GRUMMAN • AG-CAT •

By FLOYD FITZGERALD . . . A Mammoth Scale model (2-1/2" = 1') for 2 cubic inch engines or belt-drive 60's, the Ag-Cat spans 7-1/2 feet, weighs 18 pounds, and is a totally realistic flier. Already a trophy winner.

• Everyone has that certain time, place, person, or thing indelibly etched into his memory. Mine, as a lad of 9 years, was of being literally thrown out of bed early one summer morning by an old Stearman Duster, flying right by my window. With more speed than I ever could muster getting ready for school, I was dressed, down the stairs, and outside watching the Stearman doing its thing. From that time on, spray planes (biplanes in particular) have held a special fascination for me. My first impression of the Ag-Cat was predictable. It was even better looking than the Stearman! A strictly utility-type airplane, it has struts, wires, scoops, etc., sticking out all over. Beautiful!

Not being a designer or scratch builder of any note, I kept waiting for an article on the Ag-Cat to appear in one of the magazines, but it never happened. If I was going to have one, I would have to build it myself! After receiving a set of three-views from Grumman, I took the easy way out by sticking the whole works in an old Navy opaque projector and blowing it up to the scale I wanted. Not very kosher, I suppose, but it worked. After a lot of eyeball engineering on the construction, I ended up with a damn fine flying airplane.

HISTORY

The Grumman Ag-Cat was designed in the late fifties to take the place of the fast disappearing Stearmans, N3N's, and other types that were wearing out beyond use in the hard-flying, chemical-eroding field of crop dusting. The design parameters included ease of flying (stable), maintenance simplicity, and pilot safety. This last point is well demonstrated by the N numbers on my model. The full-size plane that bore those numbers no longer exists, but the pilot does! (He lost it in a stall turn while spraying.) Whatever the design reasons, she looks typically Grumman, harkening back to the days when the Wildcat and the Hellcat were engaged in the more serious business of trying to blow the other guy out of the sky.

Similar to the photo angle on the front cover, this pose creates a very realistic appearance for the model Ag-Cat. If you have any doubts, compare this with the photo below.

CONSTRUCTION

Before beginning construction, you must decide whether you will build to Sport or Precision scale. The plans will do fine for Sport, but you should visit your friendly local Ag-Cat (they seem to be everywhere!), with camera and tape measure in hand, for the exact scale version. I have yet to see one that looks exactly like the next one, so you should stick to one particular example. Not being a beginner's project, we will assume that you will be able to decipher the plans, so we will cover only the more complex items.

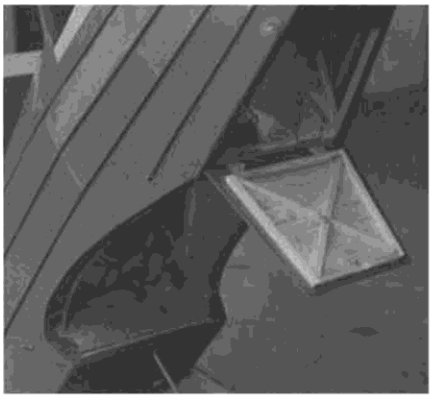
FUSELAGE

Construction is begun with the basic framework. Two sides are built, and when dry, the cross members, cabane strut, and landing gear blocks are glued in. Keep everything in line! Note that the fuselage assembly from section B forward to the firewall is built separately, and then attached to the main fuselage structure. Add the firewall, following the plans as to correct location. Next, sheet the fuselage sides with 1/16 balsa at noted areas. The section from B forward is sheeted on all four sides for strength.

