#380

Bill Dunlop, from Greensburg, PA, shows off his 1980 1st place National Contest trophy and the Witch Hawk 500 which won it in Class B.

Design by Jim Clem
Text by Larry Kruse

Photos by Kathy Tabita and Steve Clem

Likely there's not a better no-frills design than this one for A/B Free Flight Power. It has an enviable string of wins, and its heritage is second to none. If you're a FFer or want to get into it, give this one a look.

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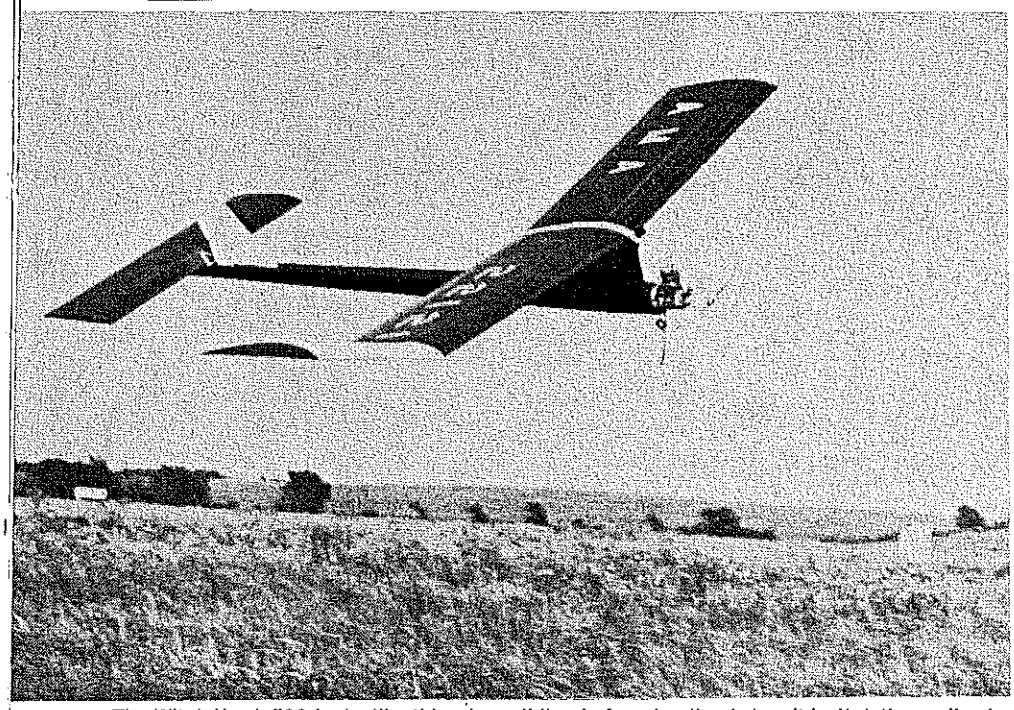
Witch Hawk 500



The Witch Hawk 500 looks like this when gliding in for a landing (when it isn't dethermalized—which isn't too often). This one belongs to Bill Jenkins of Memphis, TN. Note that Jenkins prefers a single-strut landing skid, but that Dunlop's has a double-strut skid.

WANTING a small, hot-climbing ½A job that would have a glide comparable to larger ships, Jim Clem designed the 237 sq. in. Witch Hawk in 1978 for Category II and III work. Since then, its contest record has been phenomenal, winning scores of local and regional meets, and the Nationals in 1979. At the same time it was winning contests, the little Witch Hawk was setting national records in the hands of Bill Jenkins. It received NFFS Top Ten Design recognition for Jim in 1981.

Operating under the precept that "if a little is good, then more must be better," Jim scaled up the 237 sq. in. model late in 1979 to the Witch Hawk 500 presented here. The precept proved to be accurate. The contest record of the bigger bird is no less impressive. Ranging from a first place at the 1980 Nats by Bill Dunlop to prestigious wins in 1981 at the Tulsa Glue Dobbers Annual Meet and the Huntsville Heart of Dixie Contest by Bill Jenkins, the Witch Hawk 500 is a bird of the same feather as its smaller nest mate.

