



# 720 TURN

Many years ago when I was learning to fly in a J-3 Cub, my instructor had me practicing 720 degree turns by the hour. The maneuver was judged to be good if we hit our own slipstream the second time around indicating that altitude had been held constant. I've never forgotten those 720 turns, but it is coincidental that this ship happened to turn out with 720 sq. in. of wing area and is trimmed for a two turn or 720 degree power pattern. There is, however, no danger of encountering its own slipstream on the second turn as there will be a considerable difference in altitude at that point in the flight.

I'm certainly not going to claim this ship is the ultimate in competition power models. If I thought that the ultimate design were possible I would quit today. For me, Free Flight is truly the greatest of all model flying, unlimited in challenge, development, and best of all, pure enjoyment. May it live forever!

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Simple, warp-resistant structures give competition performance reliability.  
Excellent text on trimming too.

CLARENCE HAUGHT

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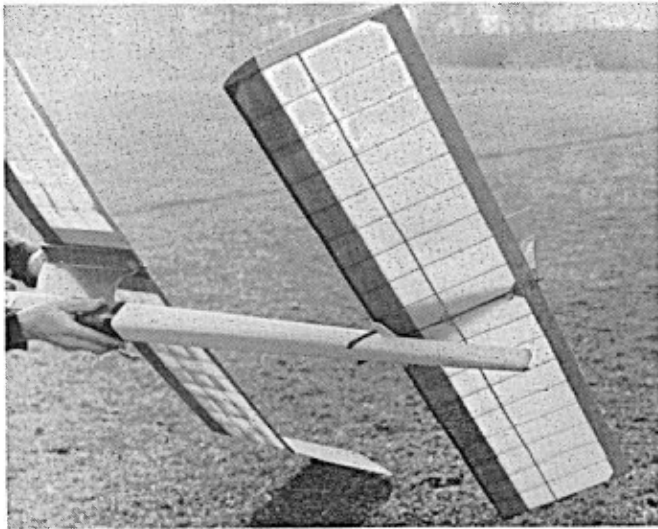
The 720 turn happens to be my best design effort at this time. I have incorporated the features I believe to be the most compatible for a compromise situation—that of a fast, high climb and a floating glide. Either of the above-mentioned characteristics are easily attained but when efforts are made to combine them it is a compromise at best.

For the climb portion of the flight to gain that all-precious altitude for a better chance at the elusive thermal, I

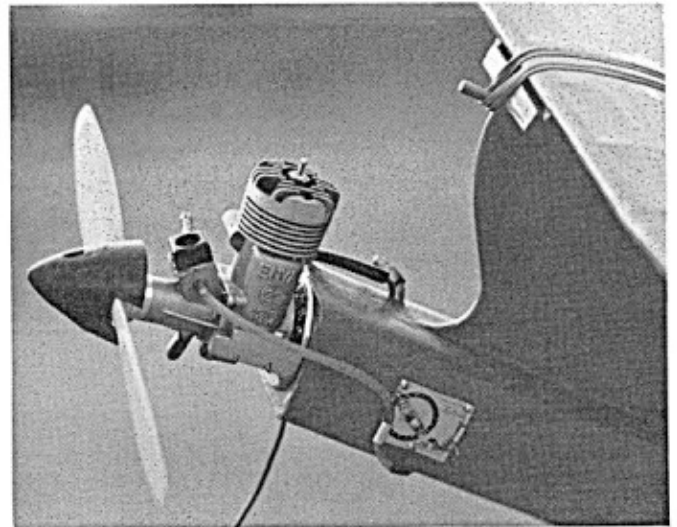
have relied upon a thin, flat bottom airfoil. It's sort of a "draw around your shoe sole" airfoil of questionable ancestry but it works on this design. It was kept under 10% in thickness in hopes of reducing drag without sacrificing lift. Another drag reduction measure is the use of minimal frontal area.

Keeping the structure as light as possible, yet with sufficient strength, contributes to overall climb and glide performance.

Probably one of the most important climb influencing factors is the power plant. The original ship utilizes an Enya 29 setup with the high compression head and the No. Three venturi insert running on a pressure fuel system with high nitro fuel. 9-4, 10-3½ and 10-4 props have been used with good results. (Start with the 10-4 and work back to the 9-4 as the ship is more docile on a 10-4.) A competitive free flight must have a "going" engine. The 720 turn



Forty degrees pop-up DT is ideal on this model. Fuse trips the DT and is located along the fuselage.



The motivating force is an unmodified but carefully freed up Enya. Flood-off use to stop engine run.

was intended for Class B competitions so I have not experimented with larger engines. However, the above combination provides a spectacular performance controllable without a Variable Incidence Tailplane. A larger engine would definitely require more downthrust as the increased climb speed with resultant increase in lift will create looping tendencies.

