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BIG STIK

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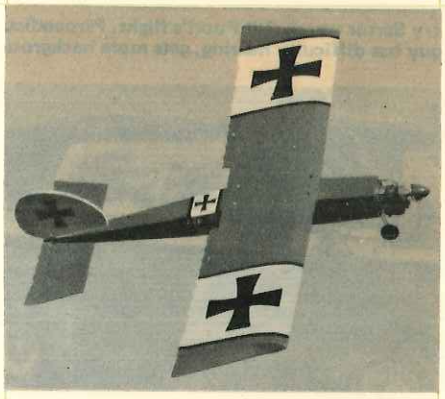
By DON ANDERSON . . . An enlarged version of Phil Kraft's famous Ugly Stik, designed in collaboration with Mike Smith. Impressive!



● I spent probably a month thumbing through old magazines, looking at kit plans, and thinking about what airplanes I had enjoyed flying in the .40 and .60 versions. I finally saw a picture of 3 Tulsa-area modelers' airplanes that totally made sense to me. They were huge "Ugly Stiks," enlarged 1.7 times the .60 powered size, designed for Quadras. Weight was reported over 30 pounds each. *(See Flap Co. Ugly Sticks in last month's "R/C World." wcn)*

Without going into too much detail, I decided I would rather try my own design. I had learned to fly on a Jensen Ugly Stik ten years ago, and have kept one around ever since for a fun-fly airplane. I dug out a set of my old plans, got out my calculator and decimal ruler, and went to work enlarging the plans. I started out considering just how big a 1.7 times enlargement would be, and when I realized it could not fit into the back of my full-sized station wagon, started thinking smaller! After playing with different sizes, looking at wood sizes available, and thinking how large my Quadra was, I decided to enlarge the outline only 1.6 times. I quickly plotted a new rib outline on graph paper, drew in the "scale" spar and center-of-gravity locations, and decided to call it a night.

The following night I went to a local club meeting, at which I asked if there was anyone else interested in my idea. Mike Smith voiced interest, and we scheduled a work day the following Saturday to finalize plans and start building two of the monsters. I spent an afternoon rounding up more drawing paper and supplies and was ready for the weekend.

Saturday came, and so did Mike. We tore into the project, first considering the use of cardboard, arrow shafts, aluminum tubing, and several other construction techniques. We finally decided to come back to basic balsa, plywood, and spruce construction. My large airplane experience had familiarized me with this style of construction, and I felt I could better judge the weight of our structure in this form than any other. Weight was my main concern, as I felt the completed model should weigh no more than 20 pounds for good performance. The fact that we wanted a tricycle gear model this large bothered me, because I knew that no model manufacturers made nosegears that were suitable. We both ended the day realizing we had accomplished very little and that a lot of work remained to be done. We had enlarged only the outline, and still had all the structure design ahead of us.

The following Saturday we again got together. I had thought a lot about the wing structure, and decided I wanted to keep the "Ugly" look of the open framework. I suspected torsional strength might be more of a problem than G-load strength, so looked primarily for a way to add torsional strength to each wing panel. The simplest way seemed to be to build in a large box spar, using the "scale" spars as corners. By making the top and bottom of the box parallel to the rib centerlines, the box idea looked to me to have an added benefit of making a nice alignment jig during assembly! Due to the wide spacing of the ribs after scaling them up, we decided to use 1/8-inch lite-ply plywood to be sure we had enough strength. Provisions in the center two rib bays for aileron servos and wing hold-down blocks, plus added contact area for the fuselage wing-saddle, seemed to make it desirable to sheet those bays, but all other ribs and spars could just be capstripped. The overall result looked to me to be lighter than a fully sheeted panel, with far less sanding required. Mike agreed, so drawings were completed and wing rib and false rib templates were made.

My experience with .60-powered Ugly Stiks included a couple of damaged servos (and airplanes!) resulting from aileron flutter. Tapering the ailerons and shortening them so they ended at the tip rib seemed to eliminate the problem, so the Big Stik ailerons were drawn in accordingly. We decided to worry about any remaining details when construction reached those stages.

The fuselage design began with us discussing nosegears and Quadra vibration. My Quadra was stock out-of-the-box, and had been run only the few times at Las Vegas. Vibration was undoubtedly many times that of any .60 I had ever seen, so I planned on building a strong fuselage and empennage assembly! Convincing Mike was no problem, so he decided to work on the stab and fin drawings while I did the fuselage. We ended the day looking at an old Royal P-38 double-strut nosegear I had, wondering whether an enlarged homemade version could be made simply.

