CUNNINGHAM ON R/C

R/C Design Made Easy

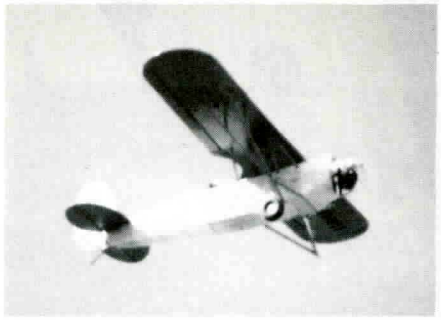
Part V

This month we are going to continue talking about the structural integrity of our model design.

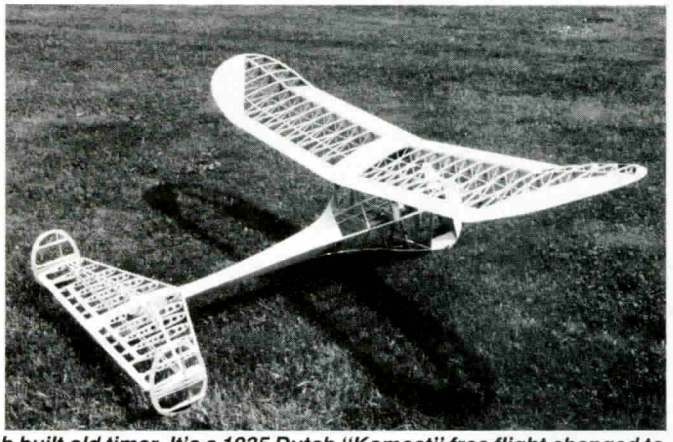
A structural system that has proven to be good in the past with a smaller, less powerful engine, might well fail when exposed to a larger, more powerful, engine. A good place to consider this problem is at the tail end of your aircraft.

Over the years, model aircraft have been designed with super lite structures at the tail end to save weight. This was okay when engine power was low, but needs a good bit of re-thinking when using more power. Oftentimes you will see indications on the kit box that the aircraft is suitable for engines of .40 to .61 size. In most cases this is so, but in a number of cases the aircraft has been designed both in size and structure to accept a .40, but, physically, you can cram a .61 engine in the nose and go fly. If you decide to build this type of aircraft and are going to use a larger engine, go ahead, but use your own brain power to decide if the model needs to be strengthened in some spots.

Here's an example of what we are discussing. An aircraft has the horizontal stab designed of an open framework of very small balsa pieces; small leading and trailing edges with small ribs. In the center is just a small amount of sheet balsa to use as a gluing surface for the fin to attach to the stab, and for the stab to attach to the fuselage. No extra cross members to distribute the load carried by the stab from one side of the fuselage to the other. This is probably okay for a moderately powerful .40, but way too light and flimsy for a .61. How do you go about solving this problem? Simple — first at the center section replace the light ribs with balsa sheet (installed with the grain spanwise) about 2" to 3" long, extending from the leading edge to the trailing edge. Next, cover the entire stab structure on both top and bottom with 1/16" balsa sheet. Sure, this makes the stab thicker, but this extra thickness will help the flying ability of the aircraft. You can't stop here. The elevator will be 1/8" thinner than the horizontal stab because of the extra sheeting, so add extra sheeting to both the top and bottom of the elevator. If the elevator is made from tapered stock, then just add a piece top and bottom. If it is a flat



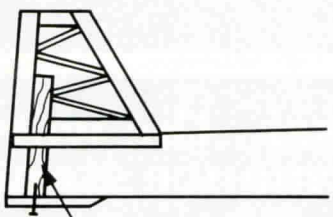
This series of photos are of Joe Forbes' Fairchild powered by a Quadra 35. Somehow, it lost a wheel and in spite of it, landed with only a slightly crunched rudder. Photos were shot with a Canon A1 and 210 telephoto lens.



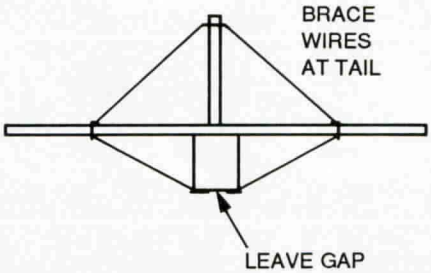
Mr. A.V. Sorgen of The Netherlands sent in these photos of his scratch built old timer. It's a 1935 Dutch "Komeet" free flight changed to R/C for lack of flying space in Holland. Beautiful building job. It has a 77" span with fuselage length of 47¼". Power is an O.S. .60 4-stroke.

The same type of problem can and does exist with the big models, those that sport big, heavy chain saw engines up front. Lots of structures have been designed for something like a Quadra 35, but the modeler — ever on the lookout for more power and performance — sticks something like a Sachs 3.2 or 3.7 up front and goes out to fly. Sometimes the structure simply won't stand up to the increased air loads that more speed brings. Again, let's look at tail feathers on the big birds. A light framework structure with a bit of 1/16" balsa top and bottom simply won't carry the load. An open framework is okay but muscle must be added to make the structure stronger. One way to do this is with the addition of spruce spars to the tail feathers. Spruce is so much stronger than balsa that its addition adds a fantastic amount of strength to the structure. Another way to strengthen the tail structure is to make a post in the fin structure that completely penetrates the stab structure and is tied into the fuselage structure at the bottom of the fuselage. Most large aircraft have a piece of 1/4" plywood at the bottom of the fuselage for the attachment of the tail wheel. It's a simple matter to extend the post in the fin all of the way down to this bottom piece of plywood, then attach the two pieces with glue and a screw or nail. Drill a pilot hole first to make the screw or nail work easily.