Emphasizing the time-honored Jim Clem success formula best described as simplicity in action, the 500 builds quickly and accurately for any modeler, almost regardless of previous building experience. It is an excellent first choice airplane for anyone wanting to break into the competition scene, as well as a potential Number One ship for the experienced competitor.

Construction. Probably the best approach is to

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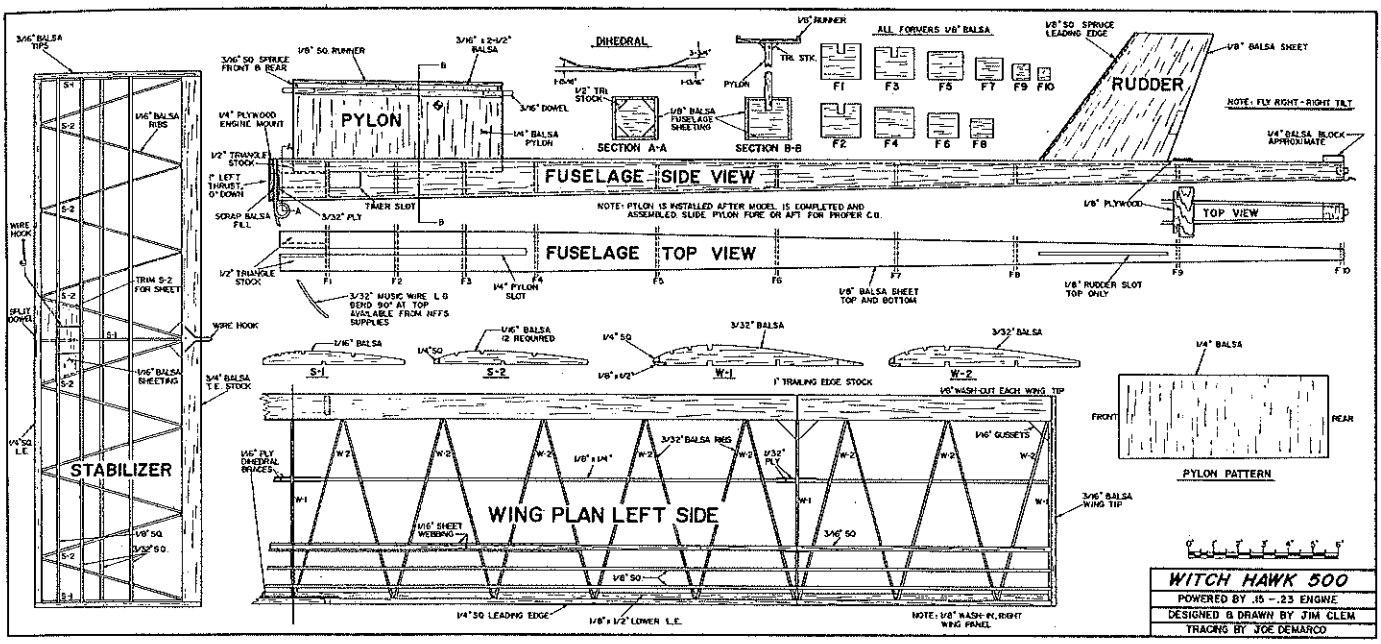


think of it as though it were a kit, instead of it being scratch-built. In translation, the way to go is to "pre-kit" all of the necessary components before starting the construction phase.

For the fuselage, the pieces you will need to pre-cut are the sides, top and bottom, pylon components, plywood engine pieces, and interior formers. The critical pieces for purposes of alignment are the top and bottom of the fuselage. Since they are situtated *inside* the fuselage sides, they dictate how straight the completed fuselage will be. Take special pains to cut both the pylon slot and the rudder slot as accurately as possible. If not straight there'll be no assurance that the plane will fly as it should.

For the flying surfaces, you'll need to pre-cut all wing ribs, stab ribs, and the rudder. Note that the rudder has a spruce leading edge to ward off hangar rash. The spars and leading and trailing edges are all stock sizes, so they can be pulled from your wood bin as needed.

