At A Glance

Specifications Wingspan: 60 inches

Length: 42 inches

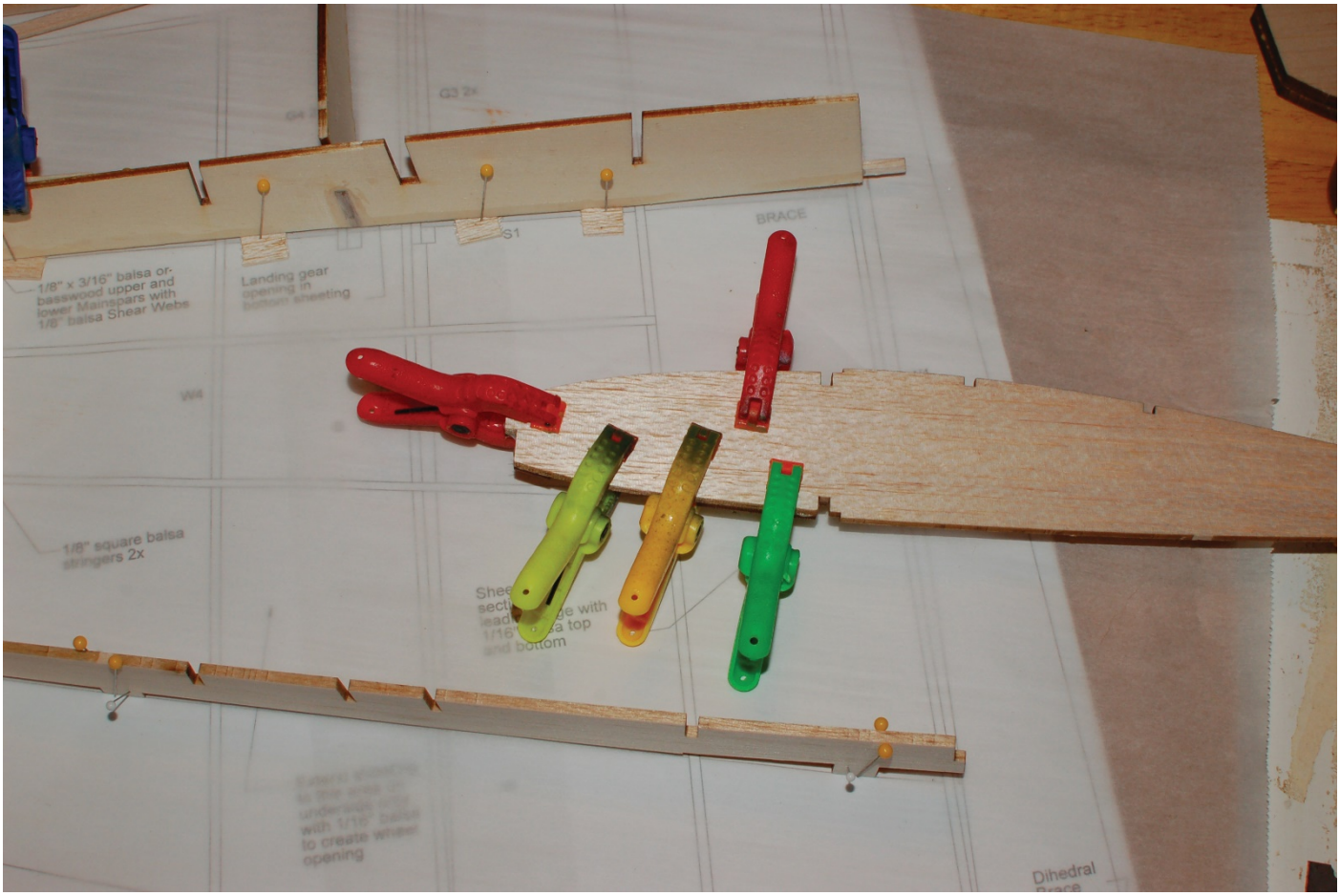
Weight: 4.5 pounds ready to fly

Power system: 650 Kv brushless motor; 60-amo ESC; 4S 3,700 mAh LiPO battery

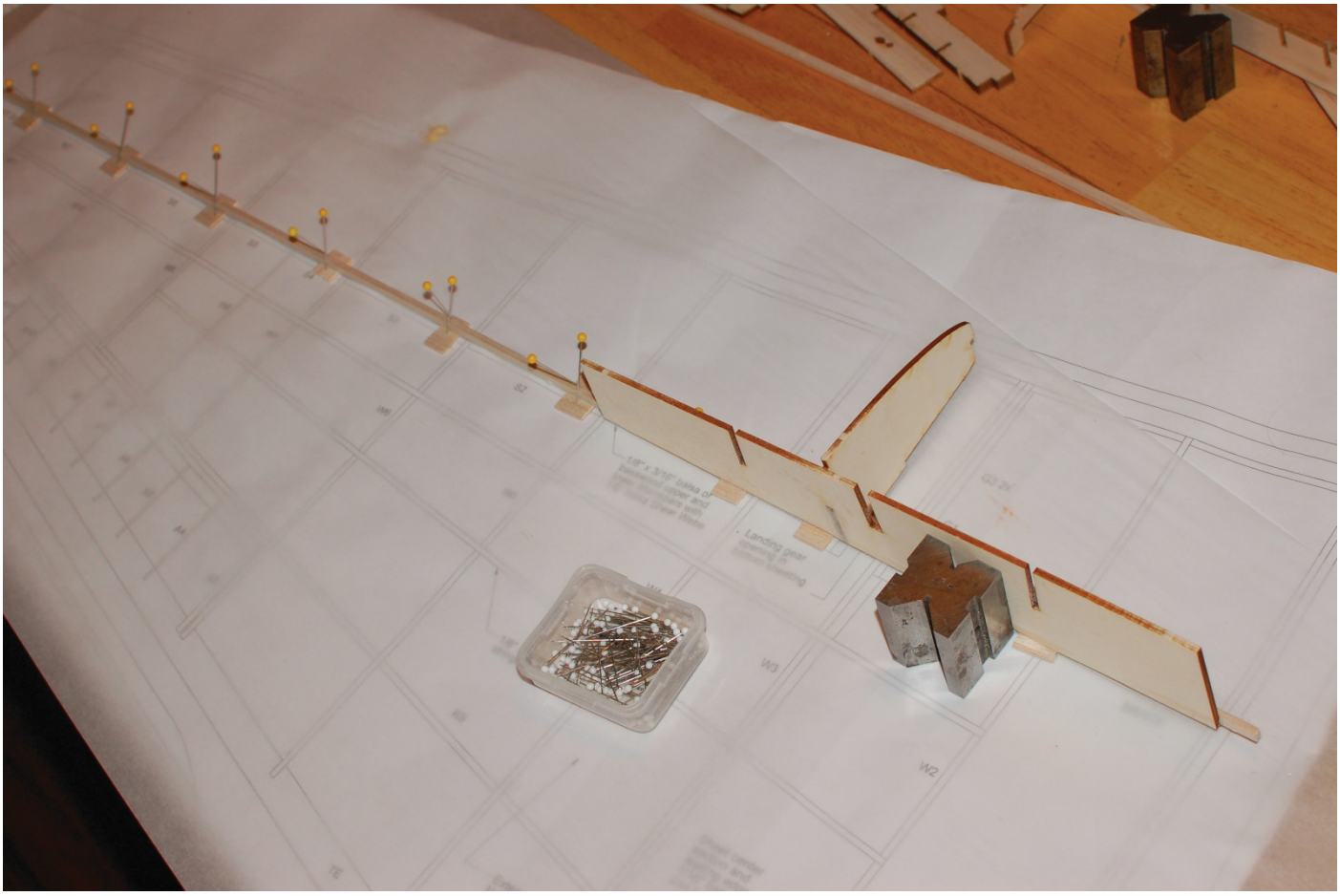
Welcome to the second chapter of the 60-inch Douglas Devastator build. We kicked things off last month by covering the Devastator's operational history, and then built up the tail group, fuselage, and cowling. In this installment, we will complete the major framing by building the wing and adding some of the key characteristics of this iconic airplane.

Framing the Wing

A strong plywood box is designed into each wing to hold a servoless retract. Start by doubling wing rib W3 with plywood half-rib G1. Epoxy half-rib G2 to plywood shear web S1 to form the other side of the box. Get this done before you begin pinning things down to the board.