ADDING EXTRA SHEETING TO A LITE STRUCTURE PRIOR TO SANDING AIRFOIL SHAPE



POST TIED TO FUSELAGE WITH NAIL OR SCREW



Another method of beefing up at the aft end is to use brace wires just as full scale aircraft do. Brace wires should go from the fin to the stab, then from the stab to the bottom of the fuselage. Make sure that you do not make this a completely closed loop because this might affect your radio. With all of the flying wires, tail brace wires, etc., it is tough for your radio to decide just what is its antenna, and what is a brace wire, so always leave an opening in all of this hook-up. It's pretty easy at the tail, just connect the bottom brace wires at the sides of the bottom of the fuselage and do not use a metal piece going completely across the fuselage bottom.

A lot of the information that we have been looking at is based upon using kit or magazine plan models, but all of the ideas hold true if you're designing your own aircraft. Making it strong enough is up to you. After all, it's your radio, engine, time, money, and effort sailing around the wild blue.

Another place to look for weakness at the aft end is in the depth of the fuselage just under the stab saddle. Over the years I've seen several models twist this part of the structure so badly in a violent maneuver that the fuselage has actually fractured at

this point. The way to make this location stronger is to simply make it deeper. If you have a kit model that has a fuselage that appears to you to be too skinny here, then go inside of the fuselage while it is under construction and add plywood braces to the fuselage side --- braces that are 6" or more in length, centered on the fuselage just under the leading edge of the stab. A bulkhead is generally not needed here unless the fuselage bottom is not covered with cross grained wood. If it is an open structure, then you may need to add some extra beef here by the use of gussets, or a complete bulkhead. Adding extra wood may seem like a problem to you, but, when you're in doubt, beef it up, you won't be sorry. Lots of the newer radios have snap roll buttons built into them. Nothing is more spectacular than a model zinging along suddenly doing a snap roll in flight, then continuing on its path. Well, something is more spectacular than this --- it's a snap followed by the aft end of the fuselage twisting off followed by a rapid plunge to the ground. Now, that's really spectacular. Hard act to follow.

While we're on the subject of extra muscle, let's talk a bit about the ever popular servo board. Servo boards have been around for a long time, and all of today's radios come with a plastic servo tray that does a great job. It does a great job for the normal size model, but may not be too good for the larger ones because the plastic will flex under a load. Because of this flexing it's a good idea to build your own servo board out of plywood for models with engines of .90 size and up. These boards can be constructed of 1/8" five ply aircraft plywood. Never make them of lite ply or 3 ply plywood as they will not be strong enough. The servos can be held to the servo board by the use of #3 x 1/2 wood screws, or #3 x 1/2 sheet metal screws. Remember do not cinch the servos too tightly to the board. The rubber grommet in the servo hole is to absorb

Look what you can do with a Great Planes Big Stik 60. Ken McDaniel of Tucson, Arizona, made a Tri-motor out of his with an O.S. 40 in the nose, and two K & B 20 Sportsters on the wing. As Ken put it, you have to admit it's not the ordinary "Ugly Stik."

engine vibration to some extent, and it will transmit the vibration if clamped down too tightly. The best method is to tighten the screw down until the screw head just begins to compress the grommet.

Let me tell you a little horror story about a homemade servo board. This story was passed along to me by the one and only Helmer Johnson who, over the years, has kept his eyes open for things like this to bring to you. Seems that a relatively new modeler brought his bird to the field to be checked and test flown. Everything looked all right. The wing was strapped on and the test flight began. After a couple of minutes in the air, the engine of the model suddenly went to low throttle, and other funnies started to happen. It seemed like a complete case of radio failure, or outside interference was causing the aircraft to go wild. The throttle control kept jumping from high to low and back again. At the first sign of trouble the pilot had throttled back and finally the throttle went to low and stayed. The pilot guided the aircraft in for a landing, but the elevator control kept acting up. At about three feet above the runway the elevator went wild and the aircraft dropped the rest of the way to the ground, breaking the prop and killing the engine. Since the aircraft was undamaged, the builder took the plane back to the pits. No one else on the flying field was on his frequency. Unexplained radio problems . . . unexplained until he removed the wing. A look inside told the story. The screws holding the servos to the ply board had backed out and each servo was just sitting in its hole, held in place by nothing. Older heads took a look at the servo board. Everything was fine, except that the builder had drilled the pilot holes in the board too large and the screws had nothing to "bite" into. A 1/16" pilot hole is right for small screws. If the aircraft had crashed from way up in the air, everyone would have believed the problem to be some type of radio failure.

One method to check out for problems like this (and other mistakes) is to completely assemble the aircraft, fill up the tank, run a complete tankful on the ground. With the engine running sometimes at high, sometimes at mid range, and sometimes at low, do a radio range check, operating through a complete range of signals. When you have run out a tankful, stop the engine, take off the wing and completely inspect the aircraft to find what has been loosened by engine vibration. If everything looks okay, then take it for a test flight. By the way, don't do this in the pits on a busy flying day, you won't make many friends if you do. Go some place where neither the noise or tying up the frequency will be a problem. □