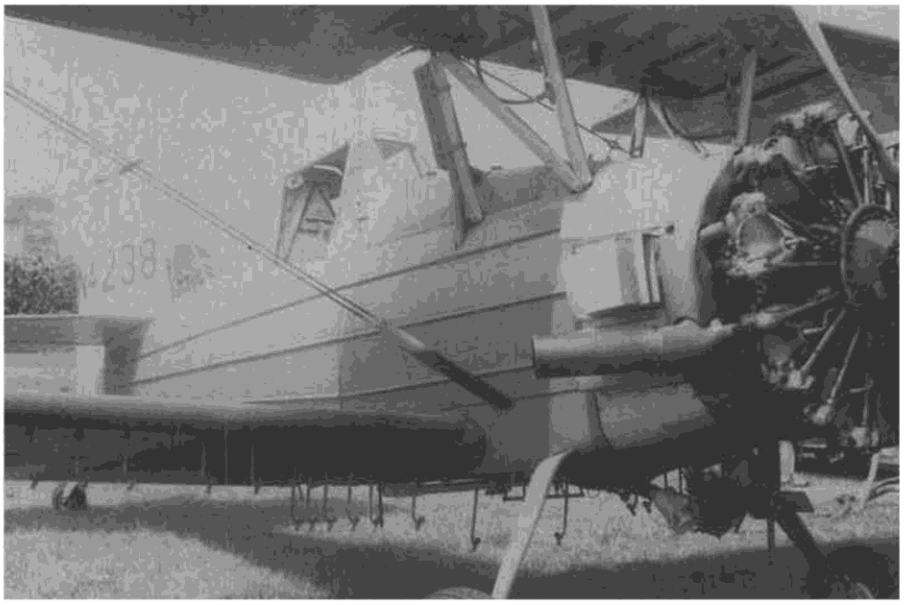
From the same angle as the photo above, it is obvious that the builders of the real one did a good job of duplicating Floyd's excellent model! This one has optional auxiliary wing gas tanks.

Pinning top wing in place. Tank is a Superpoxy thinner can. Gravity feed, like real!

Same pliers, same hand, different job. Attaching strut. Note rigging wire attach point.



Radio hatch, spray tank and shut-off valve. Tube connects to spray booms.



Nice detail shot of 1 to 1 ship, for scale nuts. Note size of exhaust pipe, exhaust blast protector sleeve over flying wires, and fairing under bottom wing.

Close-up of steerable tail wheel assembly. Usual wire rig won't handle this job.

Install cabane struts, keeping them vertical to the top longerons. All formers, stringers, and wing saddle areas are now completed. Sheet the top of the fuselage from cockpit forward to section B. Watch it here, if you intend to go Precision Scale. The top of the fuselage from the windscreen to the rear cabane strut is actually the top of the spray bulk tank in some examples, and may differ in cross section from the plans. Stringers, all around forward fuselage section from B to firewall are added, and sheeting glued on. Install plywood on the bottom of the fuselage ahead of wing saddle.

The canopy is built up as per the drawings; refer to plans as to correct location of all parts. This step could be done away with if you have access to a vacuum-form machine, and can carve a mold. The canopy itself adds nothing to the structural strength of the fuselage.

LANDING GEAR

This proved to be a sticky area for me to handle. The gear on the full-size Ag-Cat is of the Cessna spring type. I tried to duplicate this with 3/16 wire, but after much swearing, broken wire, and smashed and burned fingers, I threw the whole mess away, and made for the local hardware store. I eventually came up with a 1/4x1-inch strap of aluminum, used for molding around large plate glass windows. While it is not exactly scale-like in cross section, it has proven quite serviceable. Maybe you scroungers in the crowd can come up with a better substitute. In case you are wondering about the method of attaching

Strange method of fueling, at least for a model airplane! It's poured through funnel into tank. Center section stays with fuselage.

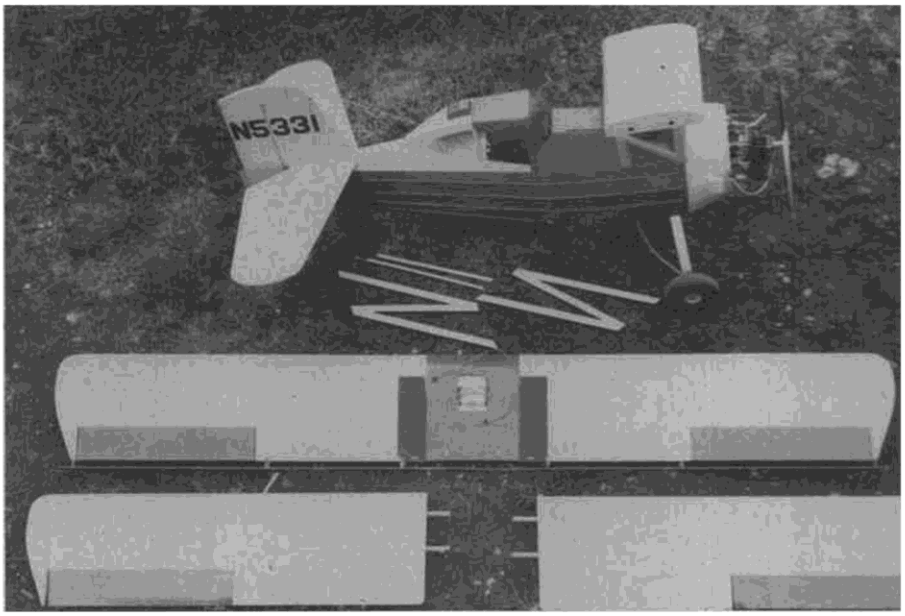
Designer Floyd Fitzgerald applies manual starter to O&R ignition engine. Radio is unaffected by ignition interference.

