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The 200 Sq. In. SPACER

For 1/2 A and A Nostalgia Gas

The Spacer was Designed by Sal Taibi
As a favor to Bill Baker at California Models who needed a new product.
The rehash with side and down thrust was done by several flyers in Central California in the mid 1950s.

Welcome to the Contest

Congratulations, you've made the right choice ! The Spacer is one of the very best designs for the Nostigal event. This model is quick and easy to build, does not have a whole lot of lumber in it and there is nothing complicated. This is a clean low drag design with thin light weight wing tips. With a little bit of care you can build a strong model down to the design flying weight of under 5oz. The most outstanding characteristic of this design is that it is very easy to adjust and fly safely. When built as shown on the plans, your Spacer will handle unlimited amounts of power with no trim problems. The decalage and thrust line changes were developed in 1953-54 era and the 435 inch version with a Torp .15 was on the USA FAI team. The Spacer on the drawing is Contest Legal.

The Lucky Lindy is the only other design that matches the Spacer in performance. But the Lucky Lindy has way too much lumber to be built down to weight as a small model.

These Spacers are quick and easy to build. *Don't build just one, build two at the same time, it really doesn't take much more effort.* Also a word to the wise: Buy spare engines now while they are available. The Cox Killer Bee .049 and .051 are by far the best Nostalgia engines. These engines will run well above 20,000 rpm and stay together at 23,000 rpm. I have been running these engines since about 1989 with out blowing a single engine. There are no serious problems with this engine, stock up now. There is no reason to believe Cox will still be around when you need another engine.

The reduced size of this Spacer in due to the new rules with short engines runs. In the good old days we all flew with 20 second engine runs and most of the competition flew overweight, out of trim models so that 3 maxs and a decent 4th flight was usually good enough to win. NO MORE! Most of the contest today will limit motor runs to something in the 9 to 12 second range and the competition is vicious. It is not unusual to have 5 or 6 competitors making it to the 7th flight. You don't luck out anymore. The short motor runs have forced us to climb faster. Climb is a function of weight and drag, Glide is a function of wing loading and drag. Drag increases on the square of the airspeed and minimum airspeed increases on the cube of the weight. The only sensible response to the current rules is to build models down to weight and not a gram over, while also reducing model size to help reduce drag. Its the same compromise again. Light weight, small size, minimum wing loading.

For the Spacer, 5 oz, 200 inches and a 20,000 RPM noise maker on the nose is about right. These Spacers will climb out of sight in 20 seconds with a dead air glide time of well over 7 minutes.

Looking at the drawings you will notice two types of lettering, this is so you can see where the updates are. Basically, we got a fresh set of plans from Sal Taibi and had them reduced 10% to provide us with a 200 sq. in. wing area model. We then made the needed changes. (I) 3 degrees down thrust and 4 degrees left thrust. (2) Added a ballast box under the stab. (3) Added 1/8 sq. in fuselage at front of stab. (4) Added a small piece of bamboo in leading edge of stab. (5) Added much needed 1/8 sq. in fuselage at rear of pylon. (6) Added some pieces of 1/8 sq. on one side of each wing rib at the dihedral breaks. (7.) Changed DT set up to move fuse nearer to CG. (7) Added eyedropper fuel tank. (8) And one other thing, we set the decalage at 2 degrees, *(decalage Is the absolute angle between the wing and stab).* With this change your models will not glide with the balance point where Sal had it on his original plans. These Nostalgia Spacers will fly best with the decalage set between I and 1-1/2 degrees and the CG about 1/2 inch aft of Sal's indicated CG. We are going to fly these Spacers just like a big hand launch glider, with I to 2 turns to the right under power and a big right circle in the glide. The safe way to start out is with the built in 2 degrees of decalage and just move the CG as needed for the glide.

The down thrust is needed to allow us to VTO safely in the wind, and also to straighten out the climb while still climbing out with some degree of decalage between the wing and tail. The left thrust is needed to improve the VTO and climb stability all the way through the climb pattern. The model will not handle all the power if you use left rudder tab as shown on the old original plans. Also left rudder tab does not work well when you are climbing to the right and also gliding to the right. The rudder tab will screw up the transition and interfere with the thermaling stability of the glide. We use left thrust instead of left rudder tab and the model goes like its on rails with no tendency to loop over at the top of the climb. The ballast box is needed for adjusting because these light weight models all come out nose heavy.

We added the 1/8 sq. at he front of the stab and the piece of bamboo in the stab as reinforcement in a weak area that is near the ballast box where we will be putting lead anyway.

The 1/8 sq. pieces added in the fuselage at the aft edge of the pylon are because you need to anchor the pylon to the fuselage former with a good glue joint. A pylon that is not solidly attached both front and rear makes for some really weird flying characteristics. I have twice built spacers where the pylon was retained at the aft end primarily by the fuselage top. Of course the fuselage top flexes under high speed loads and suddenly things are not going so well. But that engine sure runs really good going downhill. !

The only weak part of Sal's wing design has been the ribs at each dihedral break always seem to get crushed a bit and the leading edge is pushed back about 1/4 inch after only a few vertical landings. With addition of this 1/8 sq. and the new Mylar coverings, the wing will survive to fly again.

We all hate the eyedropper fuel tanks for lots of good reasons. But no one has ever come up with anything better. All we need is a fuel tank and timer system that adds no weight, seldom has overruns and never hangs ups causing flyaways. So in the meantime we are using the eyedropper timer tank.

