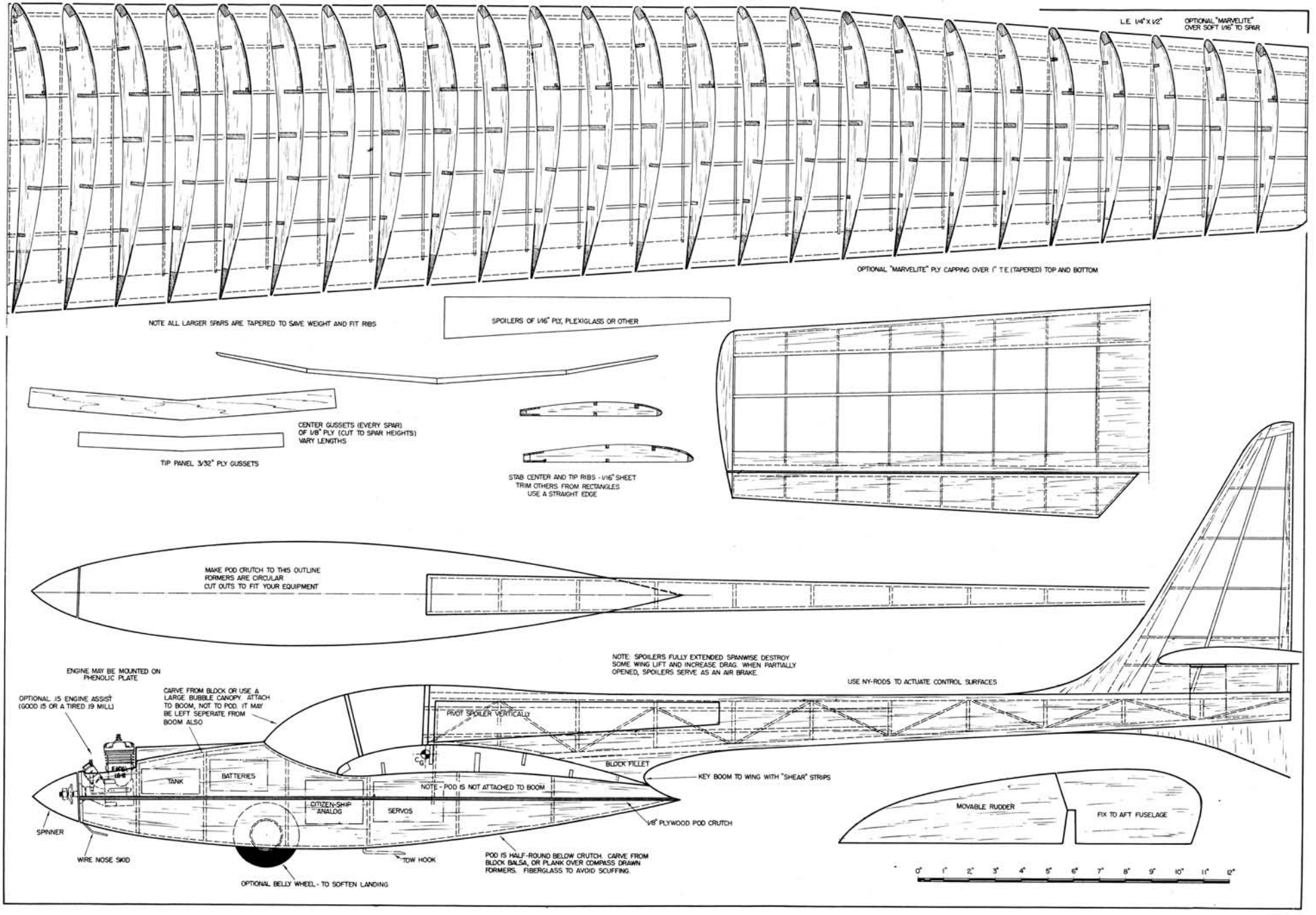

L.E. 1/4" X 1/2"
OPTIONAL "MARVELITE" OVER SOFT 1/16" TO SPAR
OPTIONAL "MARVELITE" PLY CAPPING OVER 1" T.E.(TAPERED) TOP AND BOTTOM
NOTE ALL LARGER SPARS ARE TAPERED TO SAVE WEIGHT AND FIT RIBS
SPOILERS OF 1/16" PLY, PLEXIGLASS OR OTHER
CENTER GUSSETS (EVERY SPAR) OF 1/8" PLY (CUT TO SPAR HEIGHTS) VARY LENGTHS
TIP PANEL 3/32" PLY GUSSETS
STAB CENTER AND TIP RIBS - 1/16" SHEET TRIM OTHERS FROM RECTANGLES USE A STRAIGHT EDGE
MAKE POD CRUTCH TO THIS OUTLINE FORMERS ARE CIRCULAR CUT OUTS TO FIT YOUR EQUIPMENT
NOTE: SPOILERS FULLY EXTENDED SPANWISE DESTROY SOME WING LIFT AND INCREASE DRAG. WHEN PARTIALLY OPENED, SPOILERS SERVE AS AN AIR BRAKE.
USE NY-RODS TO ACTUATE CONTROL SURFACES
ENGINE MAY BE MOUNTED ON PHENOLIC PLATE
