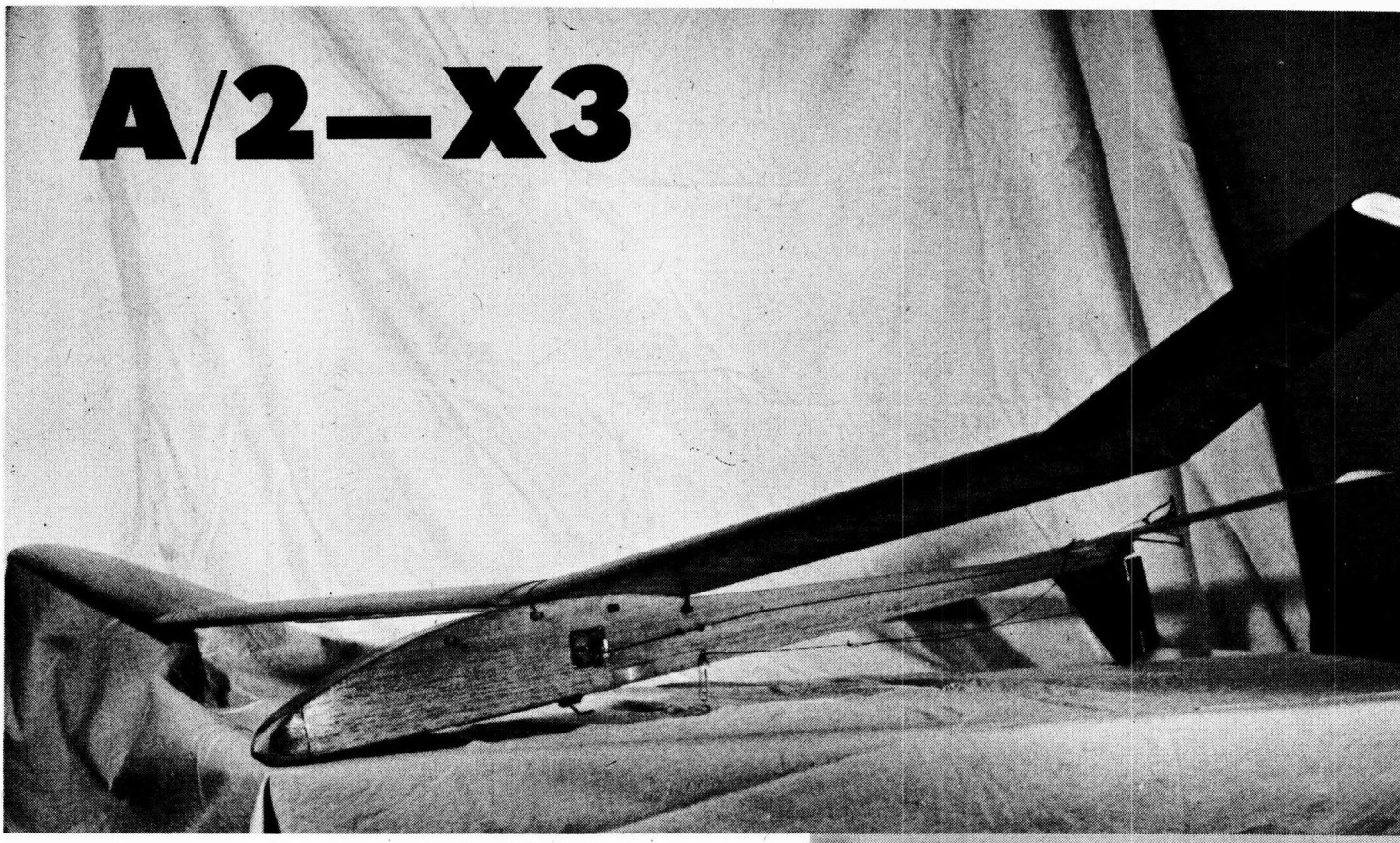
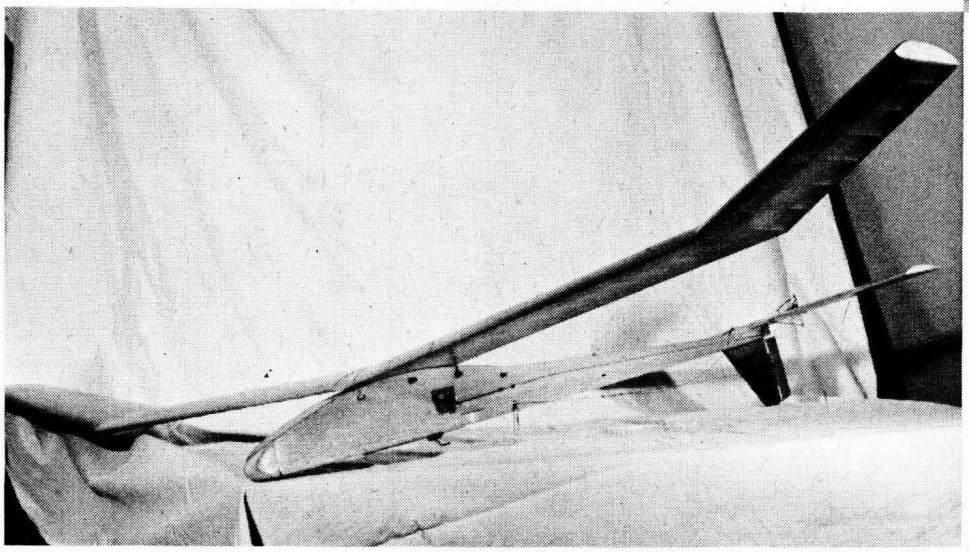
A/2—X3