As mentioned before, I trim for two turns in the climb. It could be less but the advantage is a faultless, consistent transition which to me is a better buy than a few more feet of altitude and an occasional bad transition. The altitude difference just isn't that much.

In the glide department you can probably spot my Nordic upbringing. A high aspect ratio to ride those gentle currents with the lowest possible sink and turbulator spars to extend still-air time, while providing valuable structural strength with low weight penalty. You'll note the reference to "still-air" and "gentle currents." Any old barn door will turn in a max in a good thermal so why not put in a few still-air performance features? If your ship has these capabilities, a quick on-site trim change, born of familiarity and experience with your ship, and you're ready for smooth or rough air.

The pylon layout was chosen for this design over the high thrust layout. Here again, a compromise must be reached. High thrust ships are less sensitive to trim changes and are much easier to handle in this respect, but that engine, nacelle and prop combination sure creates drag and turbulence at a poor place—right in front of the center wing section. This will have a negative effect on the lift generated by this portion of the wing. A pylon mounted wing can operate in undisturbed air for the most part. The slightly more difficult trim characteristics are easily worth the better glide.

All these things add to the model's potential to do well in a meet. Of course in free flight a well designed and trimmed model is only part of the game. Launching into good air and just plain luck have an important bearing on suc-

cess as well. The fact that the same guy doesn't win *all* the time is another reason why free flight is so great. Of course the more effort exerted, the more often Lady Luck will smile in your direction.

Reliability of your equipment is vitally important, too. How many times have you seen some hot dog sit on the ground all day with a hybrid machine with so many bugs in it no official flights are made and the meet is won with a simple, consistent, reliable model? Practice and know the flight characteristics and traits of your model thoroughly before entering competition. Use proven, reliable systems. I suggest the use of a pressure fuel system with a tin tank and a "squeeze off" timer. This works best for me. Pacifier tanks, flood off systems, etc. are all good; if they work for you, use them. All I'm saying is use a good system that works for you consistently and keep good fuel tubing installed. Make frequent checks of all fittings, screws, fasteners, etc. and strain all fuel through a filter on your fuel can or in the actual aircraft system. It will show up on your trophy shelf!

Flying a new ship is always a "nervous" experience but can be lessened somewhat by a careful systematic approach to the subject.

Set the ship up with CG and downthrust as shown on the plan and slight left or zero sidethrust. Wash-in the right main wing panel 3/8 in. (TE down) at the dihedral break and wash-out both tip panels 1/8 in. (TE up) at extreme tips. The left main panel should be flat. The wash-out at the tips is to prevent the tips from stalling before the main panels resulting in spins or spiral dives. The wash-in in the right main panel serves to hold the right wing up during the right turn power pattern. This warp will also help prevent the model from spiral diving in during the right turn glide when strong lift is encountered.

Tilt the stabilizer right tip high so that it is approximately parallel to the right main wing panel. This will produce the desired right turn glide.

From this point all trim adjustments should be one of the appropriate four listed below.

Glide turn—more or less stab tilt as required.

Climb angle—shim up trailing edge of stabilizer to increase climb. Lower stabilizer trailing edge to reduce climb angle.

Power turn—use rudder tab, usually none or slight amount required to produce two full turns on full length motor run.

Glide angle—shift center of gravity, add nose weight to avoid stall, add tail weight to slow glide.

The above trim adjustments act independently with the possible exception that stab tilt will affect stab incidence slightly. Using this system, a change in one adjustment can be made relatively independent of others. When trimming any ship, make only one change at a time and proceed slowly.

We are now ready for the moment of truth. Select the calmest possible conditions hopefully in an area covered with the proverbial tall grass. Check alignment once more and hand glide to determine if a stall or dive tendency is present. Shim trailing edge of stabilizer accordingly. Hand glides on a ship this size prove little and expose the ship to unnecessary damage.

Always use the dethermalizer on all flights. Thirty seconds is good for tests as it reduces chase time and allows more power flights. Also if a poor adjustment is evident there is less chance of damage. I prefer the remote DT fuse location rather than the usual tail mount as a ship this size is too awkward to handle alone if the fuse is on the tail.

