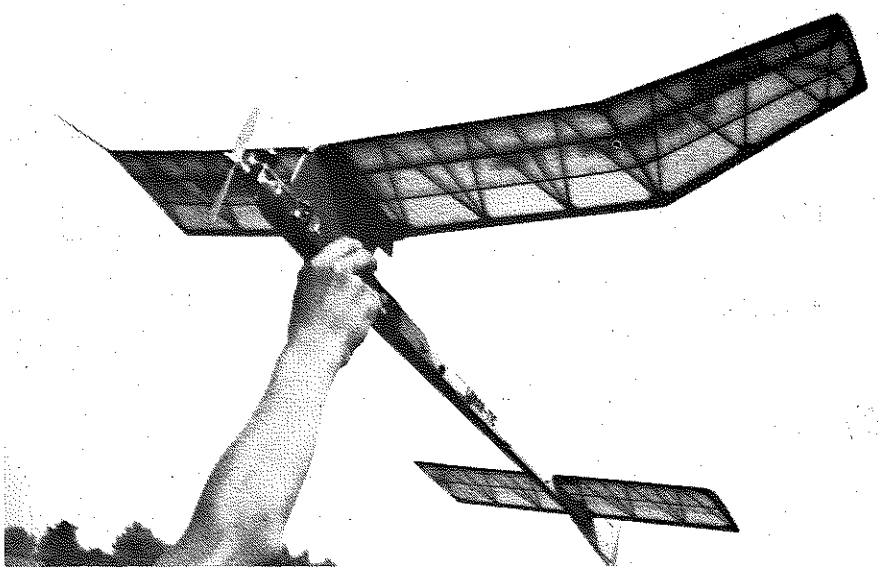
Half-A Gas

'LUNAR-TIC'

By HARRY MURPHY



The "Lunar-tic," as presented here, is the current status of a four-year design evolution to perfect a high-performance 1/2A-A free flight model with a dash of "class." The initial inspiration was to develop a model pleasing in appearance, as well as highly competitive, that would be interesting to the experienced free flight contest modeler, yet retaining sufficient simplicity to prevent ruling out those with less talent, plus comparing favorably with normal construction time of a conventional 1/2A model.

The "Lunar-tic" is therefore a pleasant divergence from the general run-of-the mill 1/2A designs with their solid slab pylons, power pods, profile fuselages, and squared constant chord wing and stab planforms. Yet, it strives to marry conventional 1/2A model construction with just enough streamlining and complexity to make it an eye-catcher on the flying field . . . even before it's ultimate power pattern attracts even further comment.

Prototype models have progressed through numerous actual experiments with varying dihedral and polyhedral angles, decalage and C.G. locations, fuselage lengths and moments, stab and rudder areas, and various lightweight wing and stab constructions, including geodetic types. It has been this modeler's experience that down-to-earth, seat-of-the pants, trial-and-error, wins more contests than beer-parlor-paper-theories, and consequently, this design has seen the route of the contest battlefield.

Trailing Hulan Mathies to a second place finish in 1/2A at the 1974 Lake Charles, Louisiana Nationals, stands as mute testimony of its contest potential. (Any time I can place second behind this California "super flyer" . . . I feel I have won anyway).

After thirty years of active competition, I would suppose I should be permitted a few basic observations as to what it takes to win. The 1/2A "free-for-all" at any large meet is typical proof that the "professional edge" is more difficult to attain and maintain in the small engine classes than in the larger bore categories. For the moment, let us consider as constant the major influences that affect any single flight of any free flight model. These might be, "Outhouse Luck," Mother Nature, The Thermal Gods, and the like . . . we may then analyze the other variables on which any given modeler may exercise "positive personal control," if he really so desires.

To continue with our game plan, let us also consider the Cox .049, fuel, and props as constants, then what remains are "two basic controllable factors." These may be categorized as, (1) individual model design and trim, and (2) attention to detail. I feel very strongly that these two areas separate the men from the boys . . . the winners from the losers.

Model design and/or trim theories get banged around at every club meeting or "hangar flying" session. Numerous books and magazines hold a wealth of detailed experience and technical knowledge on this and associated subjects. I do not profess to offer any new, world-beating theories here, except to note that most of the reference info appears to be presented in "general" terms rather than "specific" terms, and that it is my belief that proper power trim varies greatly with each specific model design. This stated, simply means that using your favorite power trim set-up on all of your models, regardless of design, just because you have done it that way for years, does not necessarily mean you are milking all the potential possible from your particular model design.

Power patterns, whatever theory they represent, perform one single function, and that is of getting the model as high as possible on the alloted engine run. Aligning the proper power theory with a given design is the real task.

The "Lunar-tic" design is no different, in that a definite power trim has been developed which would appear to sap the most from this design. It follows at the close of this article.

