# CUNNINGHAM ON R/C

*Beaver on floats by Gary Dumond up in Plaisted, Maine. Gary flies the full size float planes for a living. Beaver has 96" span, kit by Unionville Hobby Supply. Has never been flown with wheels, always floats or skis.*


*Lazy Ace built by Dennis Fahselt. O.S. 90 2-stroke engine. Going to add smoke system.*

**R/C Design Made Easy**

**Part II**

Before we get started with this month's installment of R/C Design Made Easy, let's take a couple of minutes to mention some other things. First, would you believe the story about the R/C flier who was out flying at a remote site by himself. When it came time to go home he could not get his Volkswagen Rabbit to start. Looking at the engine led him to the conclusion that the fuel pump on the Rabbit's engine wasn't working. A bright light flashed in his mind; he grabbed his Sonic Tronics electric fuel pump, hooked it to the car battery and car fuel line, strapped the pump to the carburetor with rubber bands, turned on the switch, jumped into his car, hit the starter button — and away he went home. A car mechanic in real life, or an aerospace engineer? Nope. This man is a concert pianist! Got to say it again, R/C modeling is the best teacher there is for getting along in everyday living.

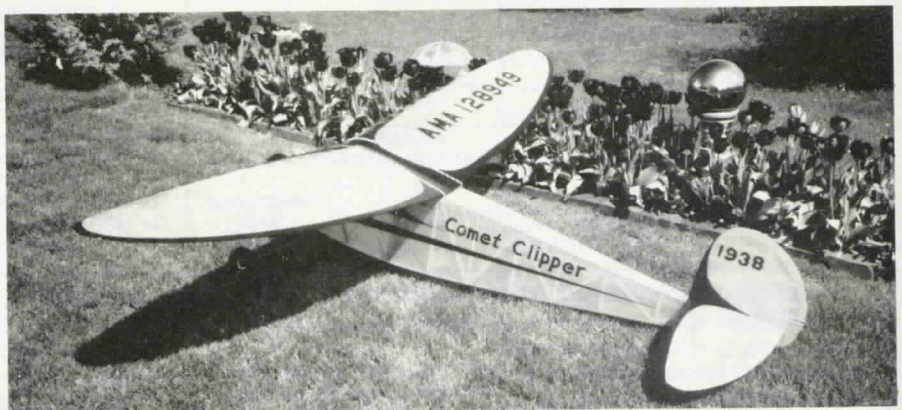
The second thing that I want to mention, is that here in the North Central Texas area, November 4 and 5, the Fort Worth Thunderbirds are going to have a Gold/Silver transmitter inspection checkout. The location will be at the Arlington, Texas Convention Center, located just south of the Texas Rangers baseball stadium. Cost will be $5.00 per transmitter. For further information check your local hobby shop in the metroplex area, or call Ronnie Morrison at (817) 735-1833. Please call after 6 p.m. or prior to 8:30 p.m.

Now, on a more personal note. I've finally found someone to again kit the Lazy Ace bipe for me. By the time that you read this we should have kits in stock. For further information, contact: Sky Master Industries, 2440 Colonial Parkway, Fort Worth, Texas 76109, or call (817) 924-9737.

Now, let's get into this month's subject for R/C design, the design of biplanes. A bipe really isn't much different from a monoplane; naturally the outstanding difference is that it has a couple of wings rather than just one.

So, where do we start when we want to design a bipe? Well, let's start with a monoplane of equivalent size and work from there. Since we designed a simple monoplane last month, let's use this aircraft as the basis from which to develop our biplane. We're not going to add another wing of the same size to our bird and call it a bipe. Rather, we're going to consider that a bipe should have an area of roughly 40% more than an equivalent monoplane. We would not want to