The less decalage the less drag.... and the better a model performs, It will climb better and it will glide better, with no exceptions. The only downside to low decalage is stall recovery. These small light weight Spacers will recover from a vertical position with a loss of less than 50 feet, and thats plenty good enough for a serious contest model. The original spacers had about 3-1/2 degrees of decalage. We are flying these Spacers with about I degree and even that is more than is actually needed. Remember this: Indoor Hand Launch Gliders R E A L Y do fly with 0-0 settings, (no decalage). Trust me, you have nothing to worry about.

Note that on the plans I drew a datum line right down the center of the fuselage and put the stab right on the datum line. Draw this datum line on your fuselage side with a ball point pen when you are building your models and even years later you can always see a little bit of decalage does exist. This will provide a warm fuzzy feeling under adverse contest conditions.

The other major change since the good old days has been the engines. The original Spacers flew on Space Bug engines that would turn about 17,500 on a 5-1/2 x 4 prop with good fuel. A new out of the box Killer Bee engine with a block Tornado 5 x 3 prop and good fuel will turn about 17,000 just for starters. With 15 minutes of work and a high compression head, (Cox *I702), on good fuel most Killer Bees will pass 20,000. The very best Killer Bees with some piston draft will turn over 22,000 on 50% nitro fuel .....AND with 15% castor oil in the fuel it appears these Killer Bees will stay together forever at the 20,000 to 22,000 RPM range.

The other really good acceptable engine is the Cox "product engine", part number 290. This is the engine in millions of ready to fly plastic models that Cox built. Under normal conditions most of these engines can be expected to turn about 14,000. The majority of these engines do not have a satisfactory cylinder-piston fit, but if you have access to a bunch of the engines you can assemble a good one.

The major advantage to this engine is that the Cox high compression plugs are legal. In the mid 50s Cox also built thousands and thousands of these product engines for Jomar race cars that had very good cylinder and pistons assemblies with piston draft. About 5,000 of those engines also used Tee Dee cylinders. All of these engines will exceed the 20,000 RPM mark. I never pass up any old race car engines at the local flea market.

Another legal engine is the Cox Medallion, A major problem with this engine is that high compression heads are not legal. I, personally have never seen a legal Medallion turn 20,000. The addition of a Tee-Dee shaft is not legal but it will add about 1,500 RPM and dropping the head .020 can add another 1,000 RPM. I don't see any reason to use the Medallion engines. Contest Directors should have a problem with this engine.

The Holland Hornet is the most popular engine for Nostalgia and its a good engine that runs with the best of the fast puppies in the 20,000 to 22,000 range. There are three major problems with the Hornets. Number I. Is the cost of a good engine is around $150. Number 2 is the glow plug problem. Plugs cost about $6 each and it eats them up. Number 3 is the Hornet won't stay together at anything over about 18,000 RPM. The failure mode is normally the connecting rod but sometimes the shaft lets go first. Either one and you need a new engine. I have a copy of the original detail drawings, and you can follow the revisions where Bob Holland beefed up the connecting rod 3 times. I flew these engines in control line speed for a couple of years and probably went through 20 engines. Every single time I had a good engine going It would come apart before I could get the other details worked out. Flying with an expensive Holland Hornet is like using a $100 bill for a snuffer tube. Don't let your mom find out.

The only other engine that can be considered is the Cox Space Hopper. I remember these were good engines but I had no practical experience with them. They are kind of rare now and I have not seen a good one in several years. There is an excellent chance they will out run the Killer Bees and stay together.

There has been no significant change in fuels in the past 40 years. The difference is that fuels are better understood by more people today than in the good old days. With these small engines there are only three basic rules to remember.

1. They must ALWAYS have at least 15% castor oil. Anything less will cost you the piston-rod ball joint.
2. They absolutely love nitro, 30% is the lowest percentage you can expect to obtain a smooth running engine.
3. They must have at least 40% nitro to run decent, and 50% nitro is the minimum recommended standard fuel.

In the old days the secret hot fuel was: *65%* nitro
15% castor
20% Propylene Oxide.

This is still the very best running fuel but it still has the same drawbacks. Hard to set the needle, one click either way is too much and you need to reset it every flight. You are not likely to get even 3 good runs under contest conditions, and remember you will need maybe 7 or 8 good runs to win. To get the best from this fuel it seems like you need to mix a fresh batch every 1/2 hour or so. Yesterdays fuel mix will lose about 1000 RPM over night. I have not used this fuel in free flight in about 20 years, I just don't think its worth the problems.

A good standard fuel for these small engines is: *50% nitro*
15% castor
35% alky

This is a good basic fuel and you will not have problems with the needle valve or shelf life of the fuel. It takes the 50% nitro to make these little engines wake up and tell them to run, run, run. In cold weather you need to store your fuel is a glass container so you can see that it is staying mixed. The nitro and castor tend to separate out and the fuel will look cloudy when you shake it up. All you need to do is warm the fuel up a bit and it will mix again. Don't put your fuel in the trunk of a cold car on the way to the big contest.

A very hot fuel for warm weather is: 65% nitro
15% castor
20% alky

A major problem with this fuel is keeping it mixed in cool weather. On the morning of the contest the nitro separates from the castor every time the fuel cools back down to ambient temperature. Also you will definitely have trouble setting the needle on some of the flights. When there is another engine running nearby its just about impossible to get a good setting. All in all, this fuel and the extra 500 rpm isn't worth the trouble you encounter with it under contest conditions.