Now that your workbench is littered with bits and pieces, you can start making some sense out of it all by covering the plan with Saran Wrap and pinning down the fuselage top over the plan. Install the ⅛-in. fuselage formers with the aid of a small 90° triangle as an alignment guide. The sides are next. An aliphetic resin such as Sig-Bond is most useful in this type of construciton, because it allows time to make minor adjustments and check the alignment of the work as you go. The fuselage box is completed by adding the bottom (which is at the top, since the fuselage is being built upside down). Check the pylon slot to make sure that none of the formers have any excess glue on them that might alter the pylon incidence angle in the final assembly steps.

The engine mount "sandwich" is made of one layer of 3/32 plywood, the 3/32 landing gear wire (available from NFFS Supplies), and the ¼ plywood engine mount. The pieces should be epoxied together. Fill in the area around the gear wire with scrap 3/32 balsa and epoxy before installing the assembly. Note that ½-in. triangular balsa should be inserted and glued inside the fuselage box at Section AA for additional gluing area prior to epoxying the engine mount in position.

The rudder should be positioned carefully in its slot and glued in place. It penetrates the fuselage box only to the depth of the ⅛-in. fuselage top. The rudder must be aligned perfectly for a predictable flight pattern to occur.

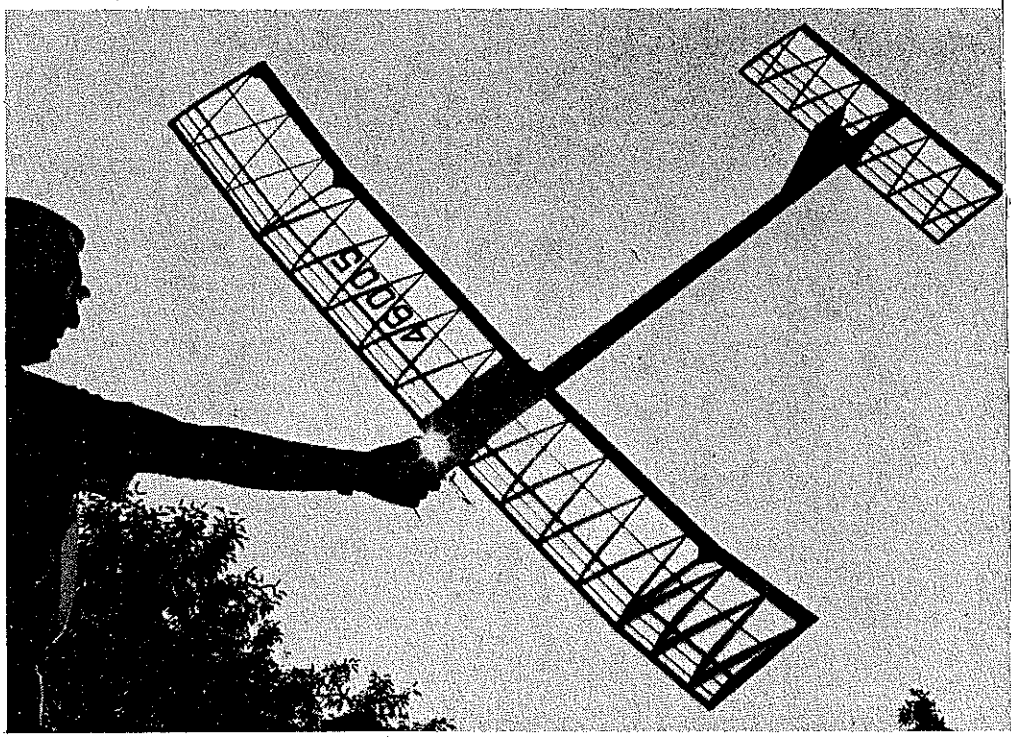
The plywood stab mount and the ¼-in. incidence block complete the basic fuselage structure. Do not glue the pylon in place at this time. It will be installed as the last stage of construction in order that it may be shifted to locate the CG properly. Sand the fuselage, and set it aside until the flying surfaces are built.

The main wing panels are constructed flat on the building board. Start by pinning down the ½ x ⅛ leading edge strip, both front and rear bottom spars, and the triangular trailing edge stock. Install all W-2 diagonal ribs, but omit the W-1 ribs until the dihedral is installed.