OPTIONAL .15 ENGINE ASSIST (GOOD .15 OR A TIRED .19 MILL)
CARVE FROM BLOCK OR USE A LARGE BUBBLE CANOPY. ATTACH TO BOOM, NOT TO POD. IT MAY BE LEFT SEPERATE FROM BOOM ALSO
PIVOT SPOILER VERTICALLY
BLOCK FILLET
KEY BOOM TO WING WITH "SHEAR" STRIPS
TANK
BATTERIES
NOTE - POD IS NOT ATTACHED TO BOOM
CITIZEN-SHIP ANALOG
SERVOS
1/8" PLYWOOD POD CRUTCH
SPINNER
WIRE NOSE SKID
TOW HOOK
POD IS HALF-ROUND BELOW CRUTCH. CARVE FROM BLOCK BALSA, OR PLANK OVER COMPASS DRAWN FORMERS. FIBERGLASS TO AVOID SCUFFING.
OPTIONAL BELLY WHEEL - TO SOFTEN LANDING
MOVABLE RUDDER
FIX TO AFT FUSELAGE
0" 1" 2" 3" 4" 5" 6" 7" 8" 9" 10" 11" 12"

**Sleek, graceful pod and boomer . . . an N.A.C.A. 6409 foil,**
**Spoilers nest against the booms, extend spanwise.**
**An engine assist for the less fleet of foot. (Getting fat?)**