Synthetic oil is not satisfactory. The best of the commonly available synthetics burn away at about 485 degrees F. Castor oil turns into a protective varnish/ash at about 580 degrees F. The synthetics are used only because they are cheaper and a lot easier to mix. If you absolutely must use the latest fad synthetic oil, use it only in excess of the 15% castor and anything in excess of 3% synthetic is just filler. Satisfactory synthetic oils cost well over $100 per gal.

Fuel ingredients should be available at your local drag race supply center.
I cannot ship them to you.

ENOUGH OF THIS BULLSHIT. LETS BUILD SOME AIRPLANES ! !

Building.... Flying .... and Winning....

This is not exactly a beginner's project, and certainly not a good first model. Therefore there will not be any step by step, glue A to B type instructions. Contest free flight models do not come any simpler than a Spacer, you build it straight, light, and like the plans, you will have a winner. Our instructions will cover only the items that are different, unusual, or require extra care.

Golden Rule No. I. The flying weight of this model shall not exceed 5.000 oz.

Select good straight grained light weight wood for everything, except the wing spar in the center panels only. Use medium balsa for those wing spars. Do not start adding wood or other garbage. You do not need to reinforce any of the structure. This is an airplane, Not a tank. As drawn, the model will withstand several seasons of contest flying, and that includes an unlimited number of full power DTs. The Nostalgia rules do not require multi-colored paint jobs or lots of decals. Anything you do in the way of decoration will add weight. Color is needed only to increase visibility in the air.

Golden Rule No. 2. Build it straight, Keep it Straight, and it will fly Straight.

The idea of no warps is such a simple concept. "All warps are unwanted warps in any high speed model."Do not even go to the flying field with a warped wing. I know lots of models fly with lots of warps, but I also know that small, very fast models do not fly that way very long. Bear in mind that a warp has zero effect at zero air speed, small effect at low air speeds, and tremendous effect at very high air speeds. This Spacer will be moving near 80 feet per second within 5 seconds of launch. These are small light models with light extremities and an extremely low moment of inertia with a corresponding high roll rate. A warped wing is almost impossible to adjust, sometimes the best thing to do is stomp on it before it destroys you and the rest of the model.

Don't fight a warp, get rid of it.

Golden Rule No. 3. Know your equipment and know what to expect.

You have got to know how to operate everything connected with this model. Such things as crummy plugs, poor engine runs, cross wind launch, tight glide circle, short fuses, dirty fuel, engine over runs and on an on are pilot errors, not equipment failures. If you can't seem to win, its probably your own fault. You are not ready to fly. Your failures are not equipment faults.

Hold yourself accountable for the results of your effort, or lack of effort.

Golden Rule No. 4. Thou shall never ever launch this model in a horizontal position.

It's better not to do this as the model typically will dive into the ground every time. The downthrust is pulling down a whole bunch and this is way before the wing has enough air speed to be pulling up, (because you hove a good engine on the nose, right?), I have personally tested this rule at least a dozen times and have hit the ground every time. It's not even close.

Building.....

Keep it simple and clean. Good wood, good parts, put together right. Its easy. We build on a flat glass table top with wax paper over the plans. The wax paper is necessary because we build with a water thin CA glue known as Plasti-Stic, this glue sticks to everything except wax. It also does not get brittle and seems to be at least twice as strong as any other CA. We do glue the firewall and landing gear in with 30 min epoxy. Right..... Nitro is one of the major solvents for all CA glues.

I sand every piece of wood smooth on all sides before gluing it in place. This is much easier and faster than trying to sand out saw marks from a finished assembly. I cut wing ribs on a 10" disk sander with a template system. A 10" table saw with a sanding disk would be even better. We notch the trailing edge for each rib all the way to the tips. I do this with a simple tool made by breaking a hacksaw blade in half and taping the pieces together side by side so as to cut a 1/16 wide saw slot . I also glue or tape on a strip of wood to act as a depth stop.

I keeping changing but at the present time I think the best and lightest way to build this wing is to start by building the tip panels first, prop them up for the correct dihedral and then build the main panels right onto those tips. I guarantee the joints will fit and I think it might even be faster. If you have any heavy pieces for the wing be sure to put them in the right wing because we need this model to recover and glide to the right. We always cover the wing and tail with the MRL .0015 Mylar covering because it has the stability to eliminate the warp problem and its a lot tougher and adds more structural strength than jap tissue. Jap tissue with 4 coats of dope and fuel proofer on it weights around .0007442 per square inch. The MRL mylar comes in at a consistent .0009236 per square inch. Thats .000179 per square inch difference times 500 square inches equals about .0897 ounce per airplane. Do follow the instructions that come with the .0015 Mylar.

By all means mount your engine with 2-56 screws and blind mounting nuts. The sidewinder engine mounting is a big improvement as it gets most of the exhaust off the model, and in the case of the Killer Bee, it gets the needle valve out in the open. Put the cylinder head over on the right side, the weight on the right side helps to ensure a good recovery. Because of the fuel proofing problems I hove been covering the entire fuselage with the .0015 Mylar and then spreading epoxy on the seams near the firewall. Fuel with 50% nitro will destroy any paint except epoxy and by epoxy I mean the 2-part catalyzed paint. Also K&B Super Poxy is no longer available. If you are installing a transmitter, I would recommend putting it in the top of the fuselage just behind the pylon. When setting up to fly be sure to set the DT pop angle at about 60-75 degrees as this model won't come down with the normal 45 degree pop.

In general, when building and flying this model try to think of this as a pure endurance machine. No more and No less. This is nothing but a wing that fliess. The stabilizer just keeps the wing in position. The engine just pulls it up. The only reason for the fuselage is to hold the other parts in their correct positions. This is a simple toy. Forget your school book aerodynamics.