the main gear to the fuselage, don't worry; it has been crash tested by Yours Truly! On one of the later test flights, the engine quit (traveling needle) too far out over the bean field next to the flying site to make it back. Everyone knows the sink rate of a biplane with no power. Trying to make the best of a bad situation, I set her down as easily as possible, but the soft ground was just too much. She hit with a mighty "whoomph!" heard clear to the other side of our field. Naturally, there was an audience, and everyone started out to help pick up the pieces. The three nylon bolts had sheared, and the only damage was a bunch of dirt in the cylinder fins! Didn't bust the prop, even! (At six bucks a throw, that helps.) I have never had it fail under normal takeoffs and landings.

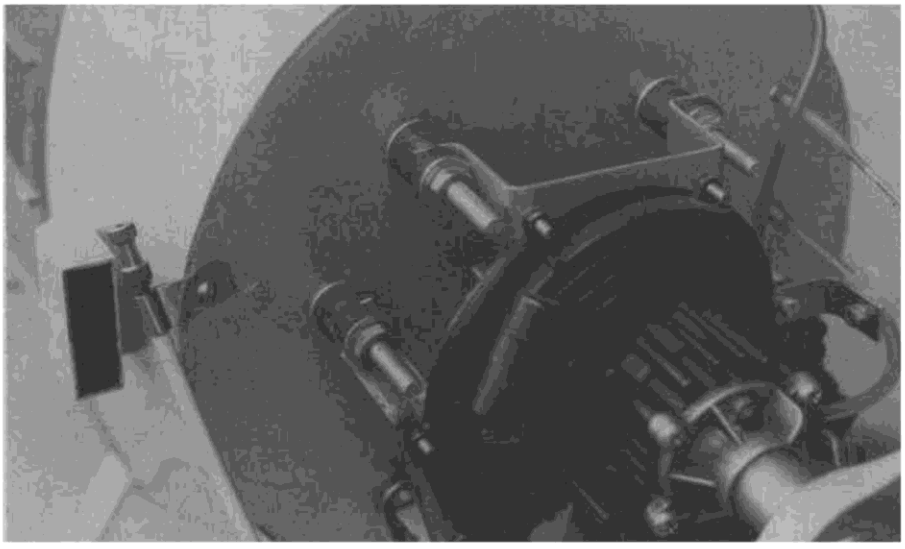
WINGS

Nothing too far-out here, but do build the top wing center section first. Do not sheet the top of this section, or the tops of the wing panels, until the locator dowels are in place. Build the wings flat on the plans by laying down the bottom sheeting first, and working from there. Remember your dihedral angle at the root ribs. After the panels are done (except for the top sheeting), place the center section (less its top sheeting) over the plans, along with one wing panel. Block the panel up to the correct dihedral (3°). Cut locator dowels to length, slide them through the center section ribs, and against the first wing rib. By rotating the dowels while applying pressure against the rib, you will make a mark for the hole. Cut out the hole, and repeat this process until the dowels are in the proper location and all assemblies are lined up, then glue in place. Do the other wing panel in the same manner. Make sure nothing slips out of line. The top sheeting can now be added to the wing panels, but do not sheet the top of the center section yet.

The bottom wing is built up in the same manner as the top, in three sections. Do not sheet the top of any of the assemblies until they are joined together with the ply dihedral braces. Make sure the holes in the ribs covered by the sheeting are large enough to allow the servo extension leads to be pulled through, or better yet, install the servo leads before sheeting the top of the wing.



The ideal ARF model! The Ag-Cat knocked down for transporting. Note spray boom along trailing edge of bottom wing. Receiver switch is inside canopy.



Close-up of engine mount. Needle valve extension on left is bike brake cable with Enya needle knob silver soldered to end. Nice way to adjust thrust alignment.

TAIL GROUP

All simple construction here. Note the dowel inserts for attaching the brace wires, and the stiffening dowels through the vertical fin.