**102" span**

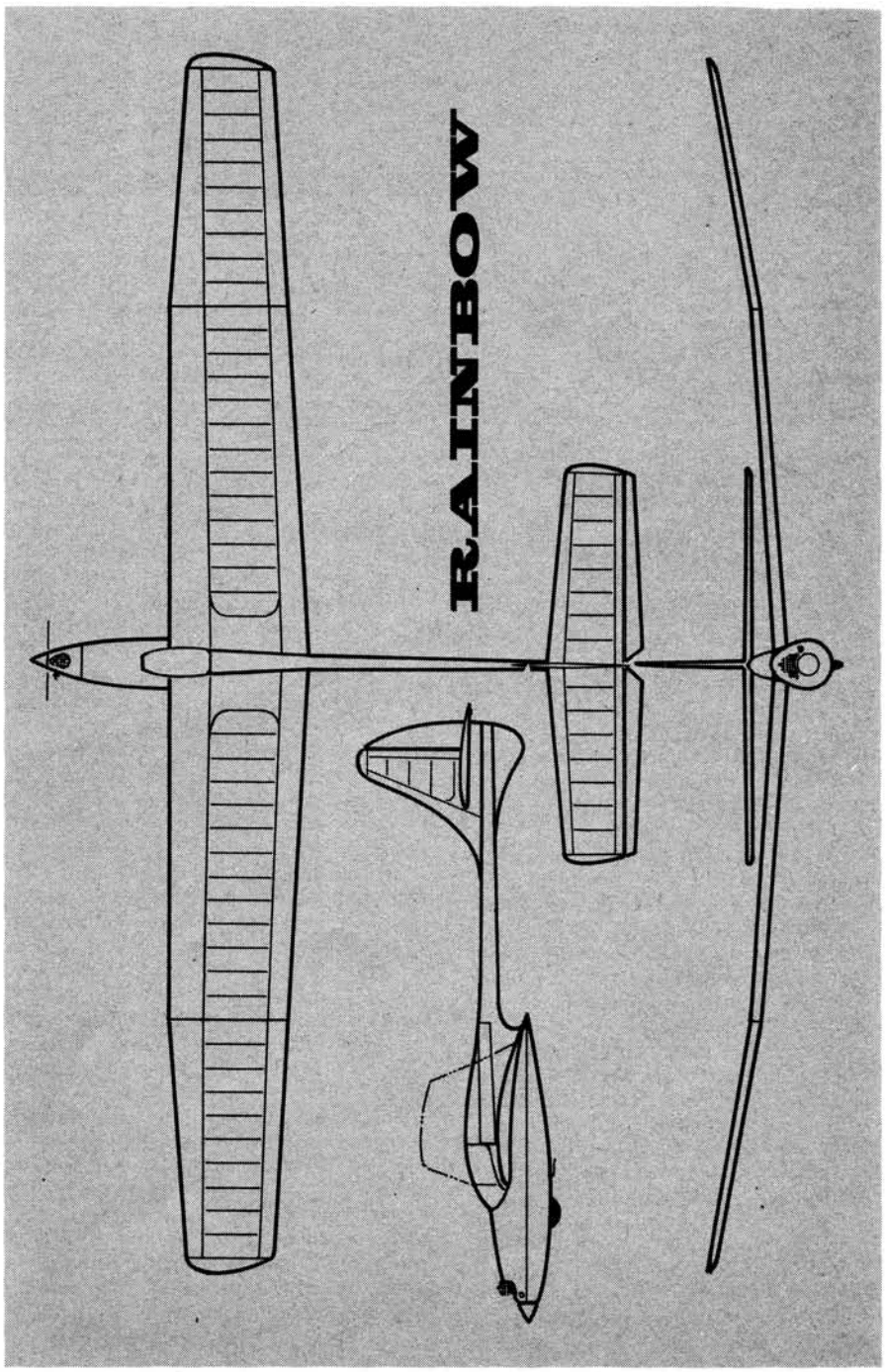
# RAINBOW SOARER

**Pod and Boom Thermal Hunter:**

**Rudder/Elevator/Spoilers/optional Engine**

**FULL SIZE PLAN AVAILABLE THROUGH "MODEL PLAN SERVICE"**

**by Don McGovern**




♦ The awesome powers of nature never fail to amaze me. I couldn't care less about city life, but forever wonder about the wind and sky, the restless sea and the immensity of space. I am not alone, for I never met a modeler who did not stand enthralled by the building of a thunderstorm. Nature on a rampage! I have flown over them, under them and through them, and words cannot describe the latter.

Before the storm, there is the sun on the fields, the thermals are born and spiral into the sky. You can see the hawks riding free, wheeling ever higher. The cumulus puffy clouds start to build, and the cycle of life in the sky goes on. I don't think very many people ever look aloft, or understand it all, but a modeler does. A dust devil forms, swirls the leaves and travels off. You gaze at a multi, and dream of a glider. With a soarer you could join the hawks. Quiet silent flight, defying gravity, a quest of altitude surfing on natures waves. A game of skill and a game of chance. If you win, you soar for the hour. If you lose, you try again. But stay away from the bowels of the thunderhead! Hail and turbulence lie within. You must fly by nature's rules.

High aspect, a light loading, undercambered, minimum drag, sensitive and stable . . . nature's rules for soaring. An A/1 is fine, an A/2 better, but neither is truly big enough to house proportional radio equipment, so you must go larger. Better for soaring, better for visibility and less burdened with the load. More work, but more fun, and a Radio Soarer is worth the effort. With a little luck, it will fly for a long, long time.

You lay the paper across the board and sketch in the lines. A glider to be a glider must be a functional thing. You must be able to get it aloft. A hillside will do, but what if the terrain is flat? A towline then, but what if the man is old? A rubber shock cord "hi-start" line can haul it to 500 feet. This is the "purists" way, and you must make it on the currents from there. But what of cooler air, December weather? Still good for soaring even over the snow, but you need a thousand feet or

*(Continued on Page 32)*

more. And what of the tree lined scrubby fields where towlines snag and risers are hard to come by? An engine then, a tiny engine, just enough to climb the ship, to get it up to the blue. The "purists" choke, but it is a practical compromise, and aerodynamics is nothing but such compromises. Power to payload, speed to economy, safety to chance, strength to performance. Where to put the engine? Too much drag in a nacelle, and no advantage. Put it in the nose, it helps the balance so it adds no weight, and very little drag. The smallest prop possible, and the prop can be removed if you wish to launch on a line. Thus the powered soarer is preferred by most flyers, it can function either way and can be flown alone.

