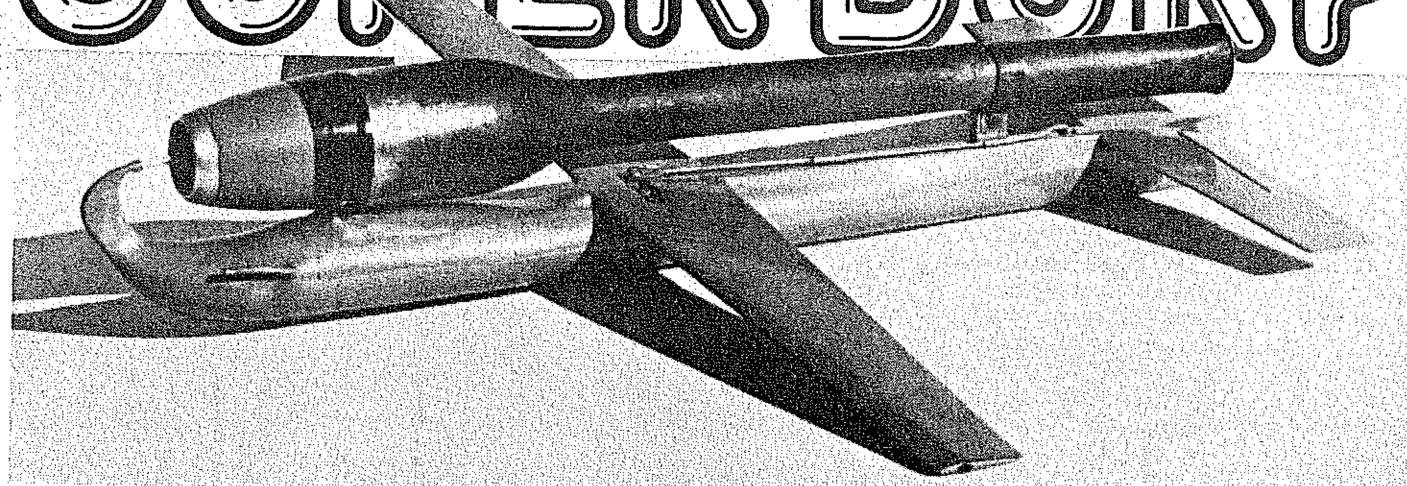
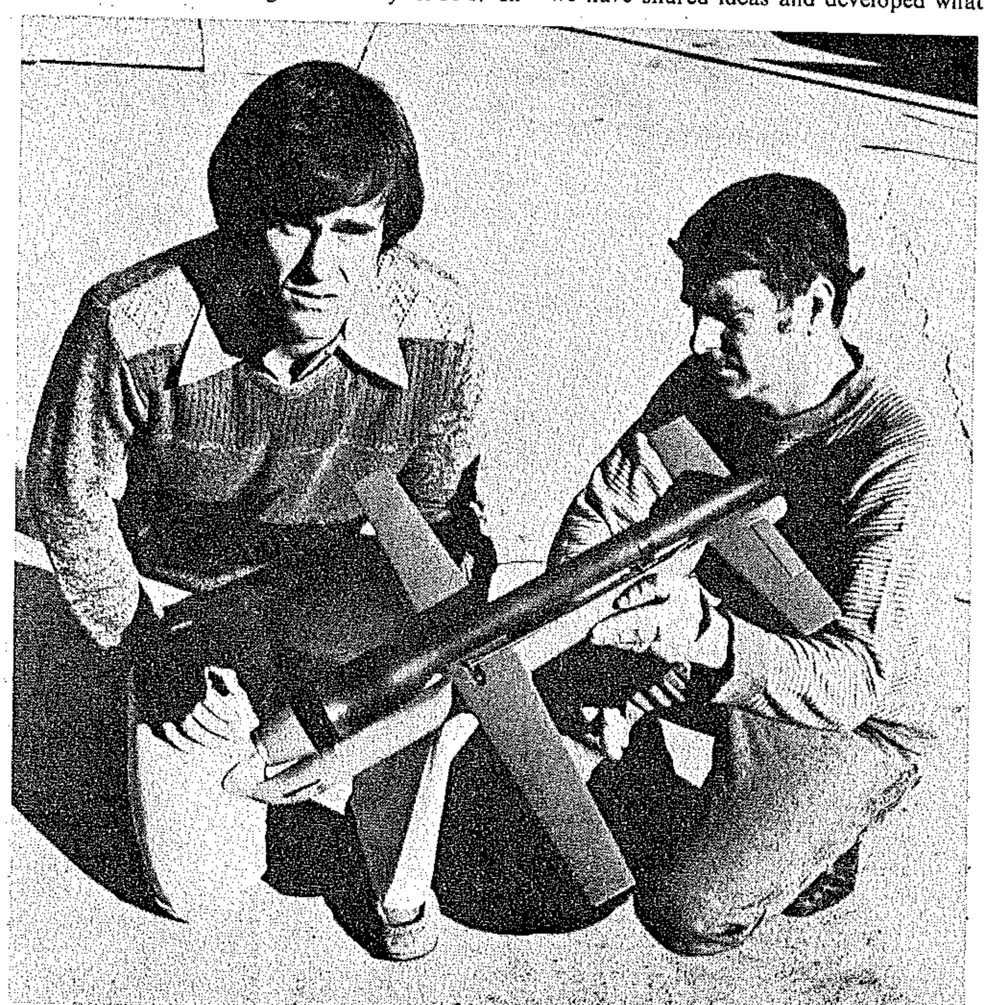
SUPER BURP