The wing is in the aft position in this photo. Note the fuselage has a curved shape to give a high incidence angle for tight circling in the wind.

Auto-rudder, auto-stabilizer, variable-trim wing and a clockwork D-T—who could ask more from a single Nordic?

by Jim Horton

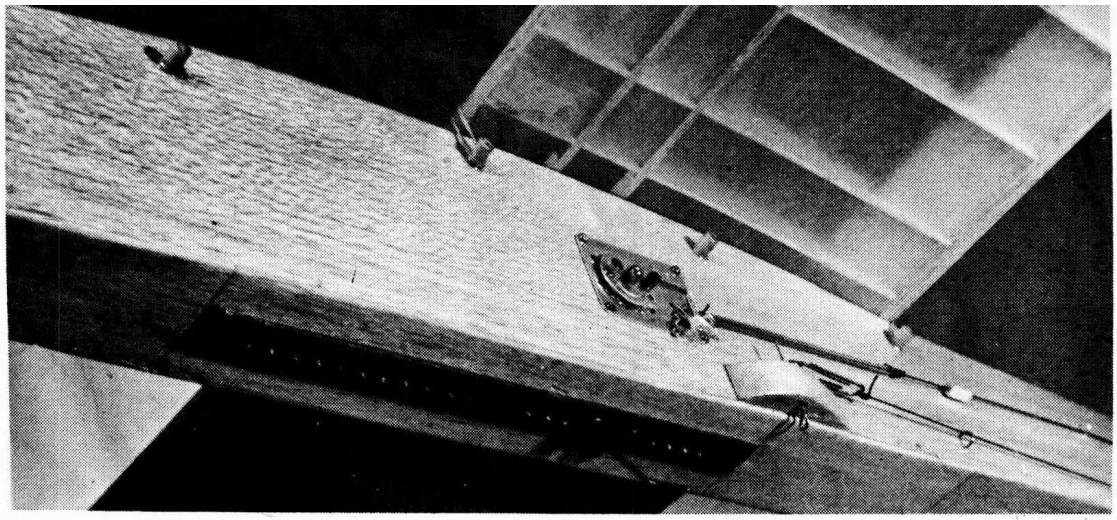


With the wing moved forward the model has a lower incidence short nose moment and a longer tail moment. This set-up is recommended for still, or calm, air soaring for maximum duration.