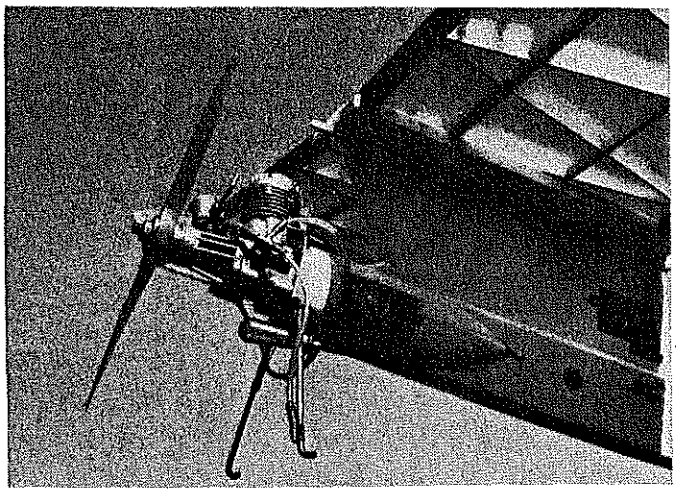
Butt the ¼ sq. leading edge piece up against the ribs, and glue it to them and the bottom leading edge. The 3/16 top spar can now be cemented in place, but omit the turbulator spars until after W-1s are set in and all panels joined. The tip panels require washout. Prop up the trailing edge of each tip ⅛ in. at the last rib juncture.

When all panels are dry, put in the dihedral by blocking up each panel to the required height and epoxying the leading and trailing edges. After the dihedral joints are locked in place, all W-1s, dihedral braces, gussets, and turbulator spars can be added. Complete the wing by adding the 3/16-in. tips, and sand the leading edge to its final contour. (A small template of sheet aluminum can be made to assure accuracy in sanding the leading edge shape.) Sand the rest of the wing carefully to remove any glue bumps and fuzz, then set it aside along with the fuselage.

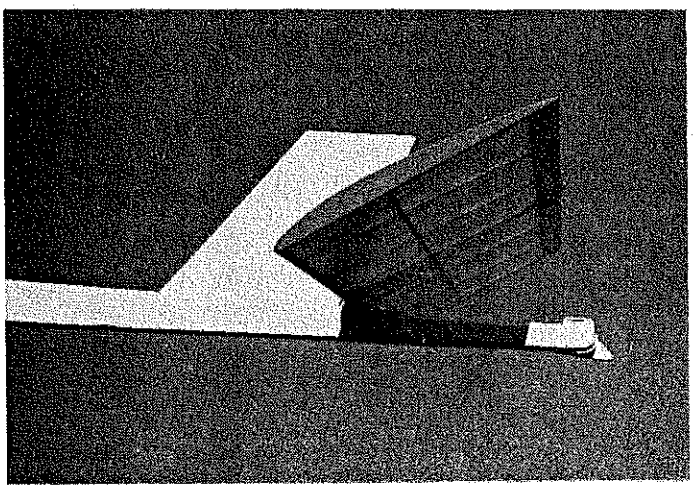
The stabilizer is built identical to the wing, except the three center ribs should be undercut after assembly to accept the 1/16 top sheeting. A template will also be of assistance here in the final shaping of the leading edge contour. After insetting the split dowel pivot into the leading edge, add the 3/16-in. tips, and sand the structure as you did the wing.



What a sight—Bill Dunlop's back-lit Witch Hawk 500 shows off the warp-resistant diagonal-ribbed wing and stab in good detail. As FF models go, this one is simple to build—flies great.

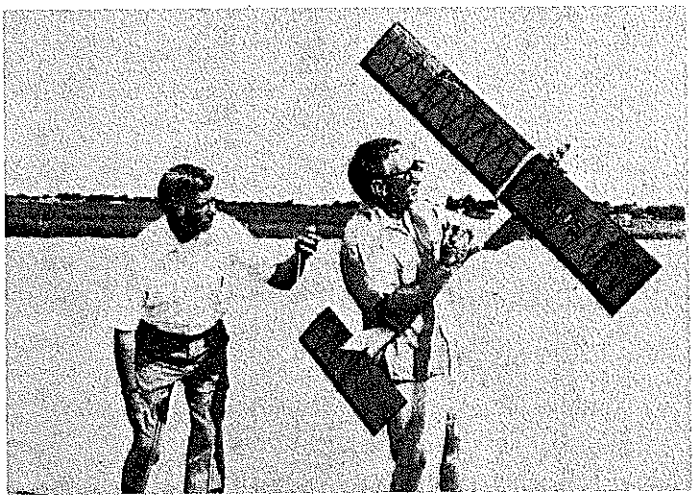


Front end of Dunlop's model shows off the fuel plumbing detail, K&B engine, and K-Mart clockwork timer—pacifier for pressure fuel tank.