Hand-in-hand with "model trim" goes our second basic controllable variable and that was "attention to detail." Wing and stab warps, side thrust, down thrust, rudder tab, proper wing and stab keying and alignment, C.G. location, correct decalage, dependable fuel system, fail-safe D-T arrangement, overall model workmanship, etc., if given close attention in the workshop before first flight testing, will suppress those "test hop jitters" and insure a minimum of required field revisions to attain the maximum power pattern desired. I once field trimmed a new "Lunar-tic" in two test flights on the morning of a contest and won first place with five straight maxes. I prefer to think that this was more closely related to 'Attention to detail' rather than 'luck.'

One may then conclude that the reason one of two identical model designs flies well and the other bombs out, may simply lie with the initial model preparation, plus the whereabouts of the modeler's momentary frame of mind when placed on the gradient between "patience" and "panic."

I offer this analogy to suggest that the modeler himself may well be his own worst enemy, and the measure of any particular design's success on the trophy trail may be more with him rather than his equipment. A self-psycho-analysis of your personal competition procedures might produce some rather interesting results for you.

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So, start over with a newly built "Lunar-tic," coupled with proper model preparation and a disciplined flying procedure. You may well be amazed how fast your trophy shelf starts to fill.

As previously stated, the "Lunar-tic" project initially aspired to attract the attention of the modeler with competition experience. Therefore, a step by step description as to where the pins go would be a bit hypocritical. I will hereby attempt to refrain from being overly elementary in explaining this model's assembly so as not to insult anyone's intelligence.

I should like to note in the beginning that should you desire a very light model, you may easily substitute 1/20 sheet for 1/16 sheet for the pylon planking, stab, and/or some or all of the wing ribs, and all gussets. Slanted tip ribs may also replace the soft balsa blocks. I show 1/16 sheet here, as 1/20 sheet is not available to all, and I personally prefer a medium weight model of 6-1/2 to 7 ounces, and they appear to better penetrate midwest surface winds. Modelers in locales fortunate enough to have an abundance of dead air competition may have a desire for a lighter craft.

WINGS

I prefer to completely finish both the wing and stab before even starting the fuselage; this is habit, but does permit continual checking of alignment and the C.G. location during the fuselage construction.

First, cut out all wing ribs from medium weight sheet stock. Cut all notches as shown into the straight ribs WA, WB, and WI, but do not notch any of diagonal or short ribs at this time. Pin the 1/4 sq. L.E., 1/2 inch wide tapered T.E. stock, and two lower spars of 1/16 x 1/8 and 1/16 sq. to the plans. The wing tip T.E. taper is accomplished by simply cutting off the thick edge of standard 1/2 inch wide T.E. stock to be 3/8 inch wide at the tip. Notch the T.E. as indicated. Follow by notching and fitting the diagonal ribs to match the bottom spars as you proceed. Also notch the diagonal ribs for the top spars before cementing in place by simply "eyeballing" a match with your tailored bottom spar notches. Again, omit notching the diagonal and short ribs for the turbulators for now. Of course, delete the centerline and polyhedral break ribs "WA" for the moment. The 45^{0} angles on the soft balsa tips are a snap. Simply cement soft 3/8 sq. stock in place. After the wing tip panel is removed from the plans, carve and sand a flat plane to the diagonal across the corners of the 3/8 sq. section. Then carve and sand the top to conform to the top of the airfoil, you will then end up with a perfectly curved tip. Construct all four panels at once and when cement has set, carefully remove only the tip panels from the plans.

Now fit and cement the tip panels to the inner panels, incorporating the 3-1/4 inch polyhedral angle and add the 1/32 plywood dihedral brace "WK" and rib "WA" at this time. Follow by now adding the top spars to the wing tips only. The 1/16 x 3/32 turbulators may be added more easily after complete assembly of the wing and after it has been removed from the plans. This is accurately accomplished by laying a straight edge between the notched end ribs of each panel, aligning it with the proper notches, marking the notch location and cutting angle on each rib in between with a sharp razor blade, then carefully cutting each notch.

Remove both newly constructed wing halves from the plans and join them together at the centerline, incorporating the 3/4 inch dihedral for each panel. Cement the 1/32 plywood center brace "WJ" in place with the remaining "WA" rib. Add the top spars of 1/16 x 1/8 and 1/16 sq. to the inner panels and when cement has thoroughly dried, remove the entire wing from the plan. Add the 1/16 x 3/32 turbulators, by the method described, and the 1/16 sheet gussets in the locations indicated.

Fill the space between the top and bottom spars either side of the centerline rib "WA" with scrap balsa, out to "WB" rib. Use 1/8 sheet scrap for main spar filler and 1/16 sheet for rear spar filler. I have found that similar reinforcement at the polyhedral breaks is not necessary, as the front and rear 1/32 sheet webbing suffices. Complete the wing construction by cementing the 1/32 sheet webbing between each rib in the locations shown, plus adding center section 1/16 sheet planking. Sand the entire wing to prepare for covering. In the beginning, you may have had a somewhat squeamish feeling about building a wing from so many "toothpicks," but note that the resultant full depth "I-Beam" center spar forms a very rigid structure.