The following week nights Mike and I worked at a breakneck pace. We were making good headway now, and the excitement began to take its toll on our hours of sleep! The full set of wing drawings was completed, remaining part shapes were transferred to plywood using carbon paper, and templates were cut out. Mike incorporated nylon bolt provisions in the stab so the stab could be bolted on and began building one set of tail surfaces. I stopped working on the fuselage design long enough to cut the wing ribs and dihedral braces for one wing, and built up the full-span 1/2-inch square spruce wing spars. I built these from two separate 1/4x1/2-inch spars similar to the way they are done in the Jensen kit and epoxied them together, being careful to reverse the center splices to avoid a weak joint.

Another weekend arrived, and by then Mike was ready to begin to assemble the first wing. We agreed to finish the one model we were working on and test-fly it before building the second. Mike agreed to let me play guinea-pig, and I was hoping that at least his airplane would turn out well to pay him for his sacrifice! Mike began the wing assembly on a flat table by pinning a 1/2x3x48-inch balsa sheet over the box spar location of one panel on the plans. He pinned the 1/2x3-1/2 balsa sheet box spar bottom on top of this and began to build the first panel, adding ribs starting at the center section side of the panel. *He found that the entire center section, consisting of all dihedral braces and all center section ribs they interlocked with, had to be first built as a sub-assembly on the bottom 1/2-inch square full-span spruce rear spar before being epoxied in place over the bottom sheeting.* This was mandatory, as the full-span bottom rear spar would prevent the adding later of any of the interlocking style ribs! Once the center section assembly was completed, he tilted the wing so the first panel could be built on the already started jig, and proceeded adding the remaining full-length ribs and front spar, carefully positioning each and gluing them in place as he worked outwards toward the wing tip.

When all the first panel full ribs were in place, he epoxied a piece of tapered trailing edge stock to the 3/16x2 bottom trailing edge sheeting and Hot Stuffed the assembly to the ribs. Leading edges were cut from 1/2-inch balsa sheet and 1/4-inch square epoxied into a 1/8x1/4 routed slot in the back side. This assembly was glued to the leading edges of the full ribs. The top spars and box spar top sheeting were then added, followed by vertical grain balsa webbing at the front and rear of the box spar. The false ribs were next glued in place, followed by the front wing bolt plates, and blocks, top trailing edge sheeting, and top filler ribs between the spars. At this point Mike began the top side capstripping, and he muttered a bit as he found the

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1/8x1/4 balsa strips used on the ribs and false ribs often broke while being bent over the leading edge. We solved this problem by soaking the top sides of the capstrips with "Fantastic" household cleaner and water before Hot Stuffing them in place. Both spars were cap-stripped, the front with 1/4x3/16 soft balsa, the rear with 1/8x1/2. A Dremel 580 table saw was invaluable, as we cut most of the special size strips we needed from scraps of 1/8 and 3/16 sheeting I had laying around. At this point we removed the wing from the building table and added all bottom filler rib pieces and capstripping on the first panel.

We next prepared to build the second panel by shimming up the proper dihedral angle at the completed panel tip so the next panel could also be jigged in the same manner as the first. You will suspect that your table must be at least 8 feet long the first time you look at the full-length 1/2-inch square spruce spars, but here it is a necessity, as the finished panel must be shimmed up carefully to insure a twist-free wing. Once in position, Mike quickly finished up the second panel, added the 1/4-inch sheet balsa tips, support triangles, front blocks, and trailing edge 1/8-inch sheeting.

The time had come to start the tedious part of radio installation planning in the wing and aileron planning. We cut ailerons and elevators at the same time out of a large 3-inch square by 36-inch long balsa block. We tried using both a 12-inch bandsaw with a rip fence and a table saw with a hollow ground planer blade, and found the table saw did a smoother job, requiring practically no sanding. Bellcrank pads, Sullivan SR steel rod and nylon tube pushrods, and servo mounts were added in the wing. Lastly, Mike sheeted the two center rib bays and fitted the ailerons.