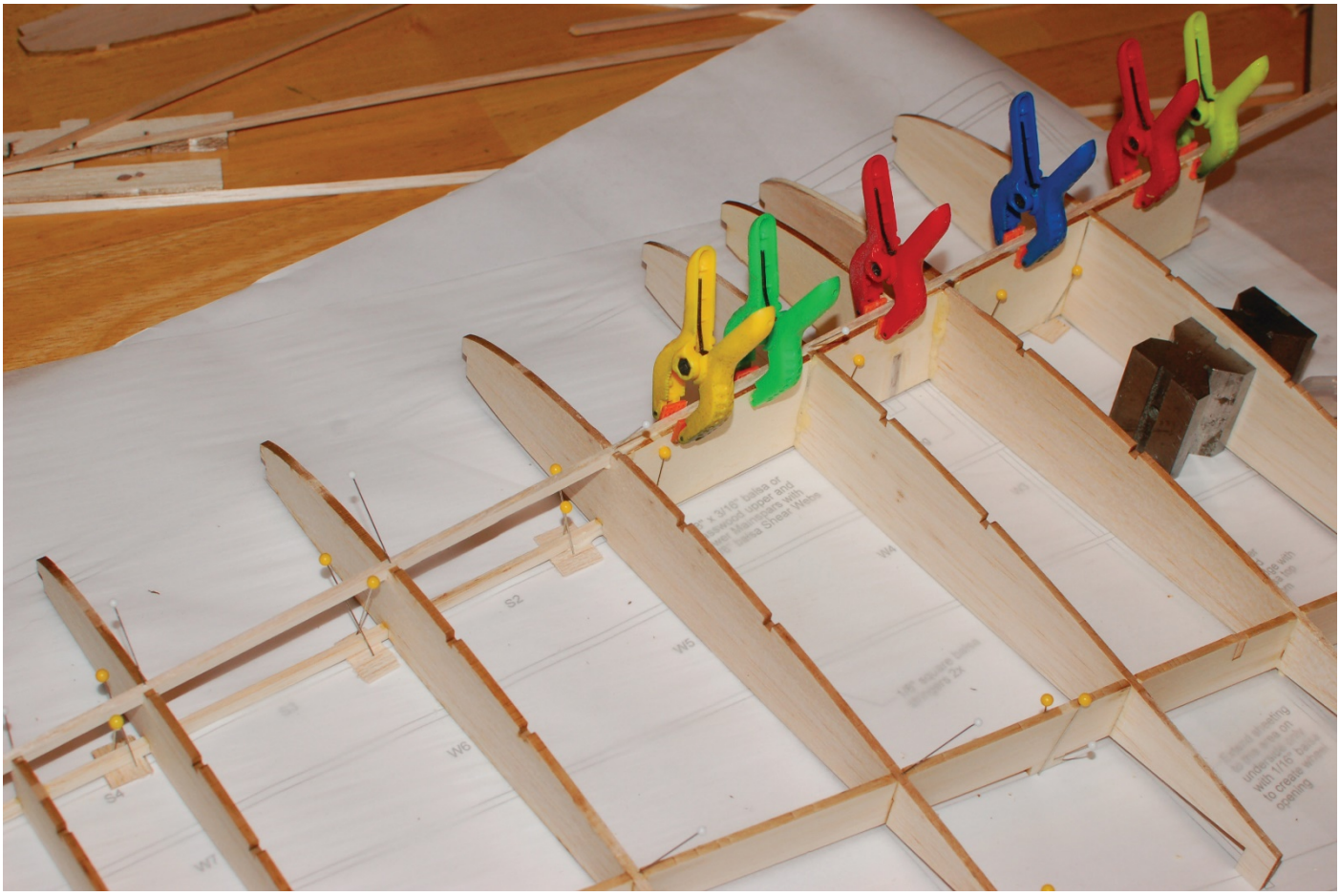


Doubling the rib that will form part of the retract bay.

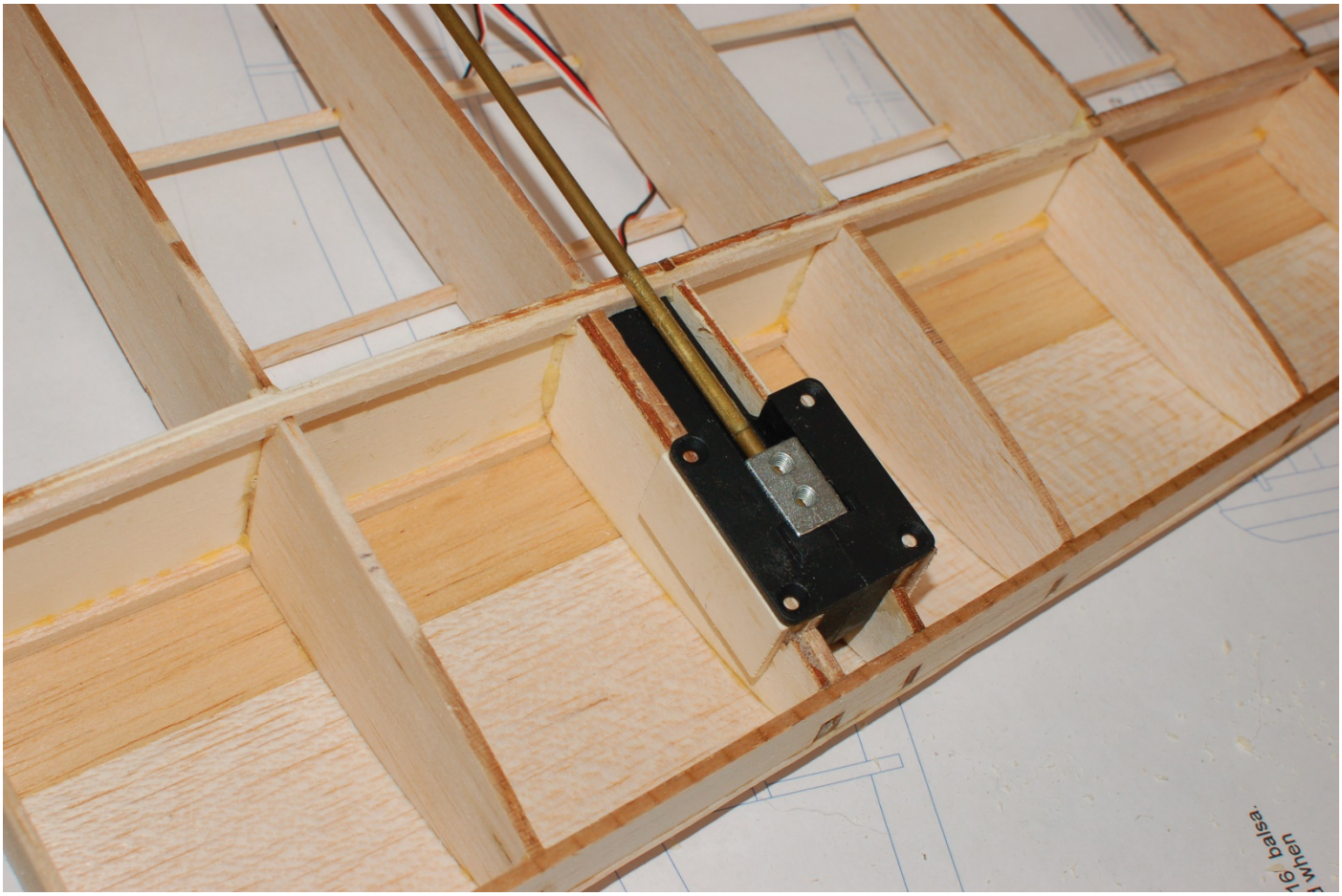


The other half of the retract bay has been epoxied to the shimmed lower main spar.