Remember That Stuff you learned in school, (Aero 101) about the air molecules separating at the leading edge of the wing and then rejoining at the trailing edge. This required the ones on top of the wing to travel faster thereby producing a low pressure area which resulted in aerodynamic lift. I'm telling you its not true. No matter what contest you fly in, no matter how good the air is, it never happens, Not even once. There is no reason in all of God's blue sky for those molecules ever to meet again. They have separated. They never even heard of Bernoulli and no one bothered to explain his law to the molecules.

When you get down to the real world level of a ½ A Nostalgia Spacer 1 believe at least 85% of the lift is produced on the bottom of the wing. Make the bottom of the wing as slick and bump free as possible. We want to fly this wing as slowly as possible, and at the highest, possible true angle of attack to the air. (10-14 degrees). This combination produces the most lift with the lowest drag that this model is capable of producing. This is a combination that will always be very, very popular on the contest field. At this level you do not need to be concerned with any possible adverse pressure gradients on top of the wing.

This is a very narrow chord wing, operating at a very low Reynolds number, and we are trying to lower it even further by flying it even slower. To succeed at this you must have a light wing loading and a very sharp leading edge, yea a sharp leading edge. I suspect the sharp leading edge encourages a small burble of air to form on top of the surface at the leading edge, this burble turbulates and destroys any laminar air flow at our low speed and high angle of attack. If you can pretend my little burble is real and somewhat flexible as to size and location, you can see it changing as needed to postpone the stall allowing a higher angle of attack and more lift. Who knows, with this we might also explain how bees are able to fly. Use this burble bit with caution, as it does not seem to apply at much higher Reynolds numbers.

You may want to get a second opinion on the above as I'm just a salesman klutz that flunked out of the 8th grade and Bernoulli was a world famous scientist that died about 100 years before airplanes were invented. Also the people pushing Bernoulli's law never actually read it or read more into it than Bernoulli wrote. Before you all pronounce me daffy, you may want to check out Bernoulli's law for yourself by reading what is actually stated.

Adjusting

The best flight pattern for these Spacers should be: VTO launch at about 70 degrees, Climb near vertical with about 2 turns to the right for each 10 seconds of motor run. From ground level the recovery appears as though there is elevator and rudder control. What happens is the model will seem to be climbing one last little bit and then fall off into a right glide as the airspeed drops. The ideal glide is to the right and very wide by most peoples standards. The very minimum glide circle diameter is no less than 100 feet. In smooth air a 300 to 500 foot circle is better. It is very difficult to determine actual circle diameter because thermal activity will change the circle diameter to what ever the thermal likes anyway. Tiny glide circles are death when you want to win a contest. You should always fly with the widest possible glide circle at the slowest possible glide speed. You slow the glide speed down by moving the CG aft a little bit at a time.

Your models hove wash-out in the wing tip panels. I have never seen a Spacer that did not have this wash-out. It is bad for the climb, can cause flutter and its not needed for the glide. Control the wash-out as best you can AND make sure both tips are the same. Most of the 200 inch Spacers will fly very well with wash-out of about 1/8 inch, but only if it is the same in both wings.

The tapered wing tips of the Spacer wing platform just flat guarantees that airflow over the top of the wing on the entire tip panel is from the tip toward the center of the wing, and this spanwise flow is quite strong near the trailing edge. Airflow on the bottom of the wing is from the dihedral break towards the tip. These characteristics rob you of lift and in the long run increase drag. There is no advantage to wash-out here.

Your model as built will glide about like an arrow. It's nose heavy. Cut a small hole into the ballast box area under the stab and add some BBs to move the CG back about 1/2 inch. Continue to add or remove BBs until you achieve that slow floating glide with a very wide right turn. When you are satisfied with the glide we do one final check. Tip the wings about 30 degrees to the right and give the model a good firm toss. The model should swing around 180 degrees to the right, stall slightly and show some signs of recovery. It will not have the altitude to recover and will smack its nose on the grass. But the main thing here is that you can see it is trying to get the nose up. When you can see this happening it indicates there is plenty of decalage between the wing and tail and the model can recover from a bad stall. In the event the model does recover and glide in circles around you, it means you screwed up, you have too much decalage and too tight a glide circle. It will take you several tosses to learn how hard to toss and to evaluate what you see.

The power phase is where it gets exciting. First thing is to get fuel in the eye dropper safety, I took a large hypo and installed a piece of copper tubing in place of the needle. This copper tubing has a 180 degree bend in it that allows me get fuel into the eyedropper from below and behind the engine. A full eyedropper of good fuel at 20,000 rpm will not run more than about 16-17 seconds. You will need to top off the eyedropper before launch.

The first flight should be at about 15,000 RPM and *3-5* seconds. Put the nose up 60 degrees and give the model a decent push. This is to make sure the model really is going to go right under power. Assuming you had a good right turn, progressively increase the power on the short motor run. Check out the glide trim to make sure its safe.

If the model went left under power it means you got something really crooked and should be more careful when you rebuild it. Any tendency for the model to go straight away under low power testing is a serious danger sign. That straight away climb is spectacular, but I just do not trust it. It is too easily upset and its just not safe. This design absolutely will not climb to the left, and even if the engine quits before the crash, the model will continue in a left spiral, all the way to the crash scene.