While Mike had been working on the wing, I kept designing and building the fuselage as time permitted. I started the design knowing full well there wasn't much I could do to make the box style construction complicated! I decided to use 1/4-inch balsa sheet for sides and top and bottom cross-grain sheeting. I put a 1/8 lite-ply doubler in the fuel tank compartment and wing-saddle area, and a second smaller doubler in the tail to help hold the vertical fin and stab. I ran 1/4-inch square spruce stringers in each fuselage corner and down the centers of both sides and the top and bottom. A 3/8-inch plywood firewall, built-up 1/4-inch plywood bulkheads at the front and rear of the wing opening, and 1/8-inch lite-ply bulkheads behind the wing opening back to the tail pretty well finished up the design . . . to the point of the landing gear design, anyway.

We decided to use a 3/16 piano wire main gear, mounted in maple blocks in the bottom of the fuselage. A 1/4-inch plywood cover plate screwed to the bearers would hold the gear in place and allow easy removal for storage and transportation. A 1/8 piano wire spreader bar bent through a screw-eye in the center of the cover plate was planned in to limit flexing.

The nosegear by now was becoming a thorn in my side! I discussed the basic idea of enlarging the Royal double-strut gear with our club's machinists, Ron Tibbetts and Wayne Craig. They each agreed to make one, so Mike and I kept working on the structure.

My fuselage construction began with building two complete fuselage side assemblies. Balsa sheeting was spliced and glued to make one-piece, full-length sides. The lite-ply doublers were cut and laminated, followed by adding all side stringers and the landing gear and splice seam ply doublers. Bulkheads were cut and built, and their locations marked on the sides. The rear fuselage bulkheads were notched in the approximate centers of each side so they would fit properly in their respective positions.

I then began assembly by installing the two wing-opening bulkheads squarely between the fuselage sides. I added the maple landing gear blocks and half bulkheads and let all dry well. I then positioned the assembly right-side-up over the fuselage top view and added the firewall and all remaining bulkheads. The top and bottom spruce stringers were glued in place, and cross-grain bottom sheeting and the 1/4-inch plywood gear cover-plate were added. Stab bolt blocks were cut from 3/8 plywood, and the vertical fin fitted and epoxied in the tail. The stab was carefully aligned and fitted, and 10-24 nylon bolt provisions made ready.

Plywood wing hold-down blocks were epoxied in place, and pine triangle support blocks added to increase the glue area. The wing was fitted to the saddle, and dowels added in the rear of the wing to support the rear wing bolts. Bolt holes were drilled and tapped for 1/4-20 nylon bolts in the rear, and C.B. long aluminum bolts with lockwashers in the front.

An EWH quart metal gas can kit was assembled and fitted in its compartment. A hatch was cut from 1/8 plywood, and the compartment edges lined with 1/8 plywood strips so sheet-metal screws could be used to hold the cover in place. A C.B. Associates Quadra engine mount was mounted to the firewall, and fuel line holes drilled to allow routing of Sonic-Tronics' new gasoline transparent fuel line to the engine.

By the time we reached these stages, more weekends and following weeks had flown by! I was beginning to think about what radio to install in my new Big Stik, and how many and which kind of servos to use. A call to Kraft Systems made up my mind, as they recommended a combination which included their KPR-7L dual conversion receiver, KB-4F 1000 mah battery pack, and four KPS-15H heavy-duty servos. One of these heavy-duty servos on each control function would be adequate, but smaller servos would require doubling up. I bought the radio and began the installation by running elevator and rudder pushrods to the tail. I again used Sullivan's SR pushrods and Hot Stuffed them in suport blocks at every bulkhead location. A piece of 3/16-inch K&S tubing chucked in a drill made quick, neat exit holes out the rear fuselage sheeting, and I similarly Hot Stuffed the nylon guide tube in place. I decided to use the landing gear support bulkheads as a box to house the battery, switch, and receiver, and I felt it would be best to use a separate steering servo coupled to the rudder servo through a Y-harness. A fifth KPS-12 servo was installed for throttle and a DuBro flex-cable added for throttle control.

At this point I realized I had just completed the radio installation without giving any thought to balance! Convenience had been the only consideration, and as I found out later, was the best way to install everything. Only 3 ounces of lead were required in the tail, and that I put in with a built-up lite-ply tailskid.

The top sheeting was all added, sanded, and made ready to cover. The aileron servo was installed, everything hinged to the point of epoxying them in place, and the wing sanded. Monokote was used on the entire airframe, a red, white, and black box-top color scheme used. A 25-foot dealer roll of red worked out very well for the base color.