Pre-dope your new wing with two coats of fuel-proof dope, cover with Japanese tissue to your favorite color scheme, and brush on a sufficient amount of dope to seal the covering. Use relatively thin coats of dope, and more coats, to prevent warping and to speed aging.

STAB

Again, start by cutting out the ribs from medium weight sheet stock and notching only the straight ribs, as per the wing. Pin to the plans the 3/16 sq. L.E. and 1/2 inch wide tapered T.E. stock, plus the 1/16 x 1/8 bottom main spar. Utilizing the same procedure as was used in constructing the wing, notch the T.E. appropriately, and cement all stab ribs in place. Cement soft 1/4 x 3/8 strips on the ends for the tip blocks. Notch the diagonals using the straight edge method, and add the two top strips of 1/16 x 3/32 and single 1/16 x 1/8 spar. After this assembly is completely dry, carefully remove from the plans and gussets and planking as shown. Carve the tips in the same manner as was done on the wing tips and sand the entire stab to prepare for covering. Covering instructions are the same as for the wing.

PYLON

Construct the pylon frame over the plans by pinning down the 3/32 x 1/4 spruce wing-retaining rail and remaining 3/32 x 1/4 balsa strips. The 1/16 plywood rear profile part is shimmed up 1/64 from the plans, which of course, is to position it on the centerline of the pylon frame in the top view. With this portion of the pylon frame still pinned to the plans, cement in place the right hand 3/16 x 1/8 upright and the two pairs of contour parts "P1" and "P2." After cement has dried, carefully remove the assembly from the plans and add the left side parts. Do not plank the pylon as yet. Construct the wing platform of 3/32 sheet and add the 1/16 x 1/8 spruce wing rails as shown. Cement the platform securely to the pylon frame. Set this complete assembly aside until the fuselage box is completed.

FUSELAGE

The fuselage box is initially of typical upside down construction. Cut the top outline from relatively hard 1/16 sheet and pin it directly to the plans as indicated. Cement the 1/16 sheet formers "A" through "G" in their correct positions, and when dry, cement the 1/16 sheet sides in place. When cement is dry, carefully remove this three-sided box from the plan and finish trim the formers of the open bottom to receive the 1/16 sheet bottom plate. Cement the plate in place. Now carefully remove the front square former "A" and cement the triangular balsa wedges inside as shown on the plans. Be sure you have trimmed the wedges to proper length, as the former "A" is to be replaced later.

Now cut the opening for your fuel shut-off, into which ever side you prefer, and fit it in place accordingly. If an internal fuel tank is to be used (personally I am not yet totally sold on the pacifier fuel systems for 1/2A's, as so far, the increased engine performance has not been worth the oily mess), hog out the balsa required to receive your metal tank and epoxy securely, replacing former "A" as you do. I use a Perfect No. 18 wedge tank, modified as indicated. Next, mount the Tatone 1/2A mount to the 3/32 plywood firewall and secure it in place with epoxy on the front of the fuselage box with the mount assembled. Remove the mounting screws and "Tatone" mount before the epoxy gets too solid so as to insure against the screws freezing in place, thereby preventing screw breakage when

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the screws are eventually removed. Carve and sand the front end to blend from the square box cross section to the round firewall, as noted on the plans.

Fabricate the rear fin from medium soft 3/32 sheet and cement it in place on the rear of the fuselage box. Add the 1/16 plywood stab platform, 1/8 sq. spruce stab stop, and the triangular 1/16 sheet top reinforcement strip as shown. None, or very little stab tilt is required, so keep the platform parallel to the wing platform. Form the skid from 3/16 sq. spruce and epoxy it securely to the front underside of the fuselage as shown. Finish sand the fuselage box and fin assembly and tentatively assemble the fuel timer, engine mount, and engine, including propeller.

Rubber band the stab to the fuselage and temporarily pin the pylon, per the plans location, to the top of the fuselage box. Now rubber band the wing in place in place on the wing platform. Carefully locate the longitudinal balance point of this complete assembly by balancing it on a single or double edged razor blade which has been stuck into a balsa block. The horizontal blade serves as the fulcrum for our homemade teeter-totter.

Next, pull out the pylon pins and carefully relocate the pylon frame assembly, with the wing still assembled, over this fulcrum point so that the eventual rear edge of the wing will locate 1-1/2 inches rearward of this point. In this finalized position, securely epoxy the pylon frame assembly in careful alignment to the top of the fuselage box. Complete construction by adding the 1/16 planking on the pylon sides, running the wood grain vertically, and complete final sanding.