The only power adjustments you should be making at this point is to the side thrust and you may end up taking that back out later. I carry a few shims for trimming side thrust. I added a shim drawing on the plans, .010 thick is never enough and .030 is always too much. Use only what you really need. When the model will handle full power for the 3-5 seconds runs you increase the motor run each flight. Watch the climb pattern carefully, the right turn should remain pretty constant all the way up. When you can run full power for 20 seconds with out any tendency for the turn to straighten out in the last 5 seconds, you've got it whipped. If the model tries to straighten out or loop over the top it means you have a warp somewhere and its usually wash-in of the right main wing panel or wash out of the left main wing panel. Remove those warps now, while you still can.

In the rare case where the model insists on gliding to the left, the only thing I have ever found that works is to just let it go left. The transition and recovery will suffer but on these small light models its not really a problem. I like to accomplish the right glide circle with a combination of stab tilt and weigh on the right wing tip. Strangely enough on some of these crazy, little toys, adding weight to the right wing will cause them to turn left even more. If your model is going to turn left, be sure to remove any weight you may have in the right wing or you may end up with a sideways glide that resembles a crippled dog walking. That is the glide that will avoid all but the very strongest thermals.

At this point you should have two Spacers adjusted and flying just fine, getting real high and thermaling every flight. Looking goood. Take the best one of the two and put it away for now, that is vour no. I model. A good reason for building 2 models at a time is because one is always noticeably better than the other. Repair any minor dings in old no. 2 model and proceed all the way throuqh the trimminq procedure outlined below.

Trimming

This is what will turn your good flying #2 Spacer into a sure winner. Put on a balanced Tornado 5x3 black prop. Start using a fuel of at least 50% nitro, and tell the wind to stop and the thermals to die for a few hours. We need to see whats happening with the model, thermals will only interfere. Your engine should be turning at least 20,000 on the ground. From here on we try to optimize the climb and glide without compromising safety of flight. We are going to straighten out the climb and slow down the glide. Simple.

With the present adjustments your spacer is making about 10 turns in a 17 second motor run and the glide is slow and flat. You are going to remove decalage and improve the glide at the same time. Get some card stock or thin plastic, (.006-.OlO) and cut several pieces the size of the stab platform. Glue two (2) pieces on the platform, make sure the stab is not glued down and still pops up ok. Put 2 more BBs in the ballast box. Fire it up, peak the engine and back it off 2 clicks, the engine will peak again within the first 20 feet. Launch the model from the VTO position absolutely straight into any wind. Give it at least 15 seconds of power so you can watch what happens all the way up. The climb should be a little bit better and the glide slower, if the glide stalls a bit, thats ok for now. Continue to add these shims on the stab platform along with one or two BBs as needed until the climb is a loose 2 or 3 circles to the right Anything below 2 circles is not safe, and indicates that you no longer have enough decalage, remove a shim.

IF you built every thing perfectly straight, Then you could conceivably be safe with up to .070 of shims under the leading edge of the stab. With more than about .070 the glide becomes too unstable for rough air. I become very cautious when I get more than *6 or 7* pieces of shim. Theoretically, a true 0-0 decalage setting would be reached with about .135 inch under the stab leading edge. What we are doing here is reducing drag under power to get more altitude. There are practical limits to this. Over do this and the model flies and dies just like an FAI power model when the bunt and auto stab fail to function. The 3 degrees of downthrust that you built in your Spacer sort of insures ample decalage because the down thrust will pull it over and in before you reach the true 0-0 setting. This down thrust is also essential for a VTO launch in any wind. Once the model is out of the surface turbulence, reasonable wind does not bother the model, just the retriever.

At this point the model should be getting about a 1000 feet altitude on the engine run and you can not even see how the glide really looks. Make some flights with 3-4 second motor runs and about a 3 min fuse so the model is low enough to see clearly. Watch the transition and glide. The glide should be about 150 feet diameter and very slow. I like to see the transition from power to this slow glide completed with in ½ of a circle. When you have a beautiful, slow, smooth, floating glide, you are probably nose heavy. The ideal glide for these small models is never a smooth one, The model should bobble around, bounce and be easily upset by any gust or the mildest thermal. Trim the glide to perfection using BBs in the ballast box and clay or small nails in the wing tip. Do not change anything in the stab, (not tilt or shims). This is about as good as these Little Spacers will fly.

Dead Air flight times. I don't really know how you can have dead air outdoors. In the time between daylight and sun up the air is very, very good and your #2 Spacer will do better than 25 seconds of flight time for each second of engine run. A perfect model with a great engine will exceed 30 seconds of flight time for each second of engine run. Your #1 Spacer is capable of about 18-20 seconds of flight time for each second of engine run, but under some weather conditions #1 Spacer is the better choice for the days contest.

Kaizen. Fly both models for several flying sessions while you evaluate their characteristics in your local air conditions. Determine what flying characteristics are best suited to your contest area. Most of my flying is done on the dry lake beds of California or at the Lost Hills flyinq field and my models are trimmed accordingly.

Engines

Do not ignore your engine's output. Your Spacer can handle all the power you can find. Now is the time to get serious about engines and rpm. Strive for 22,000 on the black Tornado 5x3 prop. If you are using the Cox Killer Bee or product engines, find your local control line mouse racing flyers and ask for help. The mouse racers have been using these reed valve engines for over 20 years now and they do know a thing or two. Control line flyers are OK people and their Killer Bees all turn 22,000-23,000 rpm. If this all seems like a lot of work, remember this; Thrust increases on the square of the RPM. Going from 18,000 to 20,000 rpm results in a thrust increase of about 23 %. !!