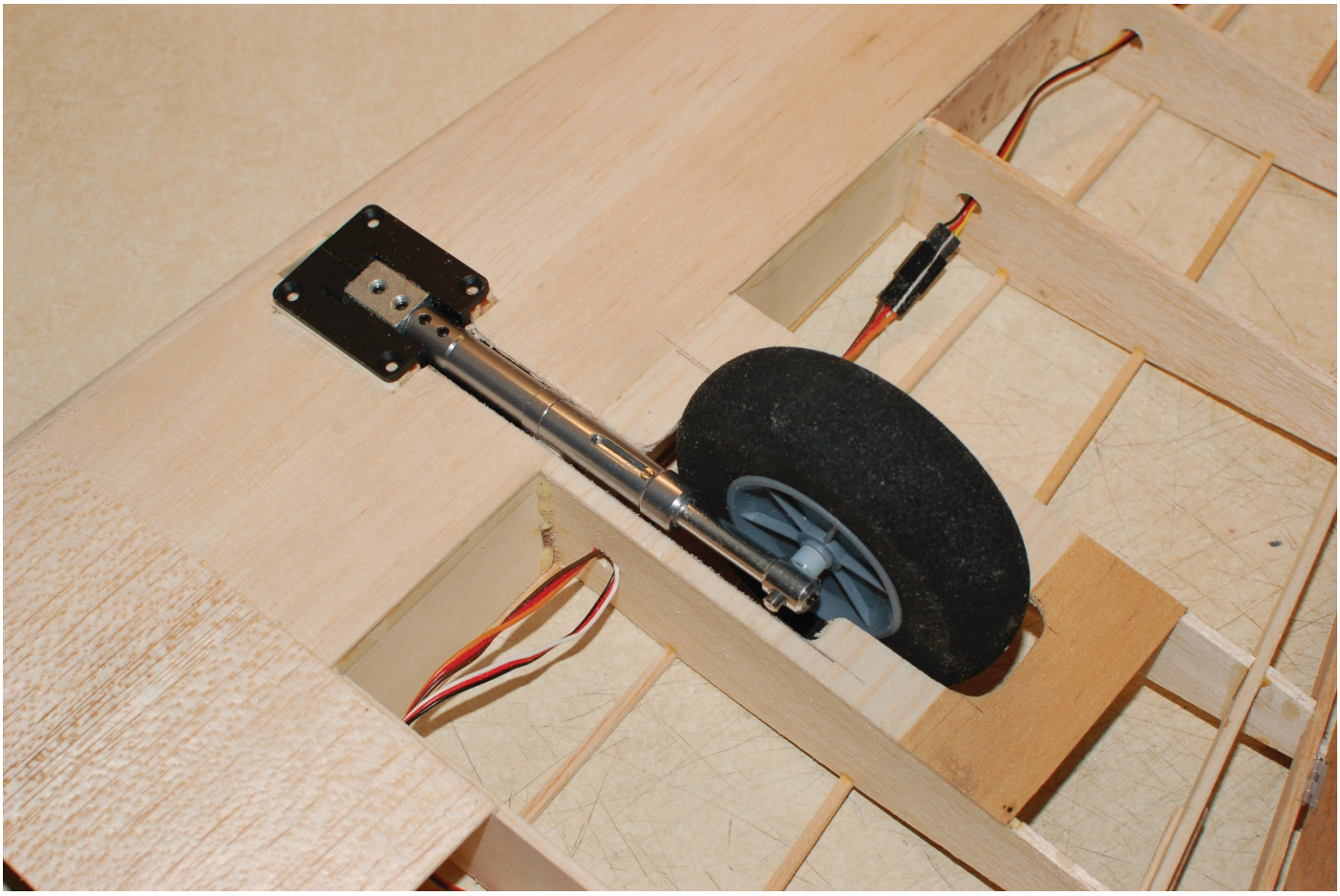
Now pin a 1/8 x 3/16-inch lower main spar over the plans. Shim it up with 1/16-inch balsa scrap. This is done so that the 1/16-inch balsa sheeting that comes later will cover the spar and the shear webs to form a stronger assembly. Epoxy the S1 assembly to the lower main spar. Crack and raise the root end of the lower main spar and align it with the bottom edge of S1. The rest of the wing construction is straight-forward. Pin the rear spar RS to the board and glue the rest of the ribs in place. Note that only ribs W1 and W3 are not perpendicular to the board. Set these two ribs to the correct angle using the supplied dihedral gauge. Now tie the tops of the ribs together with the upper main spar. Fill the gaps between the upper and lower main spars with the shear webs. The shear web grain runs vertically for maximum strength. Two 1/8-inch square balsa stringers will keep the upper wing covering from sagging. Add the leading (LE) and trailing edges. Attach the wingtip parts and move on to the sheeting. The wing is sheeted with 1/16-inch balsa between the LE and the main spar on top and bottom. Sheet all of the center section and the area around the main gear wells as shown on the plans. The rest of the wing will be left open.



Shear webs go in after the ribs and spars are in place.



Plywood doublers are epoxied to the sides of the retract bay and form the pads that the retracts will be screwed down to.