Stabilizer of Dunlop's model in the dethermalized mode. He uses remotely-located fuse for actuation—rear location shown on the plans.

Bonnie Jenkins helps her husband, Bill, get ready for his last (and winning) max flight at the Tulsa Glue Dobbers Annual Meet.



Witch Hawk 500's designer, Jim Clem (left), gets ready to check Dunlop's engine run. Especially for flyoffs, engine run must be precise.

The open structure can be covered with one of the plastic heat-shrink films, or with silkspan and dope if you prefer. Some modelers like double tissue covering, which works rather well and is sufficiently tough for flying sites devoid of stubble or other puncture-producing ground clutter.

Assemble the pylon wing mount upside down on your building board from the components you previously cut out. Use the small 90° triangle to ensure that it is square, and place the triangular support pieces and the spruce front and back in place. Carefully drill the holes for the 3/16 dowels. A useful technique is to sharpen one end of each dowel slightly with a pencil sharpener for easier insertion into the mounting holes.

Attach all dethermalizer hooks and other remaining hardware to the fuselage and stabilizer using epoxy. Perforating the hardware location with a pin numerous times will allow the epoxy to grip the wood tightly. Nothing is more disconcerting than to have a DT hook pop off a stab just before your first flyoff flight in a major contest.

Finish the fuselage either with a good fuelproof dope or with one of the epoxy finishes. Treat the pylon/wing mount assembly in the same fashion. You will note that some scrap filling will be necessary in the fuselage top around the pylon slot area after the pylon is epoxied in place. Save a bit of paint for this spot.

Mount the timer, engine, pacifier tank, and stabilizer to the fuselage, and strap the wing to the pylon. Fit the pylon into its slot, and slide it either backwards or forwards until the center of gravity (CG) is as shown on the plans. Bill Dunlop found it necessary to cut away a small portion of the pylon in order to move the wing far enough forward to balance properly without adding dead weight to the tail. Epoxy the pylon in place when it's properly located, and close up and finish this area.

First flights should be hand glides from shoulder height. Assuming the CG is correct, adjust the stab incidence block to get a flat, penetrating glide. A right glide turn is accomplished by tilting the right side of the stab upward (as viewed from the rear) to approximately the same height as the dihedral angle of the right main wing panel. The right glide turn should be flat but not "mushy." If the plane dives, pack up the incidence block 1/64-in. at a time.

First powered flights should begin with no more than a 3-sec. engine run at full power. Launch the plane at a steep angle, tilted slightly to the right. If the right wing does not want to stay up, warp ⅛-in. washin into the main panel at the polyhedral break—either by steam (if the plane is covered with silkspan or tissue) or with a MonoKote iron (if the plane is covered with plastic film). Another way of creating washin is to add a small (about 2-in.) piece of trailing edge stock to the bottom of the right wing panel just inboard of the polyhedral break.

If the ship goes too hard to the right, add a bit more left engine thrust. Do not add left rudder. If the plane goes straight up or to the left, add a very small (1/32-in.) right rudder tab, or reduce left thrust a bit.

One problem to be aware of with low-thrust-line airplanes is the possibility of the plane going to the right but not keeping the right wing up—even after adding washin. Potential solutions: (1) decrease right rudder tab; (2) increase left thrust; (3) decrease the incidence. The latter solution should be kept well in mind. It's amazing how many models will right themselves and scramble for altitude once excessive incidence is removed.

When trimmed correctly, the plane should make about one complete rotation and snap out on top of the power pattern into a right glide turn when the engine cuts. Because of its short nose moment, it will transition as well at the end of a 5-sec. engine run as it will at the end of 7 sec. or more. Proven under contest conditions, the Witch Hawk 500 offers consistency and a winning flight potential every time it's launched.