102" span? Very scientific. It just fits in my car. Tape measure yours, or with slight modifications, you can add tubing and make plug-on wing panels, with 3/32" dia. music wire connectors, bent for the dihedral angle. I personally prefer to cart the one-piece wing, but each man to his own poison.

An N.A.C.A. 6409 airfoil. Why? I like it. I could find the ordinates. I'm too old to change. It's a shade stronger than some of the newer Nordic sections, of which too many R/C's have torn apart in thermals. It permits spars of at least moderate depth, and takes standard 1" tapered trailing edge stock perfectly. The wing is not the ultimate. It could be higher in aspect, 12 foot in span, etc., but 102" is big enough. A practical, popular size for a soarer.

For the fun of it, a second wing is being built, 12 foot in span, N.A.C.A. 6409 airfoil too. Foam cored, Marvelite covering. Plug in tip panels slipping into spruce epoxied boxes. It should make an interesting contrast when finished, though the finished weight is unknown as yet. Spoilers to break out of thermals? Good insurance and easy to operate, but where to put them in a foam-cored wing? To keep the skin smooth, the thought struck me that they might be folded aft against the boom, unfolding on command to any proportional degree as an airbrake. Full extended they can swing over the wing's center of pressure to serve as spoilers and destroy the lift. Easily hinged and operated from the pod or the boom area itself, with no controls within the wing. This same idea is in the experimental stage, but being tried in the 102" built up wing depicted here. Ailerons are of little use on a thermal seeking glider. Not worth the extra servo's weight.

The Fuselage: Streamlined, minimal, just enough to mount the engine, house a Class II radio system, and couple it to the tail surfaces. A pod and boom configuration with graceful lines as a change of pace. A belly wheel to soften the touchdown and roll to the landing. The boom is vulnerable in a crash, so lash it to the wing as a separate unit, free to sheer off on hard impact.

The Fin . . . just enough for stability at slow stall-speeds, with a huge rudder for turn control at a glider's flying speed. The stab to match the wing with elevator control for trimming the flight, mild acrobatics if you wish. Don't match Dick Florimounts flight, he tried to stunt out of a thermal some few thousand feet up as the setting sun cut short his fun. His spiral dive tore his wing off and it planted itself 18" deep in a freshly dumped load of topsoil.

Strap it all together, and you have a real soaring machine. A wide open .15 or .19 will haul it up to a speck, then the fun begins. Or go the towline or slope route.

The "Rainbow" will soar with ease on the lightest lift. Trim it flat and level in a thermal seeking turn, and once set, try to leave it on its own as much as possible. Each command creates air drag, costing you altitude. A well trimmed aircraft will feel a thermal, dip a wing into the lift and tend to ride the column of air on its own. Go for the lift that you dare, but chicken out if it carries you too far downwind. Aim straight upwind from time to time and seek new lift as the fields boil off new bubbles of air.

Your kicks will come in disorder. A few routine flights, then a booming thermal where you fight for the very life of your ship. At least one flight a day will stamp itself forever into your memories, payment in full for the extra wing tips you curse me for.

A fisherman waits for the marlin to strike, a surfer for the perfect wave, and a hawk for his free ride to nowhere. They are all kindred spirits which the modeler can identify with in his quest of the perfect flight. It is flying in a silent form, less dashing than multi acrobatics, but no less spectacular, no less thrilling, no less demanding in building skill. If you haven't played the game, I offer you the "Rainbow" Soarer.

## CONSTRUCTION

A full size plan may be ordered, or scale up necessary dimensions with a pair of dividers. Enlarge each measurement five times for the 102" span soarer. Select the wood as indicated on the plan, with straight warp free stock for the main spars, wing edges, etc.

**Wing Construction:** As the wing is tapered in planform, each rib differs in size. Each is very accurately drawn on the plan. Cut two of each as carefully as possible. Firm medium-hard 3/32" sheet balsa is recommended. If a jig saw is handy, stack four and cut out enough for a second wing while you're about it.

In the interest of cutting down unneccessary weight, several of the main wing spars and outboard trailing edges have been tapered. This also minimizes the depth of the notches cutting through the ribs, maintaining a strong airfoil chordwise. Ribs notch 3/32" into the tapered trailing edge stock as is standard practice. Note the front edge of the tapered trailing edge must be shimmed up to match the undercambered airfoil outline. Sight the relationship carefully while the panels are being assembled. It is very important to work neatly on glider wings, due to the frail airfoils and high aspect ratios involved. Double coat all glue joints at every possible point.