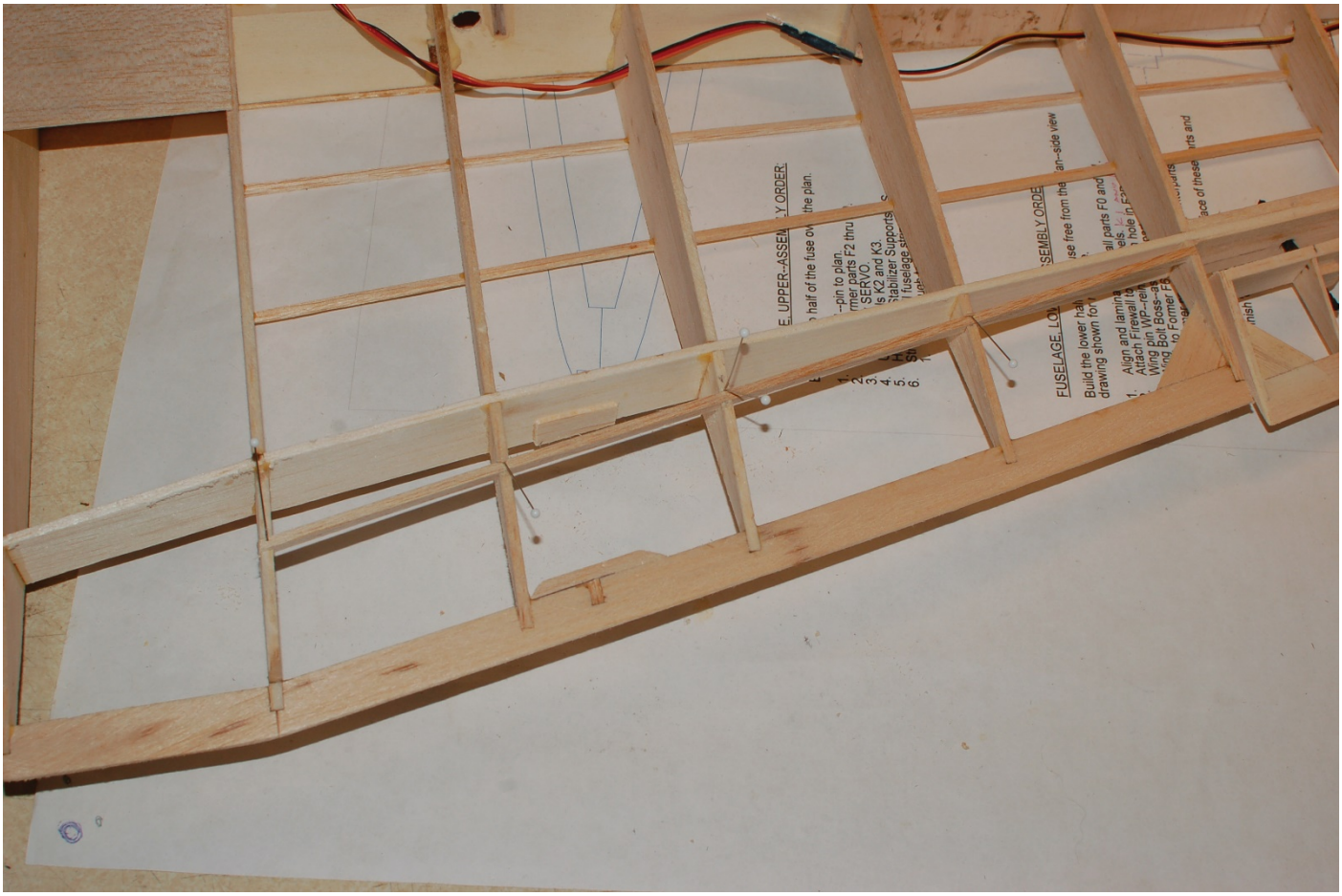


The wheel and strut are nested into the wheel well.

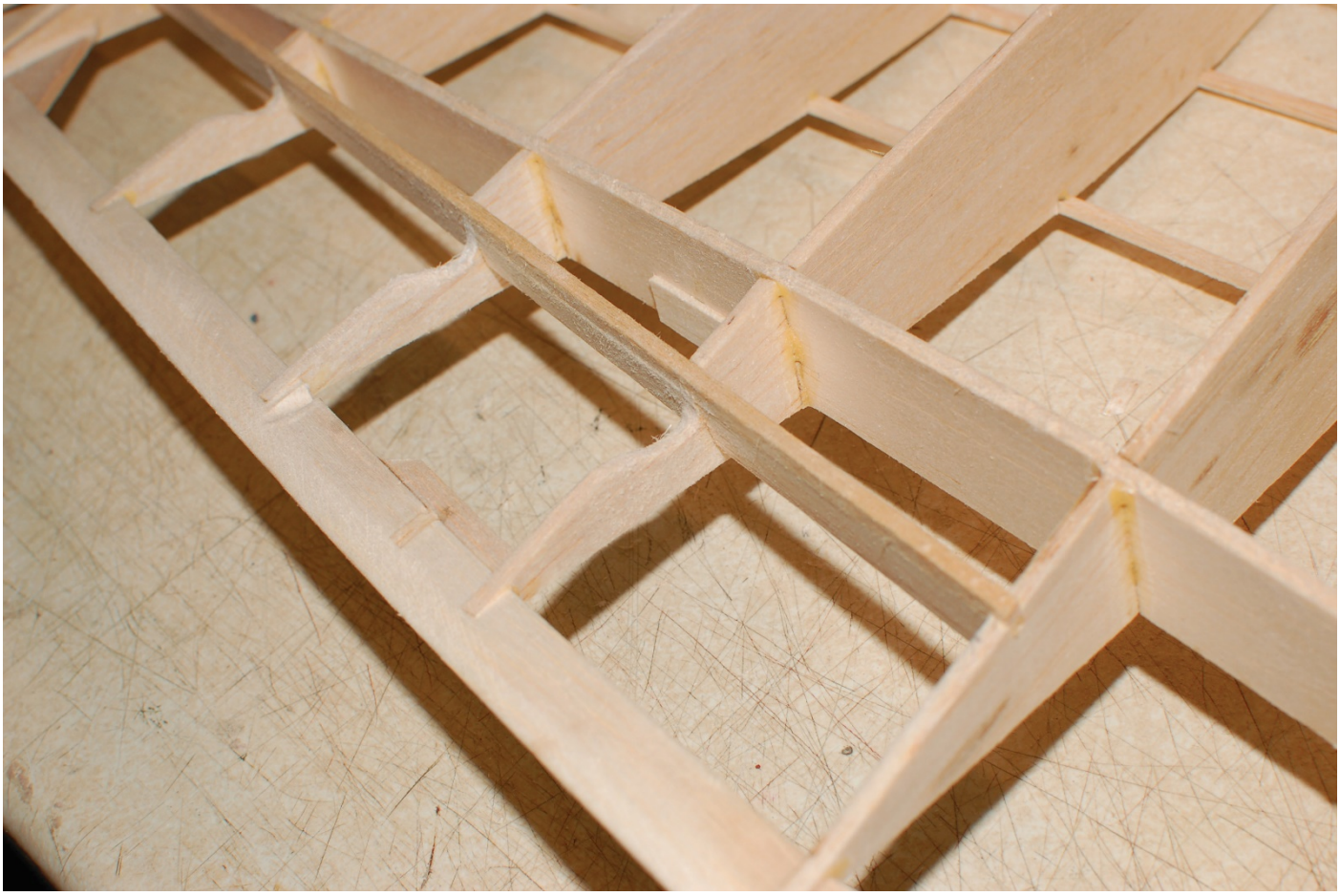
Fitting the Retracts: Fit a pair of servoless retracts into the bay formed in the wing. The prototype used a rugged set from the FMS 1400 mm P-51 Mustang. The retract body should fit snuggly between the walls. If not, shim the bay with scrap wood—the retract mount is strongest when there is not room for the retract to twist within the bay. Epoxy the plywood doublers G3 and G4 to the outsides of the retract bay as shown. These parts will become the mounting pads that the retract will be screwed down to. Note that when the servo is installed according to the plans, the main strut will just clear the main spar, as it did on the full-scale version. After the retract is secured, complete the rest of the sheeting. The semiretractable wheels are a prominent feature of this aircraft and are intended to limit damage to the model in the event of a wheels-up landing. Remove just enough of the sheeting so that the strut and wheels can peek out. On the subject of the strut, I found a nearly perfect set of spring-loaded struts on the HobbyKing website. They are roughly 1/4 inch too tall, but otherwise they look great.