Prime the completed fuselage with one coat of thinned dope, then a thinned coat of dope and K&B Micro-Balloons mixture. Sand lightly and add another coat of thinned dope. Cover the entire fuselage with tissue to match your color scheme.

Cement the 1/16 plywood trailing edge stab shim to rear of the fuselage just forward of the rudder. This will probably be a minimum requirement and you need as much as 3/32, which may be somewhat determined by initial hand test glides of the completed model.

Add the 1/16 aluminum tubing for the D-T line guide just aft of the stab, and short strips along the side as needed. Add snuffer tube and paper clip wire hooks to the fuselage side and to the stab as the plans indicate. Finish doping the entire model. Assemble engine, fuel timer, and associated hardware to the fuselage, then assemble the completed model and add wing and stab keys.

FLYING

This may come as a surprise to you, but you are not quite ready for the flying field, as most design articles will state at this point. Remember our analogy on controllable factors of model design and trim? Up to now, we just have a model design. The next step is model trim, and I suggest you head for the "kitchen" and not the "flying field" to instigate this next phase. Build a fire under the good wife's tea-kettle and wait for the steam to roll.

I have always been amazed by those who say desired warps should be built directly into wing panels. Those fellows must not reside in high humidity areas of the midwest, or they hold some secrets I know nothing about. If I build a stab flat, it warps. If I build a warp into a wing, after covering and doping, it comes out flat or warped more than that which I built in. Therefore, since I end up with a "tea-kettle session" anyway, I just build all panels flat and worry about warping or de-warping surfaces after everything else has been completed. This is where it counts anyway. No matter how you personally obtain the end result, the stab has to be perfectly flat. Make yourself a flat warp board at this time and retain the stab to it at all times when not in use. A slight right rudder warp is desired, which may need compensating later by a tick of left thrust. The wing is to have about 3/32 washout in each tip; the right hand inner panel is to have 1/16 washin and the left hand inner panel 1/16 washout. This may sound a bit troublesome, but we said that "attention-to-detail" will pay off. Now we may head for the flying field.

Here again, we will probably do a couple of things which differ from your normal, personal first-flight test procedures. A right-right power/glide pattern is desired for the "Lunar-tic." First, we eyeball a check on our tea-kettle session to insure all surfaces meet the aforementioned settings. If not, go back home and stay there until they do. Second, we do not put the prop on backwards as most suggest, and third, hand glide your model a few times to appraise the amount of shim required at the rear of the stab. Naturally, a slight stall would be better at first than too much negative. Fourth, we do not throttle back on the engine, but run it wide open. Be sure to set your timer to get about a 2 to 3 second engine run, and launch only in the following manner: Stand with your back to the wind, hold your "Lunar-tic" in a perfectly vertical position, up and out away from you, looking at its bottom. Tilt the nose slightly to the left (right of the wind) and simply let go, flipping the timer, of course.

You should get a very fast vertical climb with the slight wing warps and right rudder twisting the model in a slight right turn and left roll as it goes skyward (yes, slight *right* turn, and *left* roll). If you have seriously completed your homework, your "Lunar-tic's" power trim should be pretty close. Slight revisions for power trim and stab tilt for glide should complete your trim procedure.

Before you order me a padded wagon and an accompanying armless sweat shirt, consider this analysis comparison to the more popular first-flight testing procedure of the backward prop, subdued and short engine run, using mild fuels, and relatively horizontal launch. Fellas, with conventional methods, you are testing a high-performance model in a mode in which you never expect it to competitively perform. The slow speed horizontal launch will get you only a maximum of fifty feet up in 4 to 5 seconds. It also gives you only 50 feet or less down, and it will seem much less if your model is a bit erratic on its maiden flight. The engine will lean out anyway before it quits, and may just be enough burst to drive your model into the ground.

Initial engine and trim settings mean nothing, as you must continue to change them as they will affect your model differently as you get braver and increase engine RPM and model speed, turn the prop around, go to hotter fuels, etc. Sure, you can eventually get there in 8-10 test flights, but your model may have a few battle scars by then, and this may be the third or fourth trip to your test site.

In comparison, the "Lunar-tic" VTO full-power-procedure takes your model higher, directly away from the ground sooner, which means it is further away coming down should your workshop trim be too far off. It is a simple matter of geometry. Also, in 2 to 3 seconds under maximum RPM, "power-to-glide" transition is more realistic, eliminating any possible damage from a low speed stall into the ground. Final trim should come in just a few test hops on your first test field outing. Don't knock it until you have tried it.

What "Lunar-tic" building time may have cost you in the beginning, is more than made up in establishing you in a very competitive position in a short time. Coupled with a well disciplined competition flying procedure, your "Lunar-tic" should fast become one of your favorite models as it has fast become one of mine.

GOOD LUCK AND SIC 'EM!!!! •

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