The major problem with the Nostalgia era engines is their lack of breathing ability. Although a few of the engines had pretty good induction systems, none of these engines have sufficient volume in the bypass areas and there is really not anything you can do that helps much. I no longer even bother boring out intakes or polishing bypasses. There does not appear to be any significant difference between the multitude of reed valves that Cox has used over the years. I think the Mylar reed is the most dependable and basically if the engine has a Mylar reed I don't mess with it at all. The fit of the parts is the single most important difference between good and bad engines. The crankcase-shaft fit is normally too tight but can be expected to loosen up with some running, crashing and electric starter use. Port timing is close to correct for the rpm range we are operating in.

The major single deficiently in most of these small engine is the cylinder piston fit. This fit can usually be improved with a bit of effort and a lot of test running. Although the following applies to all small engine, its really applicable only to the Cox engines where parts are readily available. I expect you to read all of this and then follow only the parts you agree with.

Step I. Run your engines on 50% fuel, a new high compression head, and a balanced Tornado 5x3 prop. Any engines that turn over 20,000 are good ones, Put them away, don't mess with them. Engines that turn 18,000-20,000 are good flying engines that will get better as you run them hard and fly them through the dust storms and such,

Step 2. Remember that per the rules the only engines that can legally use a 1702 high compression head are the following; Black Widows, Golden Bees, Baby Bees, and the product engines from the ready to fly models (model #290 in most cases). The Killer Bee can not legally use the 1702 head. You need that high compression head to get the most from good fuel and also because the internal trumpet shape is worth some rpm The ideal engine would consist of parts from these legal engines AND including the back plate-reed valve assembly from the #290 product engine.

Step 3. From the available parts select the crankcase and crankshaft that provide the smoothest, freest turning, best spinning fit. Make sure to clean and oil all parts equally. Select the oldest, most beat up piston you can find. It helps if this piston also has black streaks running down the sides. All Cox pistons are identical so anything goes here. Make sure the ball joint slop is no more that about .003. Reset the ball joint if you need to but you should allow a couple of runs for the joint to seat property before checking rpm. Install the back plate assembly and mount the engine for test running.

Step 4. Install a legal cylinder and a new 1702 high compression head, (this same head should be used on all these test,). Fire the engine up using 50% fuel and that Tornado 5x3 prop, give it about one minute to come up to full temperature. Record the rpm and remove that cylinder and tag it.

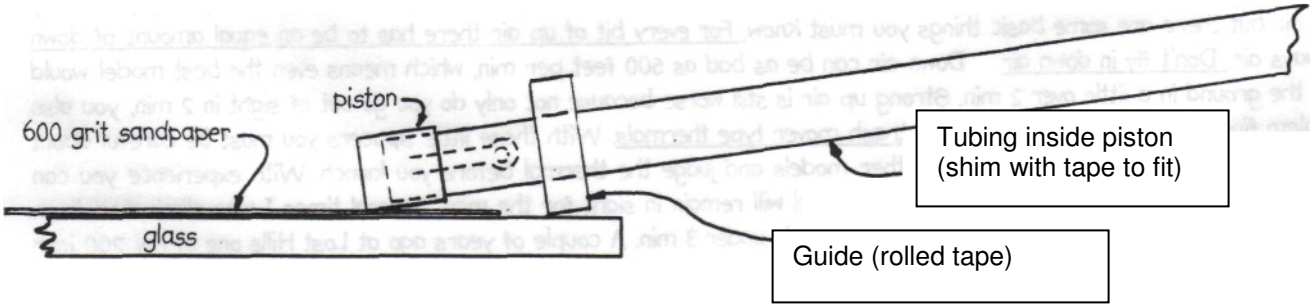
Step 5 Repeat step 4 with every cylinder you have. Pick out the best cylinder you found and test run it again. It should be a little better this second time. If it is about 20,000 or better you have a good engine and you are done.

Step 6. If none of the engines would pass 16,000-17,000 range you probably have a bad piston and should change pistons and start over again.

Step 7, Engines in the 16,000-18,000 range are getting there and may need a bit of help. First thing is to change back plates and see if it helps any. Second thing is to look at the piston and check for shinny spots on the sides of the piston. You can sand these off with some 600 sandpaper on you finger.

Step 8. Over the cliff we go. The proceeding seven steps have brought us to the brink and isolated a problem in the piston-cylinder fit. The top surface of the Cox piston gets very, very hot. Much hotter than the walls of the piston or the cylinder walls. This heat causes expansion, the hotter the more expansion. Basically what happens is the top surface of the piston get hotter and expands more than the cylinder so the top portion of the piston no longer fits the cylinder. Our option is to run the engine for hours to break it in maybe, or go for a better fit.. The Cox piston and cylinder are both made of a steel known as Leadloy, this is a good material but does not wear in very well The original people (Bill Atwood, Floyd Summa), who put together the original engines knew what they were doing and they fit the engines properly with all grinding done in temperature controlled rooms including a wee bit of taper at the top of the piston. That was then and this is now. The people are gone, the temperature controlled room is gone and pistons and cylinders are produced by the lowest bidder.