A three sec. run at 75% power will tell you if any vicious turning tendencies are present. Follow this with a three sec. full power run. If all is well, proceed with two sec. extension in the engine run and work up to a full length run. Add rudder tab as necessary to achieve a two turn power pattern. Climb angle should be about 75 degrees. As the power run is increased, speed will increase and may produce a steeper climb. Don't worry about transition until you reach nine sec. power runs. If it is not up to your expectations, you

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probably need more turn in the climb or flatten climb angle. Transition to right glide turn is normally very good with this ship. The glide should be slow and floating in calmer air. For rough air, trim the glide a little faster. Experimentation will allow you to add just the right amount of clay behind the timer for turbulent air conditions.

I like to keep my glide turns fairly tight. This helps to keep chases a little shorter and also helps the model stay in a thermal. Don't overdo this though, as you could spiral dive in due to the strong lift and circular airflow effect. About a 200 ft. dia. circle is good. Alter stab tilt to achieve this.

One last word on adjustments. Too much DT stabilizer angle will bring the model down too fast. Forty degrees is plenty. A fast DT could result in structural damage or split covering on the wing upper surfaces.

A few flights will convince you. The larger ships are a lot more fun!

### Construction

The trip to the hobby shop for the necessary materials should be preceded by a thorough study of the plans. Wood should be selected with an eye towards its final function in the structure. Pick hard, straight grain material for spars and trailing edges. The wing leading edge should be spruce or at least rock-hard balsa. Rib stock should be medium but avoid soft spongy balsa. Try to obtain 48 in. material for the fuselage to avoid splicing. If this is not possible, angle all splice joints and arrange them in the structure in a staggered fashion to avoid any built-in weak areas.

Begin construction with the wing and stabilizer. These components should be completely finished before proceeding with the fuselage to allow maximum curing time.

It is unlikely that you can find 3/4 x 1/4" TE stock, so this will have to be shaped prior to pinning to wing plan. This will be the only "difficult to locate" wood in the model but is necessary to preserve the airfoil. Shape TE with a razor plane or saw to shape on a table saw. Pin down leading edges and spar stock overlapping as shown. The overlapping spar technique produces extremely strong yet light dihedral joints. You'll like it after you've tried it. I install center section bottom planking at this stage. Install all ribs except dihedral ribs and add tips. When dry remove from plan and add dihedral, tips first, then center section dihedral when dry. Add 1/8" dihedral ribs, 1/8" sq. turbulator spars, gussets and upper center section planking.

The stabilizer construction is basically similar. Notch TE for ribs. Be sure space for rudder is correct by using temporary 1/8 sheet spacers. Do not overlook the wire reinforcement at stab leading edge.

Sand the flying surfaces and coat with two coats clear dope prior to covering. The rudder should be fabricated and covered at this point but not instal-

led until the stab is covered and has two coats of dope.

Cover stab with lightweight silkspan. Cover the wing with medium silkspan and double cover center section and center panels. If you have not used double covering before the procedure is simple. Cover and dope wing in usual manner with at least two coats of clear. Apply second layer of silkspan with grain at right angles to first layer (first layer should be spanwise). Attach at edges only and shrink with water. When dry proceed to dope with thinned dope to achieve bond between covering. This procedure results in a very rough yet light covering. Of course MonoKote or Solarfilm would be fine if you elect to use them.

After doping is completed to your satisfaction, allow to cure two or three days and then steam in the warps called for in the section on flying and allow flying surfaces to cure while fuselage construction proceeds. Check the surfaces periodically to make sure curing is progressing without changes in alignment.

Cut out all fuselage parts and glue up pylon and wing rest prior to shaping. Lay out top fuselage sheeting on plan. Add top longerons, formers, fuselage sides, and bottom longerons. Check frequently for proper alignment. The original ship had the landing gear sandwiched between F1 and F2; however, I would recommend the Tatone free flight mount with landing skid attached. When dry, remove the fuselage assembly from the plan and install pylon and 1/16" plywood timer doubler. Modify a No. 6 Rectank as shown and install on right side of fuselage. Drill firewall former F1 and F2 for engine mount and install blind mounting nuts. Install fuselage bottom. Complete wing rest and stabilizer platforms.

When thoroughly dry, sand corners round as shown on cross sectional view and thoroughly sand entire structure. Brush on two coats of clear dope and cover fuselage with lightweight silkspan. Cover forward section from rear of pylon forward to firewall with lightweight fiberglass cloth. Add dethermalizer hardware and finish fuselage as desired.

Band on stabilizer and check alignment of rudder with pylon using a taut thread. If not in perfect alignment, adjust stab key width and/or slots in fuselage to attain perfect alignment. Band on wing and check distance from tip leading edges to leading edge of rudder at its base. Install half dowel keys to bottom of wing to insure alignment. Install engine, timer, prop, etc. as ready for flight and correct CG to point shown on plan. Give everything a final check and you're ready for testing!

Remember, the big ships are more fun!