ASSEMBLY AND COVERING

At this point, you should decide how you are going to cover the various components. I used Hobby Lobby Supercote throughout, simply because it was inexpensive and came in brown and yellow, approximating the colors of the real thing. The full-size plane uses

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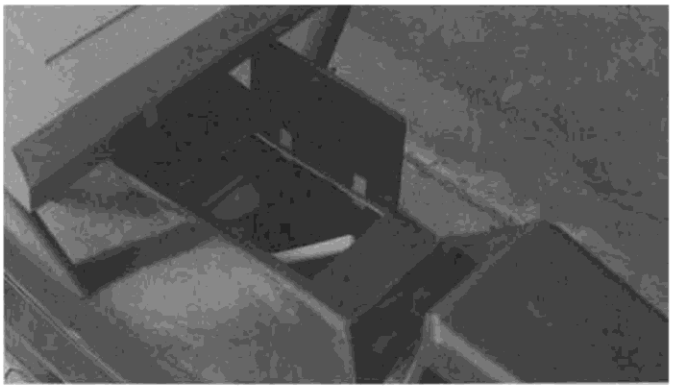
Hardwood inserts provide strong base for brace wire fittings. Operating turnbuckles provide realism and fine adjustment.



Close-up of spray tank fill hatch. Floyd is still experimenting with spray system to improve results.

Ag-Cat . . . . . *Continued from page 21*

removable corrugated aluminum panels for the fuselage covering. Perhaps this can be duplicated with sheeting. If you do this, watch the weight build-up. A few more side formers may have to be added to prevent sagging.

I would advise the purchase of a Robart incidence meter, especially if you are like me, and can't get everything lined up by measuring alone. Bolt the landing gear to the fuselage, and bolt on the bottom wing. Block up the fuselage until you get a 0° reading on the incidence meter at the firewall. The wing should be at 6° positive incidence. Shim or trim the saddle area as required. Slip the elevator horn/pushrod assembly through the rear stab platform opening. By checking incidence (4.5°), trammeling, measuring, and swearing a lot, line up the horizontal stab in relation to the bottom wing. When you are satisfied with the figures, mark the location, and glue in place. Maintain a constant check on alignment until glue is dry. Using a drafting triangle or similar tool, line up the vertical fin in relation to the horizontal stab, and glue in place. Make sure you have 3° fin offset to the left of centerline.

Begin top wing center section attachment by temporarily fastening two "line-up" wires between the cabane struts (for and aft), at the location shown on the plans. I did this using light fishline and Hot Stuff. They will hold the cabane struts in position and provide a base for the center section to sit on while you check alignment. Shim or move the line-up wires until the center section is square and a 6° positive incidence is achieved. Check everything again, then fasten the struts to the inside of the outer center section ribs with the grooved hardwood blocks and epoxy. Remove the line-up wires. Sheeting, hatch cover, and center section brace wires can now be added. Note that the center section wires go through the sheeting on top of fuselage (refer to pictures). They are tied off at the lower locations on the struts, and Proctor turnbuckles are used at the top locations. You can pull this assembly out of line, so be careful! The struts are faired with balsa, and glassed.

INTERPLANE STRUTS

With all wing panels in place, make a cardboard pattern of the strut. Use a sheet of balsa (fairly stiff), longer than the distance between the top and bottom wings, as a gauge (pin it to the top and bottom ribs near the strut attach points). This will hold the wings apart, so you can take measurements and arrive at a final strut length. Aileron slave rods are fabricated from K&S 1/2-inch streamlined aluminum tube, threaded rod, and metal clevises. Solder a clevis at the bottom location, leaving the top clevis free for adjustment.

TAIL WHEEL

It's important to make up this item as shown in the pictures. If you try the more common method used on regular size R/C models (bent from music wire), you will have the same experience I had. It collapsed on about the third flight! After all, this thing weighs about 20 lbs., and the single wire arm will just not take the weight and side loads.

FINAL TOUCHES

Complete the rest of the covering and attach the brace wires to the tail surfaces. Flying wires can be installed as per the pictures, or if you have a better way of doing it, go to it. A note of caution; you might be able to do away with the flying wires, but do not leave off the tail brace or center section wires . . . that is, unless you like to pick up pieces, and send your radio in for repairs!

ENGINE-GAS TANK

This area will be left up to the builder. If you are going to use one of the Quadra-type engines, be sure you add the extra 1/2-inch ply back-up firewall!