So, we are going to place a piece of 600 sandpaper on a sheet of glass, stuff a piece of .312 O.D. dia brass tubing with some tape shim, in the open end of the piston and proceed to put a relief taper on the sides of the piston at the top surface of the piston. Like this:



The crude taper should extend down the sides about 1/16 inch and needs to reduce the diameter of the piston something less than .0005. This is not very critical, do a little bit uniformly all the way around the piston and that engine will run better at high rpm where we are using it You probably will need to do this in two or three attempts before you get it right and you may scrap a piston or two but they were no good anyway. Using this piston, repeat step 5 again and note rpm changes. If the rpm drops off it means the cylinder was already too large for this piston but should work good on some other piston. BUT any cylinder that runs better means you are on the right tract and getting close. Use your own judgment as to whether you want to cut a bit more off the piston and go for 22,000 rpm. I once took a friends 15,000 rpm engine and with 3 minutes of sandpaper turned that engine into a 21,000 screamer.

Several years ago I watched as a disgusted control line speed flyer unscrewed the cylinder from the engine and used a whetstone on the piston while still in the model. It helped..

I know this seems kind of extreme but it usually works for most people. This piston relief taper is standard design on all the top quality high performance engines. Look in the exhaust port of any well run Rossi or Nelson and you will see black streaks on the sides of the piston just below the top surface. The ABC and AAC engines use a much longer taper. The way I have described this process will work on just about any steel piston-steel cylinder engine. Part of the reason we need this on the 1/2 A engines is because of the way the top of the piston is quite thick and has the ball socket as part of the piston top. There is a lot of mass to expand. The piston relief taper is nothing new for steel piston engines. To my knowledge, 60 years ago Bill Atwood, Mel Anderson, and Harry Orwick were all aware of this principle. Orwick ran a centerless grinding job shop. I watched him lean real hard on the grinder just before it ejected each piston. Harry told me that when he did this just right, the new Orwick required very little break in running.

If you don't feel comfortable cutting on your engines here is another way of doing the piston taper that usually works most of the time on engines that run fairly well to start with. This is the preferred method on the flying field.

1. Remove the glow head and spread a small amount of toothpaste in the cylinder at the top edge. Make sure this is
   distributed evenly all the way around the cylinder. Replace the glow head.
2. Place two drops of fuel in the intake or force fuel from the tank into the crankcase. Turn the engine over with the electric started for about 30-45 seconds.
3. Remove the glow head and flush the crap out of the glow plug element area. Install the glow head and fire theengine up and check rpm again.

H. Do not repeat this process until you have about 5 minutes running time on the engine. But if the engine still does not run good your should repeat the whole process.

In order to fly competitively you need good models, well trimmed, good fuel, good props, good engines, contest flying experience, and good air. There is no magic, the thing that that makes the big difference is the desire to win. Decide why you <u>are going to the contest.</u> The vast majority of Nostalgia flyers have decided they don't have to win to have a good time. Put up a few good flights and then sit in the shade with friends and talk of the good old days. That's all that's required for a successful contest and if they win that's nice also but not really important. If you decide you want to win most of the time and be in the top three all of the time, you must get your act together and be ready to win. You will never be a consistent winner until you able to go to the contest fully prepared and fully expecting to win. Prepare to win and you can expect to win.

At this point you need to get serious about trimming those models out perfectly and flying them until you know how to fly them and what to expect every time. You will need to either mix your own fuel or find some one who will mix it for you. You need to actually get some good props. You need to get a good tac, I own 8 tacs and think the best is a Futaba. You need to work on the engine problem until you are over the 20,000 rpm barrier. You need a place to test run engines all day long. I have a little motorcycle trailer that I mount a test stand on and drive to an empty road by the dump, not even the cows complain.

The only way to get contest experience is to go do it on a regular basis. This is also where you learn about the good air, bad air thing. Don't ever expect to do any test flying or check it out flying on the day of the contest. You do that before the contest. You must be able to take the model out of the car, put it together and put up the first official flight of the meet, (an easy max). You may not need to do that, but be able to when you need to. You can't expect to win if you are not ready.

The good air, bad air thing will be with us for ever and ever. So learn about it. Experience is the only way you really learn about air but there are some basic things you must know. For every bit of up air there has to be an equal amount of down air or sideways air. Don't fly in down air Down air can be as bad as 500 feet per min, which means even the best model would be back on the ground in a little over 2 min. Strong up air is still worse because not only do you go out of sight in 2 min, you also have a problem finding the model. Don't fly into trash mover type thermals. With these little Spacers you must be careful about launching into any strong thermals. Watch the other models and judge the thermal before you launch. With experience you can tell about how much to reduce the motor run so the model will remain in sight for the max. Several times I was eliminated from contest on the very first official flight by going out of sight in under 3 min. A couple of years ago at Lost Hills one of my 200 inch spacers went 005 in 2min 13 sec. of the first flight, and after a 3 hour drive and a 2 min flight, I was out of the contest and ready to go home.

In calm weather, sideways moving air means there is a serious thermal in the area, so pay attention. These Spacers get so high that you are seldom able to place the model into the thermal you feel at ground level but look around, if its a big thermal go for it. Be careful, if it was a decent thermal that already passed thru, there is the danger that you could go up into the hole of down air behind the thermal. Experience counts, watch the other guys too. In windy weather the only thing you can go by is the gust and the time between gust, and remember that your model is going to be about 1000 feet from where you feel the gust. The good news about gusty weather is that gust usually mean things are changing and the wind is going to die down, or maybe get really bad and blow the whole contest out. You must decide to either fly right now or wait for the calm. The internet has some good weather maps. Check them out before you go flying each and every time to gain experience.

In any kind of weather the very best indication of up-down air is the other models in the air.

