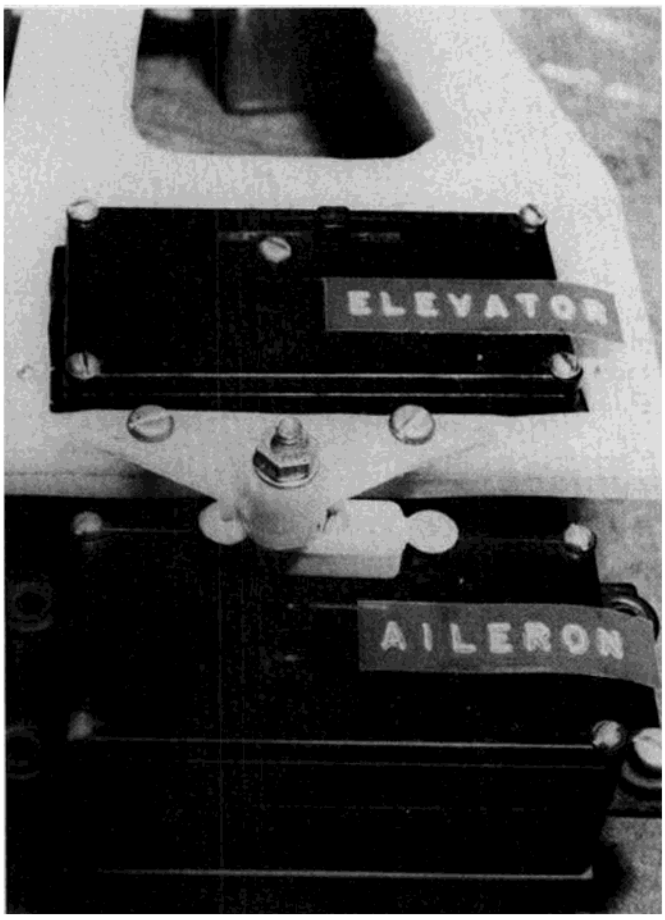


Close-up of rudder linkages.

View of inverted engine. Experimental choke was removed and not recommended.



Close-up view of aileron-elevator (elevon) linkage. Modified bellcrank attaches to servo tray.



mount it upright, it won't look as good but it will start easier and run cooler. If you mount the engine inverted, use some kind of starting jack. It is not safe to start the engine without one. Also, a word of caution about starting any pusher type plane . . . have someone hold the plane securely from the front and make needle valve changes on low motor.

WING

Before starting to build this wing be sure you have a clear mental picture of all the important details. The ideal building board for this wing is a standard interior door. Usually you can get a second for $4.00 to $5.00 at your local lumber yard. Double check it for warps. Since the two main root ribs are basswood, they make ideal patterns for the rest of the balsa ribs. After you string all the ribs on the two main spars, place them directly over the plans and align the spars and ribs with a small T square. Jig up the spars for the 4° of tip washout. Now spot glue the ribs in place. After they are dry continue with other spars and sheeting. When the wing construction is complete give the entire wing one coat of Sig epoxy and an additional coat for the center section.

CONTROL SURFACES

Probably the most difficult part of building this ship is the control surface hookup. Due to the size of the elevons, they must be statically balanced. I used NyRods throughout my plane. Whichever way you prefer, be doubly sure all linkage works **freely** with **no slop**. Note the servo linkage setup for combining your aileron and elevator servos to obtain elevon control. Also, note the rudder servo linkage to get one-way action for rudder deflection. Note how the NyRod slips in one direction but pulls in the other. You must make a simple wiring harness to couple your rudder and aileron servos to the aileron control. Hook your steerable nose gear servo to the rudder control. Set all control surfaces for maximum throw as shown on the plans. Remember, you don't have propeller blast over these surfaces.

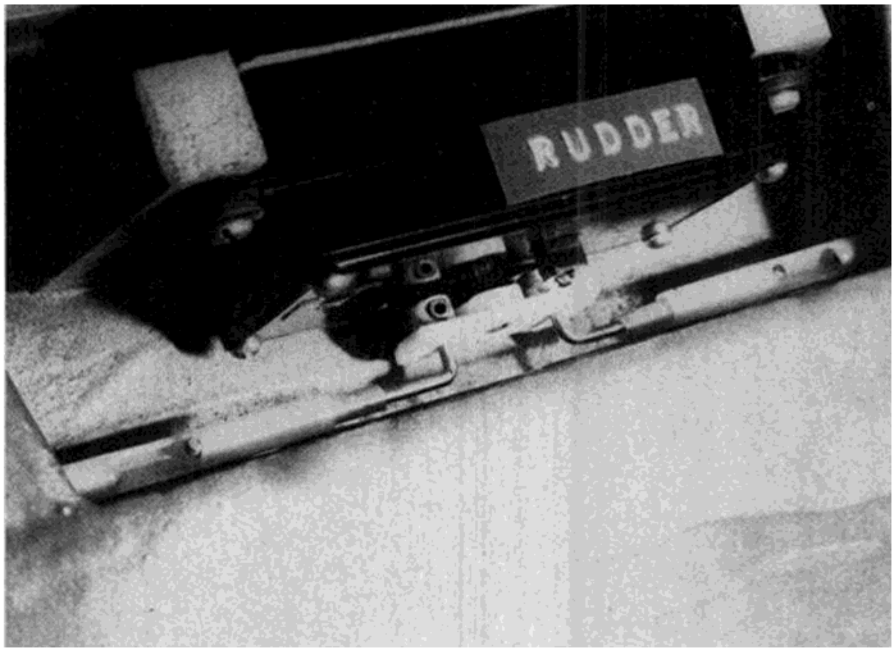
FLYING

After completing your model, you are ready for the first flight. Naturally, you have tested everything and are ready to go. Be sure your motor can be relied on for maximum power. Since most of us fly off grass strips, don't expect this ship to jump into the air. For your first test flights, use all the strip available. Let the engine build full power before releasing the ship. Crank some up trim on the elevons. Hold full down half way down the strip in order to hold the nose down. When sufficient speed has been obtained, ease back to full up, and hold. The ship should break ground and possibly start to settle back down. Hold in your up elevons and soon you should be climbing out in a normal attitude. Start a large, gentle left turn easing off on the elevons. If successful so far, continue to climb to a fairly safe high altitude. Try some right and left turns, then prepare to land. If you go dead stick don't panic, it glides better than you will imagine. The glide seems to be twice as far as any other plane I have flown so keep this in mind so you don't over shoot the runway. If your motor is still running, then set up a large left hand landing pattern and cut the power back. With the motor on, your glide path will be slower and with a faster sink rate. Try to land as slow as reasonable, touching down on the main gear first. Now that the first flight is over, check over any trim changes it might need and try it again.

Let's sum up the flight characteristics of my prototype. I believe, in general, they will be accurate for most Arrowbiles.

The Arrowbile design does fly with good built-in stability. Yes, it is even more stable than some more conventional designs. The controls have a soft feel. You do get positive control in all aspects, but with a slower and more gentle response. I have not found any tendency for the Arrowbile to tip stall. The glide is very good – fast and clean with very little drag. Taking off is the hard part since the ship is heavy and requires good speed for lift off. Landings are not too difficult but stay off the nose wheel as long as possible to avoid porpoising.

If you try this design, I would like to hear from you about any comments, and, I hope, success stories. Please forward them through the magazine. Till next time – good luck and good flying. □



View of rudder servo linkage. See text for linkage details.

Throttle servo and linkage.