**continued on page 35**



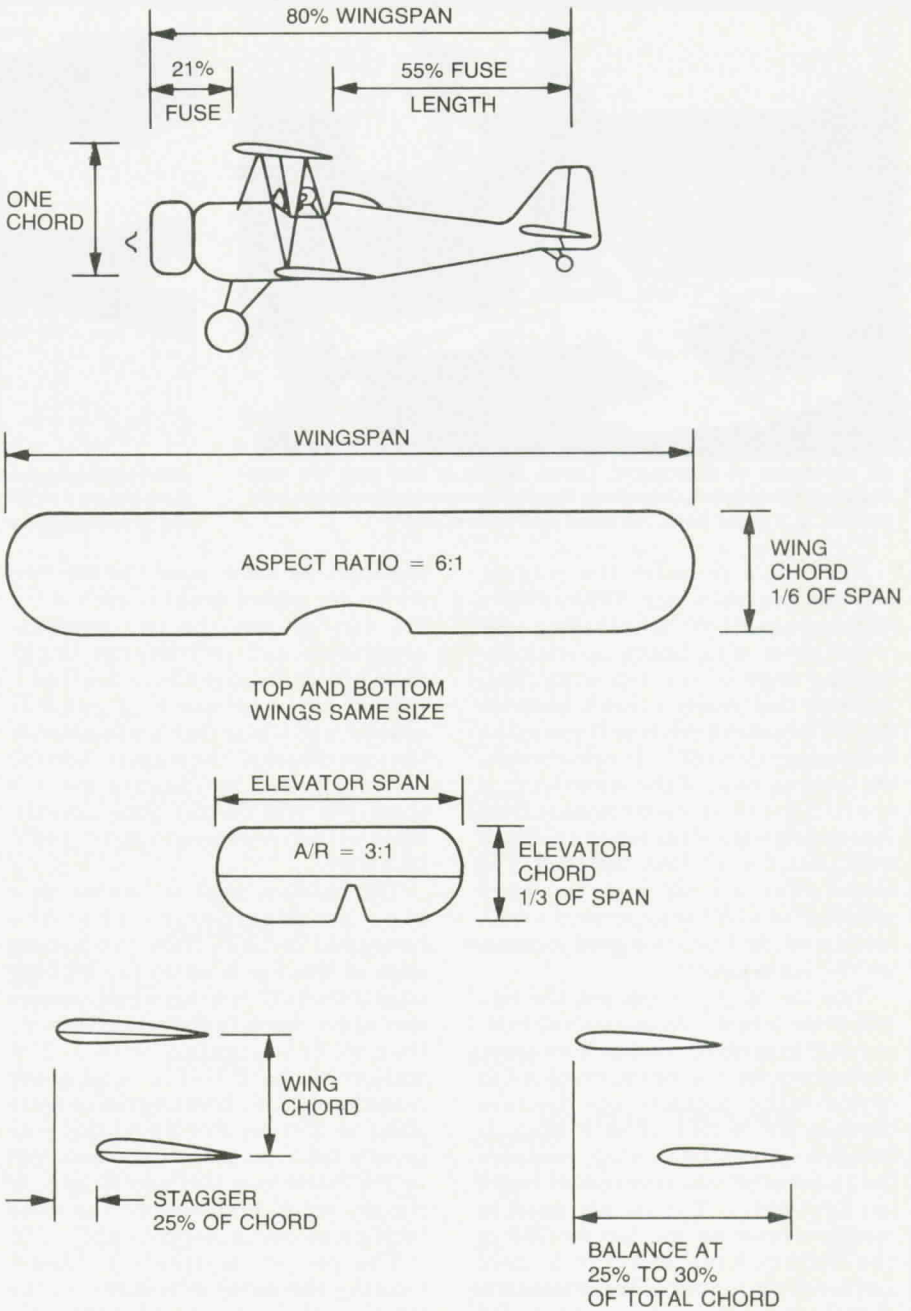

*Ten foot span Comet Clipper, scaled up from John Pond plans. Built by A.J. Serfass in Brookfield, Missouri. Plans to add 60" floats to it. ST .75 engine, 10 lbs. all-up weight, should be magnificent in the air.*

continued from page 30

make a biplane by cutting the monoplane wing size in half for each wing --- way too small. The efficiency of the bipe wings is about 70% of the monoplane wing, so by cutting the wings in half we would have a horrible aircraft. If we take the monoplane wing area of 864 square inches, and add 40% more area to it, we come up with a couple of wings that have a total wing area of about 1200 square inches. If we assume that we want each wing to be equal in size then we have a top wing of 600 square inches, and a bottom wing of 600 square inches. If we want to have the top wing larger than the bottom wing, then just make sure that the two total out to the 1200 square inches.

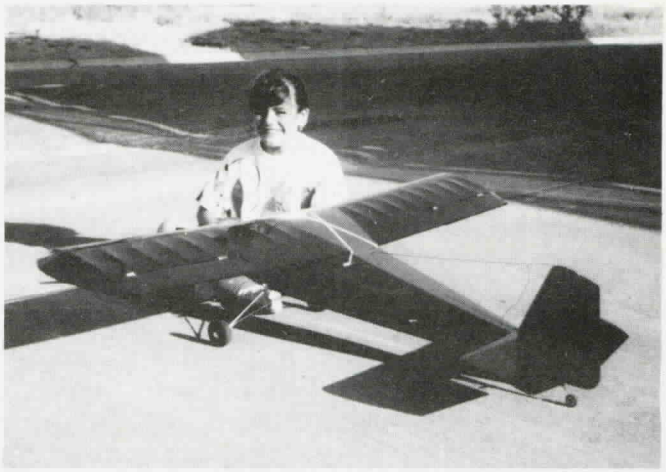
The aspect ratio that we were working with last month of 6 to 1, holds just as good for a bipe as it does for a mono. To refresh your memory, 6 to 1 means that the wingspan is 6 times greater than the chord. Since we have decided that we want our wing to have 600 square inches of wing area, and using the simple formulas that we talked about last month, we find that each wing will have a span of 60 inches and a chord of 10 inches.