Now we come to the main reason these 200 inch Spacers are better than most other Nostalgia models. These Spacers will easily make the max flight time with out the need for a thermal. All you need to do is be ready to win and avoid the down air. Generally speaking in most parts of the world, early morning air is very stable with little up or down air. The air is normally quite buoyant until the sun starts the convection heating of the earth. The air is ideal, nothing to lose and much to gain. Fly early. When you are confident that your models can easily make the maxes without a thermal you should make as many official flights as possible before the thermals break out. The early thermals are generally mild and of a very large size at the ground level. By watching your altitude and flight times you can judge the thermal conditions and know when to stop or become very cautions about picking air.

The bad part is that in some areas it is always quite windy early in the morning. I always waited for the wind to die down and Sal always went ahead flew in the wind. I think Sal always won too. Fly early and often whenever possible.

Within a year you will be a serious threat in any contest. Within two years you should be winning or within the first three places in every contest you complete. Hold yourself accountable for the results of your effort, or lack of effort.

Your first step is to decide why you are at the contest.

Addendum to the Nostalgia 1/2 A Spacer instructions

I have been subjected to quite a few comments and some serious feed back from the modelers who got the earliest plans and instructions. Perhaps this will dear up a few items.

1. *'Where is the CG supposed to be"* I don't know where the CG will be on your model, it depends on actual decalage, warps, washout and your building skills.
   What I do know is that the best way to fly this Spacer is just like a big hand launch glider. Change (reduce) decalage settings to adjust the dimb pattern. Once the dimb is the way you want it, leave the decdage alone and adjust the glide by moving the CG until you get a real slow glide speed. Just like a big hand launch glider. The minimum decalage for a safe stall recovery is something below one degree. One degree is equal to .0175 Inch per inch of wing chord. It's that Simple.
2. *What's wiith the side mounted engine?* Lots of good reasons, like a cleaner airplane, easier needle valve access, and most important a lower CG that translates into a more stable glide and better glide times. The difference between an upright mounted engine and a inverted engine is about 7% of the total glide time. Inverted engines take a terrible beating on the real life flying field and are not very practical on the contest field. The side mounted engine is a reasonable comprise that will add a few seconds to your flight time at no cost Remember that the best glide will always result from a setup that is basically a HIGH WING, LOW STAB, LOW CENTER OF GRAVITY, AND LOW MOMENT OF INERTIA ! If there is a secret to this, it's the low stab. The reason for a low stab is to get it out of the wing wash. It is not possible to get the stab high enough to avoid the wing wash at high angles of attack and its impractical to locate the stab far enough aft to avoid the wash.
3. *How do you know that 85% of the lift is produced on the bottom of the wing? I* really don't know and it's just a wild guess on my part Strangely enough 17 of the 23 people who commented on the wing lift portion agreed with me on all counts. Almost every one questioned my 85% number and most seem to feel that 70% would be a better guess. The sharp leading edge with the burble behind it got everyone's attention and most seemed to feel this was a reasonable explanation for one or more of the things they had experienced with narrow chord sections at high angles of attack and low air speeds.

   Based on what these modelers say, the majority feel that Reynolds Numbers do not apply or track or provide any usable data in the region where these models operate. Basically they all seem to feel something is not right with Reynolds Numbers when you get below about 100,000 or 200,000 or 400,000 depending on who you talk to.

   No data has ever been collected at a Rn 20.000.

   My reason was to get you used to a sharp leading edge and improve your glide time. My point was to establish the fact that there is absolutely no good data available to prove that I am right, or to prove that I am wrong. Wind Tunnel data collected on a 12 inch chord section at much higher Reynolds numbers and with no provision for spanwise flow is totally worthless for our application.

   Three people explained that I was interpreting Bernouili's law wrong. No, No I was just pointing out that other people were wrong, I did not ever say I was right.

TWO people, not real contest modelers, called to tell me how great the Selig airfoils work and that I should try those. Neither person had actually done any real testing; they just knew that their model flew great with the Selig sections. I have no idea how the Selig sections perform in real life, but two things bother me. I read where the RC glider flyers can improve the sections by adding what they call a "trip" just behind the leading edge. Sounds like a turbulator to me. This to a section that they also claim must be constructed to an accuracy of + or - .002 inch.

More significantly, one of the RC glider kit manufactures built at least 5 or 6 test wings using some of the Selig airfoils. In every case the original multi spar wings out flew the Selig sections.

In all fairness, you must also understand that these were slow flying floater type gliders. I fully expect that the Selig sections would perform much better on high speed lead sled type models flying at angles of attack under 5 degrees. Now I want you all to remember that I never actually said I was right about any of this. Think!

As a long time indoor flyer I know for sure that
When the clock starts the bullshit stops

4. "The crude taper on the piston, is it all around the piston on just a flat spot in one place" No, No, it should be a nice uniform relief taper all around the piston. You do this in the normal manner by pulling the tubing and piston toward you while rotating the tubing away from yourself. This will require about 20 to 50 strokes depending on the force you apply. Not very critical.
5. Why not just use the toothpaste system instead of cutting on the piston. A couple of reasons. The toothpaste gets all down through the engine and loosens up the rod bearings. Also the toothpaste is very slow cutting on the piston and seldom works on really bad engines. This is a good fix for the engine that's just a little bit too tight.

A better DT timer system, I will no longer be using fuses on my small models. All my new airplanes will incorporate the Badge dethermalizer timer.

This is a rotary viscous fluid system with only one moving part You wind it up and the pull of the DT line unwinds it and allows the DT line to unhook. This action is more positive that a clockwork timer but not as accurate. This is more dependable than lighting a fuse.

This timer weighs 1.*2* grams (one point two grams) and cost about $13.