I ended up with an O&R industrial engine on mine, with the gas tank (made from a Superpoxy thinner can) installed in the top wing center section. No fuel draw problems were encountered, as the engine has a very effective hand primer, and a regulated carburetor.

RADIO INSTALLATION

After 5 years of trying to stuff radios into Quarter Midgets, this was like dying, and going to heaven! Gad, there's a lot of room! After much head scratching and studying the factory drawings, which indicated where the CG should be, the receiver and the servos ended up behind the pilot's seat area. The battery pack is in the center of the lower wing. This had several benefits, in that the tail surface control rods could be made much shorter than normal (lots of load on those things), the cockpit area was open for later detailing, and the nose was free for the spray tank installation. The aileron servos were installed in the bottom wing as per the plans, using an extension lead made for me by Kraft. This system has worked to perfection. I can't claim responsibility for this idea, as I saw it somewhere in a magazine. I had no problems at all with ignition noise, but check your set-up before flying.

SPRAY SYSTEM

It seems a shame to build this airplane and not make some provisions for dust, or spray. So far, the rig I have been experimenting with is working, but the spray mist is still not too visible. I made the liquid tank out of a bottle normally used to keep water cold in the refrigerator. The shut-off valve is an old Enya carb, well greased to lessen leakage, operated from a fifth servo. Combined engine pressure and gravity feed the spray booms. I've got a feeling that a pump of some sort will have to be used to get real scale effect. Whether you install a spray tank or not, be sure you pack the nose snugly with foam. This will dampen engine-airframe vibration, and really must be used with the chainsaw type engines.

FLYING

The first test flight was anxiously awaited by all the club members, and as the time grew near, somebody was dropping by my sign shop every day, to make sure I didn't sneak out and try it without an audience! The First Annual Great Plane Fly-In was to be held the 25th of June, in Champaign, Illinois. I intended to show up with this plane, so the test flight day could no longer be postponed. I took the topper off my Datsun pickup, so as to haul it to the field in one piece, and as I arrived, I was greeted by the largest crowd ever assembled there in some time. Even my wife, who merely tolerates this airplane business, showed up! A thorough range check was performed with the engine running at different throttle settings. Everything checked out here, so next, the ground handling and taxi tests. The engine was then shut down, and the whole airframe checked over to make sure that nothing was loose. We topped off the tank, cranked 'er up, and taxied out to the takeoff position.

Suddenly, everyone seemed to have important business behind their cars, or other places where cover was quickly available. That is, everyone except LeRoy Webb, who was running the camera (He used to jump out of perfectly good airplanes though, so maybe that says something . . .). I advanced the throttle, and after a short run, the tail came up. I let her run on the mains until I thought it was time (I was running out of runway), eased in some up, and she was OFF and FLYING! AMAZING!

I had never flown a big airplane like this, and I soon learned first-hand about adverse yaw and flying on the wings, not the prop! After a few turns around the field, I checked the transmitter trims, and found that only some down elevator had been put in; everything else was dead center. The first landing also pointed out another thing to watch for. Large airplanes throw off your depth perception until you get used to them, and I flared perfectly into some high weeds at the edge of the field. But she handled it in true Ag-Cat style, and just plowed right through them for an otherwise perfect landing. Anyway, everybody gave me a good round of applause, and I went over the the pits and had a BIG ORANGE!

I made it to the Great Plane Fly-In, and came home with the Best Scale Achievement trophy. One of the nicer things I received was the praise of a full-size Ag-Cat pilot in the crowd, who told me that it looked exactly like the real thing to him, both on the ground and in flight. This was one of the first meets strictly for the 1/4-scalers, and Eric Meyers, of Great Planes Distrs., in Champaign, deserves a big hand for organizing and CD'ing what I'm sure is going to become an annual event.

An interesting side note to the meet: a pull test device was used to measure the static thrust of the various engines used. My O&R pulled 7-1/2 to 8 lbs., while the Quadras where pulling up to 12 on the same prop (18/6). *(A later note from the author indicates that the engine picked up 500 rpm after more running time. wcn)*

I'm sure that I could stand more engine. I don't think it would fly any faster, but pull-ups from straight and level could be made with more authority on more power.

Well, there it is. Hope you will give it a try, and remember, at this scale, lots of detail can be added without seriously affecting performance. AG-CATS FOREVER! ●