Straying From the Plans—Adding Flaps: The base plans and short kit don't include flaps, but I decided to upgrade the prototype. The need for them is debatable. The prototype has a low approach speed, but it does float in the ground effect for a long way. The flaps were added more for their cool factor than anything, but they help reduce the number of overshoots. The first step was to frame the flap opening in the wing. A 1/8 x 3/16-inch hard balsa spar was fitted into notches filed into wing ribs W2 through W6. Another layer of 1/8 x 3/16-inch balsa was stacked on top of the spar to make it taller without further weakening the ribs. Next, the wing ribs were trimmed behind the flap spar to make room for the flap's LE. The key was to remove no more material from the ribs than necessary, and to avoid sharp corners that might encourage fractures. The flap itself was made from a flat, 1/64-inch plywood panel. The LE was made from a 1/4-inch square carbon-fiber tube sitting on a strip of 1/16-inch balsa. The balsa allowed slots to be cut between the flap panel and the carbon-fiber tube for the hinges to engage. Small riblets made from scrap wood were used to stiffen the panel, 1/8-inch plywood was used at the ends, and hard 1/16-inch balsa was used for the rest. Du-Bro pinned hinges were used to mount the flap panel to the spar. I spent time adjusting the fit of the flap components before locking down the assembly. When I was satisfied, one side of the

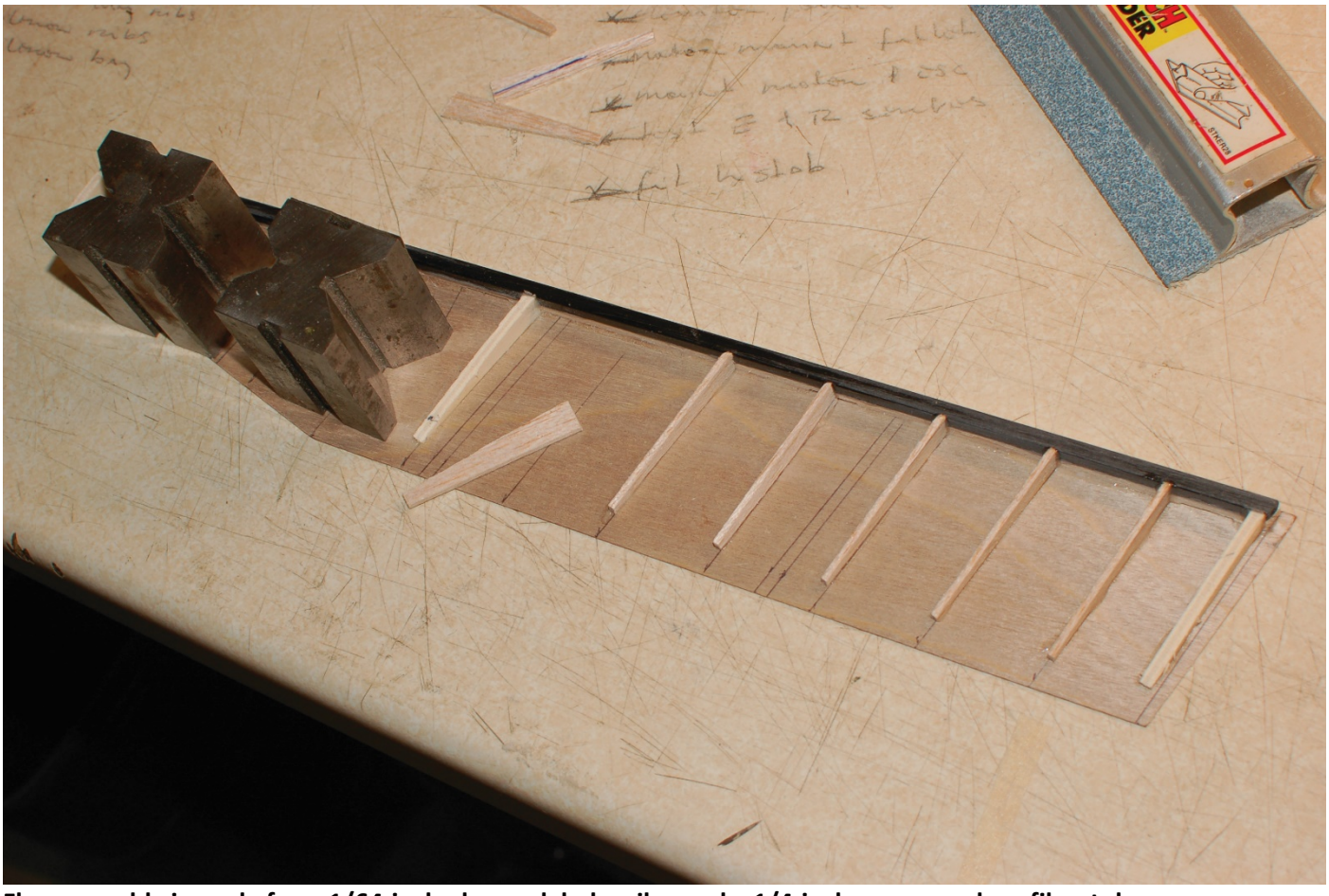
hinges was epoxied between the carbon-fiber tube and the flap panel. The other side was epoxied to the balsa flap spar. The easiest way to actuate the flaps would be to add a servo in each wing and drive the flaps directly with a straight control rod. For the prototype, I opted to use torque rods in order to hide the linkages. A single servo was fitted at the upper wing root to drive them. The result is more finicky than having independent servos, but it looks much better than exposed control horns and rods.