Now, do these wings fit on the monoplane fuselage that we developed last month? Then we had a fuselage length of 70% of the wingspan of 72", or a length from the rear of the prop to the elevator hinge line of 50". If we relate this fuselage length to our bipe wing dimension we then find that the fuselage is about 83% of the wingspan. I usually round this off to 80%. Therefore, when designing a biplane, first decide upon the size that you would consider for a monoplane, then change it to the figures that we have just been talking about for a biplane and make the fuselage about 80% of the wingspan. If you use 70% it will look just a bit dumpy, but it will work.




**BASIC BIPLANE DESIGN**

*Gil Horstman of Manchaca, Texas, about to test hop his new Goldberg Chipmunk. Grandson Justin (6 years old) looks on, and per Gil, is a great help. All went well in first flight.*



*John Valls of Laredo, Texas, sent in this photo of his "Southern Gentleman," RCM plan #422. Shown with the S.G. is his 8 year old granddaughter, Nikki Ortiz. Both models are very nice.*

Next, let's consider the stagger between the two wings. You can have no stagger at all, with the leading edge of the lower wing lining up with the leading edge of the top wing, but, frankly, this really doesn't look too swift. The same holds true if you make the stagger about 50%. In other words, the leading edge of the lower wing is one-half the chord distance back from the leading edge of the top wing. It will work, but doesn't look too good. I've found that a middle of the road approach of a 25% stagger works well, looks good, and leaves a good location for the main gear.

How far apart do you put the two wings on a bipe? As a general rule, putting them about a wing chord apart works very well. If you're using a flat bottom wing, measure the distance between the bottom of each wing. If using a symmetrical wing, measure the distance between the chord lines of the two wings. You do not need to measure between the top surface of the bottom wing and the bottom surface of the top wing. Work from the chord lines. You can make them further apart (but this looks kind of dumb) or you can move them closer together. At some point, as the two wings are moved towards each other the air between the two wings is compressed and very strange things happen both structurally and in flight. I don't know where this point is exactly, and it is probably a function of the type of airfoil (the stagger, and the distance apart) but, believe me, it's there and will destroy your aircraft. Stick with a chord length apart, you'll be happy.

The balance point is located on a bipe by considering that the horizontal distance from the leading edge of the top wing to the trailing edge of the bottom wing, simply makes one larger chord. In the case of the bipe that we're designing, with a 25% stagger we have then a total chord distance of 12.5". Locating the balance point at 25% to 30% along this line gives a balance location of about 3⅛" to 3¾" back from the leading edge of the top wing. Pretty much the same location as our monoplane had.

The rest of the fuselage design, locating the wing in relation to the total length, works out about the same as our monoplane. Nose length about 21%, then the wing chord, then the rest of the length back to the elevator hinge line. Don't worry about an inch here or there, it really doesn't make that much difference.

The horizontal stab is our next consideration. Working through all of the reasons why we do this or that, gives us an answer that the horizontal stab, including the elevator, should have an area of about 17% to 18% of the total wing area. The aspect ratio of the stab should remain about 3-to-1 for a good look. Working with our total wing area we find that 18% gives us a stab of 216 square inches. Applying our aspect ratio math formulas, we find that we have a stab with a span of 25.5 inches and a chord of 8.5 inches, just about the same size as we came up with for our monoplane.

If you want to add even more hands off stability to your aircraft, then increase the size of its tail feathers. In the case of the horizontal stab, go up to about 20% of the total wing area. Normally I like to make the vertical stab, including the rudder, about one-third of the horizontal stab area, but you can kick it up to about one-half of the total area. Take a look at the full scale Ultimate bipe and you will see that designers of full size aircraft are increasing the size of the tail end members with relation to the wings.

We have a few other things to consider such as fuselage depth and width. This is generally best left up to your eyeball, as the sizing doesn't make much difference to the flying of the aircraft, but does make a difference in how it looks. With a bipe, I like to use side and down thrust in the engine. About two degrees of right thrust, and about three degrees of down thrust normally does the job. That top wing sitting up there creates a fair amount of nose up condition which can best be countered with down thrust.

That's about it for this session. Designing your own aircraft can be lots of fun, and sticking your own bipe together can be even more fun. If you decide to scale-up some obscure WW I bipe then check it against all of the foregoing information. If you have to fudge on the scale-up to make it a bit more stable, go ahead unless you're planning on entering into scale competition. If you're doing it for your own fun, then fudge a bit. Most WW I types had noses that were too short and vertical stabs that were too small, resulting in aircraft that were very prone to snap roll and spin into the ground. If you're seeking something that looks old, yet will fly with a larger amount of stability, then blend together the old and the new to come up with something that you're going to like and enjoy. □