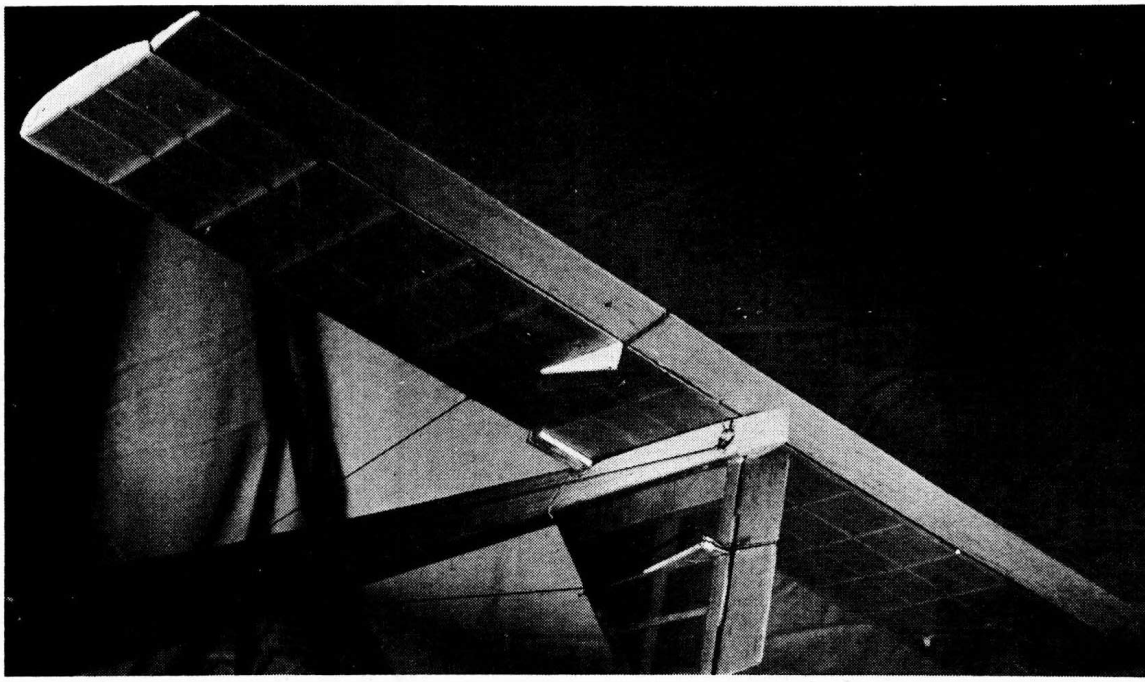
● Probably no other class of free-flight model has as much to offer the model experimenter as the A/2 Nordic glider. Since it is launched from approximately the same height each flight, the effect of design changes can easily be studied.

The X3 was not designed, but evolved. It is the third of a series. The first model was set up to give maximum dead air time. It had a 100% C.G. with minimum incidence difference between wing and stabilizer. The model glided so clean that we had to have an auto-elevator to give a low airspeed dead air tow.

The first model gave good performance in dead air, but in rough air its performance was poor. On the second design, we went to the other extreme. This design had a 50% C.G. with a high incidence difference between the wing and stabilizer. The model was set up for a very tight circle. This model gave



An adjustable tow hook provides ease of trimming. The line from the timer goes to the tail section which trips the pop-up. Just behind the Tick-Off timer, on the bottom, you see the firing pin that controls the auto-rudder and stab.



Unique auto-stab makes model climb steeply. It is coupled to the rudder to provide a straight-away even tow.

good rough air performance, but its dead air performance was poor.

The X3 was an attempt to combine the best features of the first two designs in one model. It has a two position wing which gives a 50% or 100% C.G. set up. The top of the body is designed to give the correct incidence at each position. The model is equipped with an auto-elevator for calm air tow. Since both set ups give high lift, low airspeed tow; tow stability is very good. In fact, the harder you tow the straighter the cliub.