Again the landing gear came back to haunt me, so a main gear was bent, wrapped, and soldered using Stay Brite silver solder and copper wire. We found that a propane torch made this an easy job. Ron and Wayne each came up with nosegears. Wayne's was simpler, using easily obtainable materials. Ron's, as usual, was a work of art! Both were very durable, and Mike and I had no doubt they would work. I installed Ron's in my Big Stik, and installed both push and pull-style rods to the nosegear servo. The plan shows the best features of both of these gears.

I installed a 3-1/2 inch wheel on the nosegear, and a pair of 4-inch wheels on the mains. I bolted my Quadra in the mount, installed a new Rual Engineering prop hub and spinner adapter, and put on a 3-1/2 inch C.B. spinner and 18x6 prop. Elevator throw was set at 1 inch up, 1 inch down, rudder throw at 3 inches each way, and aileron throw 3/4 inch up and 1/2 inch down. (These throws turned out to be very responsive, but not excessive for aerobatics, so consider them maximums for your first flight.) All appeared ready at last after nearly two months of work, so we ordered nice weather for the following day and went to bed early, for a change, at about 2 a.m.!

Determination, anxiety and a bit of confidence probably described my mood the day of the first test flight. I couldn't wait to see whether our design was going to work out the way I wanted, yet there remained uncertainty because the ony way to find out how a plane flies is to fly it! Weight was a relatively light 19 pounds dry, CG a "scale" 1/2 inch behind the main spar. Batteries were freshly charged. Control surface hinges

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were all epoxied, all servo screws were tight, all surface deflections the proper directions. My mind kept running down the mental checklist of most often missed items that time had not allowed checking before! I had never before finished an airplane in the wee hours of the morning, then raced to the flying field the next day (Saturday) to fly before taking time to show the project off to friends!

We fueled the red, white, and black Big Stik with a 16:1 mix of regular gasoline and McCulloch chainsaw oil. I cranked the prop over 4 turns while choking the engine with my thumb, then flipped the prop and the Quadra fired up. I collapsed my antenna, walked al the way around the airplane, checking the range, and found no problems. I suddenly realized I could not come up with any more excuses! Time had come to fly the big bird, and all was ready!

I pushed the nosegear out onto our taxiway, advanced the throttle and the Big Stik rolled out onto the asphalt. I immediately noticed ground handling was a breeze as I taxied down our 4-foot taxiway with a 3-foot stance airplane! As I turned onto the runway, I noticed the Big Stik would turn on a dime! I could easily turn the big bird completely around on 1/2 of our 25-foot wide runway. I taxied the length of the runway a couple of times, just to check her out. Tracking seemed straight and docile. I knew I had a winner as far as ground handling goes!

I taxied downwind, turned into the wind, stopped, and took a couple of deep breaths. I poured the coal to the Quadra gradually as the monster accelerated down the 225-foot runway. That huge prop was really pulling as I could have easily lifted off at the halfway point! I kept her on the ground another 50 feet and gently pulled back on the stick. The Big Stik immediately rotated and jumped into the air. Power was very adequate to climb out at just about any angle I wanted! I kept pulling the nose up, and climbed straight out to probably 200 feet before making my first turn. Never before had I had that kind of power in a large model! All trims seemed perfect!

I turned downwind, pushed the nose down to come back down where I could better see how she was flying, and tried a roll, followed by another, and another, and another. She kept rolling without any hesitation or loss of flying speed as I did about seven or eight rolls across the sky. I turned back into the wind and set up for loops. I entered my first loop from level flight, pulled back on the stick and the Big Stik did a spectacular large round loop with practically no correction. I ended the first and went immediately into a second, then a third. At the end of three I flew on upwind and decided to try something else. Everything this far seemed like a .60 powered Ugly Stik except the speed, which appeared to be in the 60 mph range.

I decided I would try a snap-roll to see whether the Big Stik had all the characteristics of its .60-powered sister. I pulled the nose up slightly, pulled off throttle and banged in full rudder, ailerons, and elevator, and the Big Stik immediately did a majestic snap-roll! I was ecstatic! I had to spin her! I pulled the nose up, chopped throttle to about 1/4, locked in the snap-roll command and she snapped and fell into a perfect spin. Her tail stayed high, rotations were tight yet smooth, and I spun her down about 4 or 5 turns. I released the sticks and she immediately stopped rotating and fell out into a shallow dive. I hauled up elevator and was so excited I could hardly stand myself!