Assembly of the panels follows routine procedures, and what to do next will be fairly obvious as the framework grows. I would suggest building one panel at a time, but retaining the trailing edge shims, etc., using them in the same positions to create matching panels. You may prefer to install some of the secondary spars after the panels are removed from the board, which is somewhat easier in the case of the undercambered spars. These have to be shimmed up to accurately meet the ribs in a flush manner.

As an optional luxury on the design, a couple of sheets of "Marvelite" are a worthy investment. A 1/64" thick threeply birch plywood of great beauty, an ideal leading edge covering if there ever was one. Ideal too along the trailing edge, as it can be readily tapered to widths desired and contact cemented in place, overlapping the rib joint to add greater strength to the airfoil. A soft 1/16" sheet fill between each rib will reinforce it against sagging when covered, though the need for this is more suspected than confirmed. Also, on the leading edge, having a few sheets of very light spongy 1/16" sheet, I chose to lay this on as leading edge covering, with the tougher Marvelite contact cemented around this airfoil curvature. I believe the Marvelite would be sufficient in itself, though possibly a sagging between ribs might be detected if it is used unsupported. 1/8" sq. spars beneath might be a good compromise. Strengthwise, Marvelite is many times that of balsa, it is only the 1/64" thickness which might possibly sag a faint degree. It is certainly a new addition to the list of exotic building materials and worthy of your structural considerations on all types of models.

It should be remembered however, the Marvelite is not a necessity. I felt it worthwhile to add strength for flying on our local tree-lined flying sites, where every other landing can be a rough experience. You may prefer to eliminate it in favor of a lighter aircraft, though the need for extreme lightness is not so important if you intend to fly mainly with engine power to a good altitude. If the launch is to be made by conventional towline technique, a heavier aircraft requires greater running effort. Certainly the ship built either way is a very able thermal

# "RAINBOW"

soarer. A good current can pick up just about any model, even those overweight and high in the drag department.

Once the panels are rough-trimmed and sanded, they may be joined with gussets as indicated. Hobbypoxy Formula I or Formula II does a good job here. Center sheeting and soft wing tip blocks completes the wing assembly. Give the assembled wing a final sanding, remembering your glue-slops will not hide beneath the covering for long. Your friends will gleefully point them out to you, so disappoint them as much as possible with a flawless job.

You might prefer to equip your "Rainbow" with wing mounted spoilers, rather than the more unusual experimental aft folding spoilers detailed on the plan. The main function of the spoilers is to create drag and spoil wing lift, thus inducing a steeper descent.

It should be realized, spoilers are important to the proper flight pattern of a full size and model soarer. While a powered aircraft depends upon throttle and flaps to steepen the approach for landing, a glider has no power at all. A real soarer is committed to land as soon as lift is lost at pattern altitudes. If the pilot overshoots or undershoots the landing site, he has $10,000 worth of mish-mash more or less. He must therefore approach for a landing with excess airspeed, aiming at the field. However, you cannot normally land with this excess, as on flaring out, you will float across the field two feet high and overshoot. Thus, the pilot enters the pattern, holds excess speed until assured of reaching the field, then spills lift and creates drag with the spoilers raised to descend to the ground in a normal flared landing.

Spoilers have a secondary value in controlling the lift in an unwanted thermal. In this capacity, the model soarer is more in need of the spoilers than perhaps the full scale piloted soarer, where maintaining ground contact is not mandatory. The wise modeler however will learn to make use of them, using them to fight out of too strong a "boomer" and make it safely into a smaller field than he might otherwise be able to fly from.

The spoilers contribute nothing to the thermal soaring ability, but they do add a secondary control system to your aircraft, doubling as a dethermalizer and a set of landing flaps. One word of caution however: spoilers "spoil" a large expanse of wing area, as the air spills on the bias across the wing, in addition to directly behind the spoiler plate. The stab is not seriously affected, with the result that the trim is altered drastically, and the effect on the flight path is quite noticeable. Be prepared to retract spoilers or lessen the amount they are raised or opened if the descent is too steep for the incidence setting on your aircraft. Up elevator can be a corrective force to maintain a happy ship. ●