Now to construction:

WING: By building and covering wing first, you can work out any serious warps while working on body and stab. Select wood carefully, medium stock for spars and light stock for all other members. Make two templates of the main ribs and two templates of the tip rib of 1/16" sheet. Pay close attention to spar notch location as spars are staggered for lap joints at the dihederal breaks. Using the templates, cut out the ribs in groups of about eight. Begin work on the left center-section, pin down the leading edge and trailing edge. The trailing edge should be shimmed up in front so that the bottom follows the undercamber curve. Fit and cement the ribs in place. Cut the top spars to the correct lengths, allowing for the lap joints, and cement them in place. Follow the same sequence for the other panels. Block up each panel for correct dihederal and cement the sections together. Cement in the bottom spars. Cement soft blocks to the tip ribs and cut them to shape. Sheet cover the wing and cap strip all ribs. Sandpaper and cover with Jap tissue. Apply about 6 coats of dope.

Check the wing carefully for warps. A slight wash-in on either side is desirable, and establishes turn direction for model. The model must turn into the washed-in wing for spiral stability. Too much warp causes excess drag and wing should be weighted on flat board until it is minimized.

FUSELAGE: Cut out two sides, two doublers, and all bulkheads of 1/8" sheet. Cut the bottom pieces of 3/16" sheet. Cement the side doubers to the bottom pieces and cement in the front bulkheads. Cement both sides to the doublers. Cut and cement in the remaining bulkheads and wing dowel rods. "V" out the top of the body at the wing positions so that wing rests flush on the body. Cover the top and bottom of body with sheet—leave the aft section at stab-rudder station and the section over the ballast box uncovered.

Cement the nose block in place and cut to shape. Make up and screw the

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towhook plate to bottom of the body.

Rudder construction is conventional. Leave the leading edge, main spar and aft spar long enough to pass through body and cement them in place. Cover with Jap tissue and dope.

STABILIZER: Stab construction is also conventional. Covering is Jap tissue with six coats of dope. The auto-surface hinges are sections of aluminum tube cement alternately to the main surface and tab, with a piano wire hinge. This bar must be tilted to give 1.5" rise on the tip which is on inside of turn (turn direction has been established by wing warp). Make up and install the auto-surface's horns and stops, D.T. mechanism, and tow hook.

Sand and dope the fuselage (our model was not covered with tissue). Weigh the complete model and add B.B. shot at the ballast box to bring the model to 14.5 ounces. Cover the ballast box with sheet and finish.

FLIGHT TEST: Pick a calm day for testing. Screw the tow hook 1.5" ahead of C.G. and band the wing on at its aft position (50% C.G.). Hand glide and set the rudder for a tight turn. Shim up the trailing edge of stab until the model has a slight stall. Disconnect the auto-elevator (not used on 50% set up). Set the tow rudder slightly off center to oppose stab tilt.

Use the full 164-foot line for the test flight. On a short line, action is too fast. Connect the tow hook ring and operating pin. Set the timer and tow directly into the wind. Observe the flight carefully, the circle must be very tight as it will open up in the wind. If the model pulls to one side, under tow adjust the tow rudder setting. If the model weaves, tighten the glide circle and increase the negative stab. Do not reduce C.G.-to-tow hook distance, as this couple will pull model straight while towing.

If the model performs satisfactorily pull it up and deliberately stall it off the top of the line. If it does not immediately whip into its turn, increase stab tilt.

Next, set the wing at the forward position. Hand glide and set the rudder for a wide circle. Connect the auto-elevator line and set the stop for 30° up. Increase the tow rudder setting as the tilted stab will be more affective. Float the model off the top of the line. If the model does not easily tow overhead, increase up elevator. Dead air time should be about 140 seconds.

The model should now be ready for wind testing. The trick here is to get the model gliding clean off the top of the line. Watch carefully for sink off the top of line. If the model takes too long to get into its normal circle, increase the stab tilt. Pick a hot day and let the model ride some thermals to be sure of spiral stability (thermals will tighten turn). Any tendency to spin is a sign of wing warp in the wrong direction and must be corrected.

CONTEST FLYING: On a typical summer day, fly 100% from daybreak until about 12 o'clock, 50% from 12 till about 5 o'clock and 100% from 5 till dark. This is of course based on calm mornings and evenings. At a regular meet, if it is windy in the morning, wait until the heat builds up and fly 50%.

REFERENCES: We suggest that the builder read Frank Zaic's article on "Designing Tight Circling Glider" in the 1951-52 "Model Aeronautic Year Book" by Frank Zaic. This article was the main influence for the #2 design.