I decided I had to see whether she would outside loop. I already knew the answer because everything this far had a feeling of flying an Ugly Stik in slightly slow motion! I set up, rolled her on her back, and noticed immediately that it took almost no down elevator to maintain level flight. I pushed forward on the stick and she did a mirror image of the inside loops she had done earlier! After 3 outsides I knew I could do any maneuver I wanted (except point-rolls, as any of you Ugly Stik fliers know are tough with a shoulder-wing).

I decided I should probably land and check out all the screws and bolts, so I pulled back on the throttle and set up a descent. The nose immediately dropped just a little and she started gliding down. There seemed to be very little drag compared to all the other large models I had seen fly. Normally, when power is reduced to idle, these big birds glide about 50 feet, flare, and stall unless the pilot is quick enough to push the nose down. I don't like having to shove that stick forward for landings, so I usually keep just enough throttle on to maintain forward speed and control my sink rate.

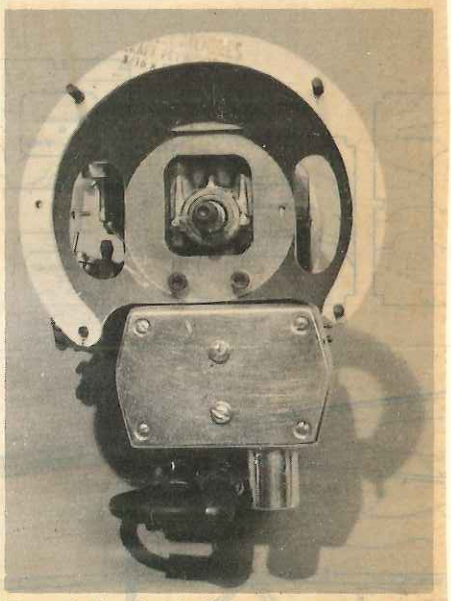
But the Big Stik had none of this tendency as she gently glided down. I was happy to see this, as dead-stick landings with many big birds become a real handful! I gently banked into final and added only slight power just to be safe. I flared at the end of the runway about a foot off the surface, and gently set her down on the mains in front of me. As any of you Ugly Stik fliers know, the airplane can easily be flared on landings to such an extent the tail skid becomes very necessary and functional! The Big Stik had the same tendency, touching the tail down first just before the mains touched down. Rollout was straight with the nosegear remaining well off the pavement until I released up elevator.

The first flight had been a success, actually better than I had ever dreamed possible! The Quadra and Big Stik seemed to match one another perfectly, and the combination is more fun to fly than any model I have ever owned. I sport fly this model now, and have accumulated over 8 hours of flying time to date. I have let over 20 other fliers fly her, and no one has found any bad characteristics. A couple have commented that they feel a straight wing version might be even more aerobatic, but I'll let those of you who try her find this out, as I'm happy with the way she goes now. I feel that she would make an ideal trainer with all controls slowed down. She is very predictable in any weather condition, and flies well without any rudder coordination whatsoever. Anyone who can fly any advanced trainer can easily move up to this bird and have success. She is very relaxing to fly even while doing the wildest aerobatics you can dream up, yet so maneuverable there is always another to try, so I don't get tired of her.

I highly recommend her to any of you. I hope you don't cut any corners on design to save weight, as you'll need all the strength that is built in to handle the G-loads possible with the Quadra. Mount the wing hold-down blocks securely, as you'll see on the first flight that what I'm telling you is true!

I hope you have the fun Mike and I have with ours. He has just got his in the air and it flies just like mine. It's his first monster, and he is learning to fly inverted for the first time, and is doing maneuvers he was afraid to before. Start out using an 18x6 prop if a Quadra is used, and when you get comfortable move up to a 16x10 Zinger. Brace yourself, as you will see a marked improvement in performance, and speeds of 80 mph will be reached without sacrificing any vertical performance. If anything, that's improved too!

Have fun, remember safety first and carry gasoline only in approved containers and we'll look forward to meeting you one of these days at a Big Stik fun fly! •



Mount is fitted with 3/16 ply ring before bolting to firewall. Q.H. muffler.