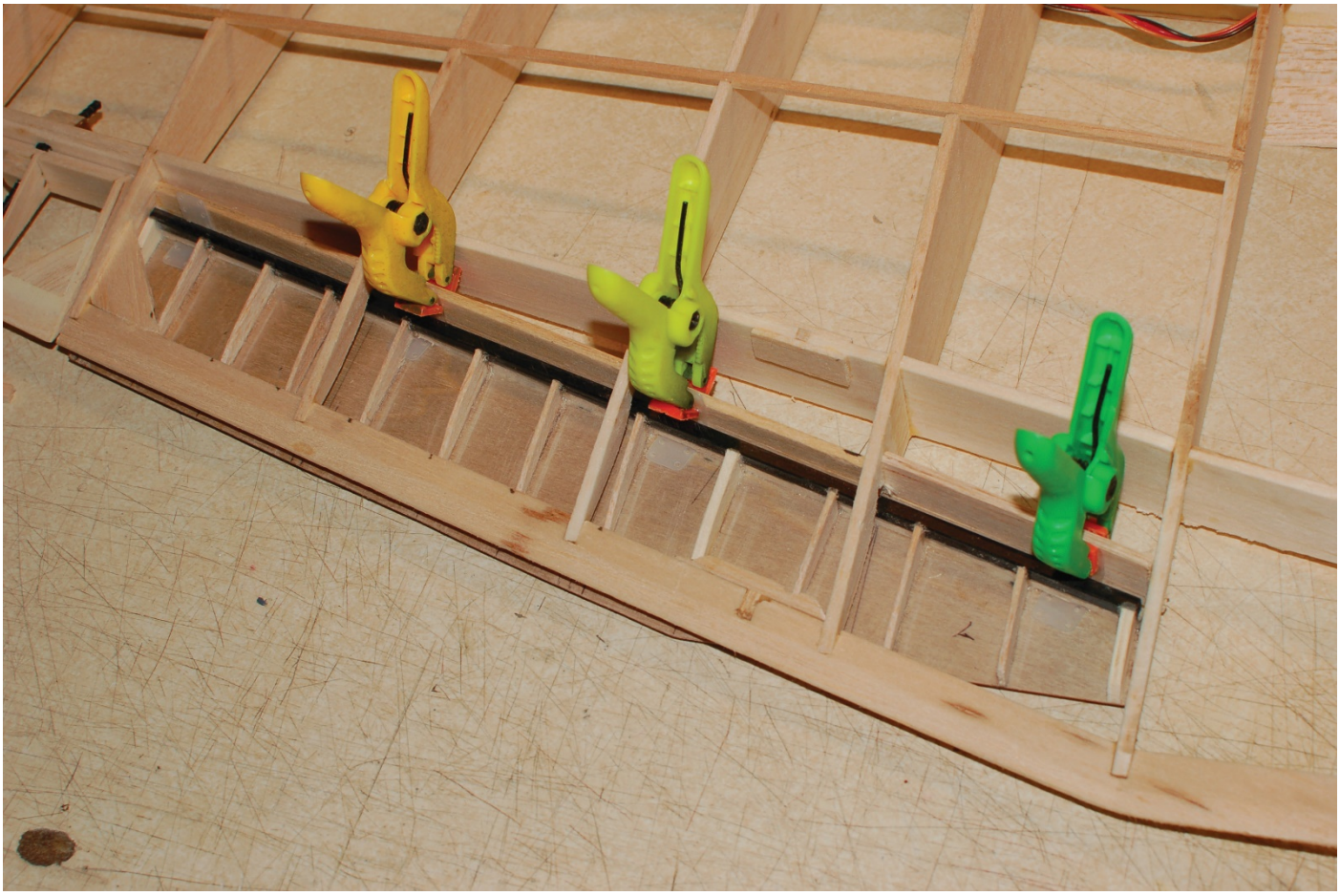
An additional spar was added to create the flap bay.



The height of the flap spar has been doubled and the wing ribs have been relieved to accept the flap LE.



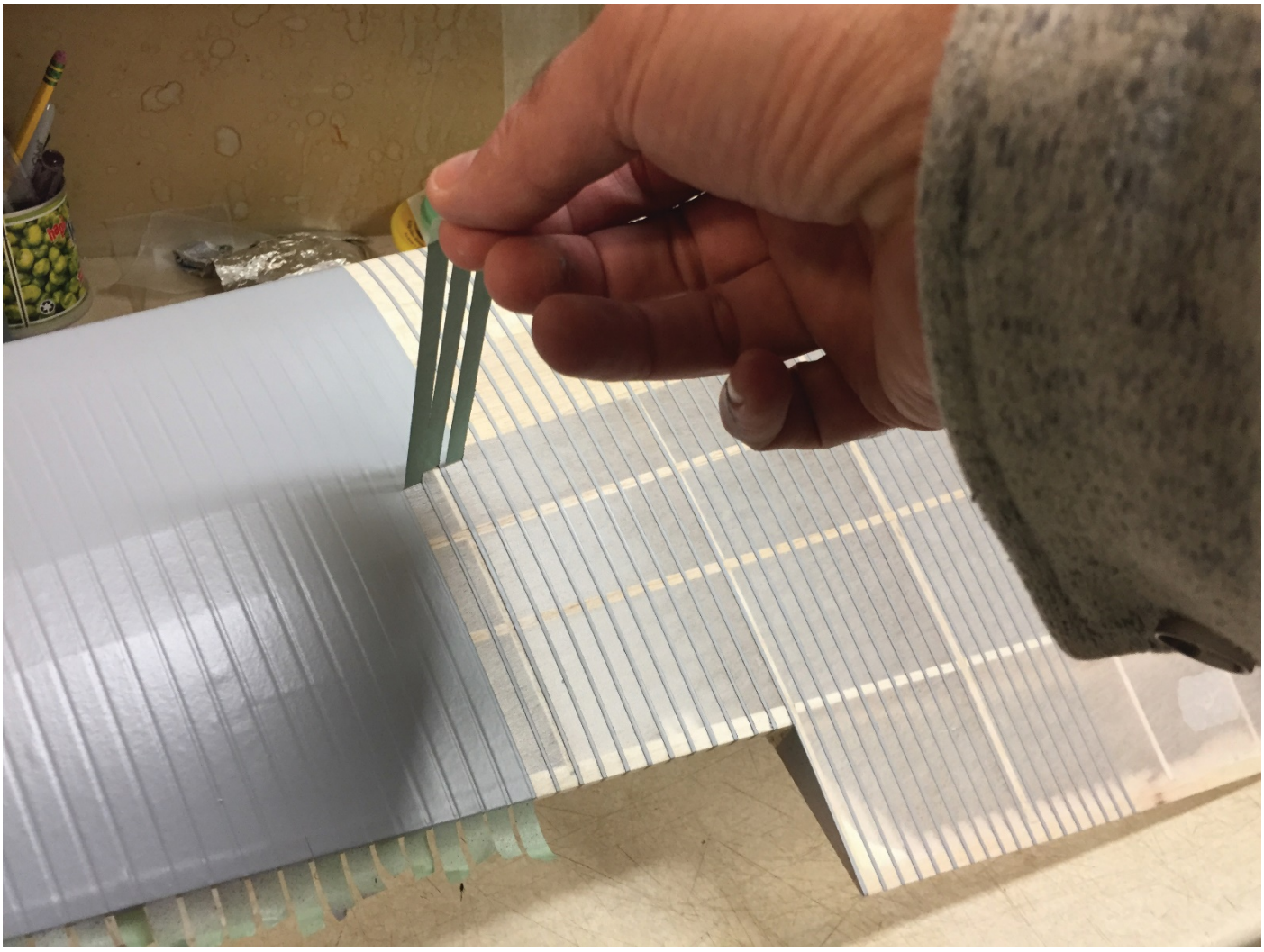
Flap assembly is made from 1/64-inch plywood, balsa ribs, and a 1/4-inch square carbon-fiber tube.



Pinned hinges were attached to the flap spar with epoxy.

Corrugations As on the Ford Trimotor, corrugated wing skins are a defining feature of the Devastator. I considered using an airbrush to create the illusion of raised ribs but I doubted that it would look good when the sun reflected off of the wings. Other builders had achieved success by masking and building up the ribs with primer, but the examples of this that I encountered were on sheeted structures and not covering open bays. After wavering between these and other options, I decided to give the tape and primer method a shot. The first step was to visit my local auto body supply shop. It carried low-tack tapes of different widths that were perfect for the job. At 1/10 scale, 1/4-inch wide was quite close to the correct distance between cor-rugations on the wing while 1/8-inch wide worked for the tail. I'm happy to report that applying the 224 strips of tape to the wing wasn't as difficult as it sounds. To get started, a few guidelines were marked on the covering with pencil. After wiping down the wing with a clean cloth to remove dust and fibers, the tape was applied from root to tip by eye. The placement of the low-tack tape was easy to adjust. After only two episodes of Game of Thrones, the wing was done. Four coats of automotive primer were sprayed over the taped areas. After letting the primer cure for a few hours, I lightly sanded it before I removed the tape. Pulling the tape back at a sharp angle put less stress on the covering and resulted in clean lines. The corrugations show up well now that the paint and markings are on and they don't look overdone.

The corrugated effect on the wings was created by 1/4-inch low-tack tape.



The moment of truth—the tape came off without damaging the covering!

Wrapping It Up That gets us through all of the major framing. I jumped over covering and paint, but that was discussed in depth in my article on the Miles M.20 in the October 2015 issue of Model Aviation. Next month I will add a few handcrafted details, and then get the Devastator in the air for its first mission!