An eight-time national record holder, three-time Nationals winner, and holder of the present jet speed record of 211.18 mph. ■ Mike Langlois

THE Super Burp is the latest version in the long line of "Burp" airplanes. The first "Lil' Burp" was designed in 1953 by Bill Pardue and enjoyed a considerable amount of success through the early 1960's. In 1972 Bill and I began to work on jets as a team. The first two years were a learning experience for me as Bill schooled me on every aspect of jet speed. Since that time we have shared ideas and developed what is the fastest control-line model airplane in the United States at this time. One of our original goals was to be the first to break the magic 200-mph mark with a jet speed model. This accomplishment was achieved at the 1974 Nats in Lake Charles, Louisiana with a record-breaking flight of 200.59 mph. Since that time the Super Burp has established many 200-mph-plus records and presently hold both the Senior and Open jet speed records at 204.93 mph and 211.18 mph respectively.



Mike Langlois (L) and Bill Pardue, codesigners of the airplane. Mike is pilot, Bill the pit man.

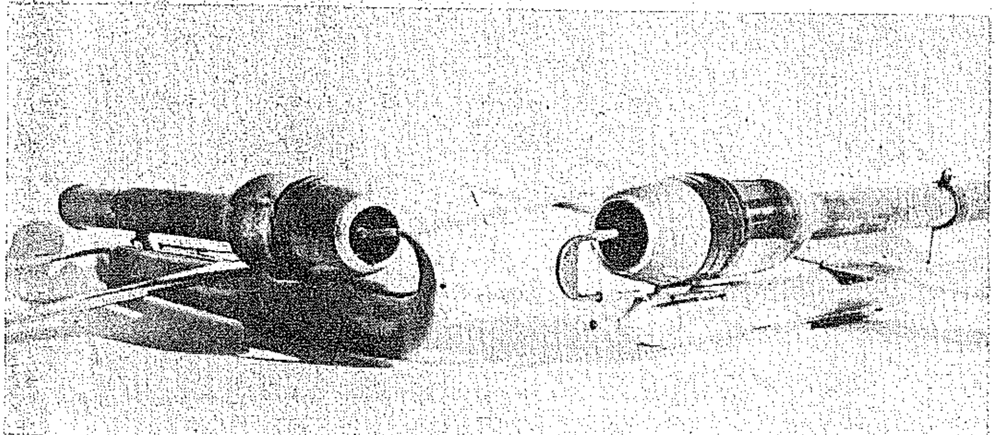
The Super Burp is a well proven airplane with many of its design features being the result of much thought, trial, and analysis. We would encourage any one who has in mind an addition or modification to any of these design features to try it, however, make sure you understand why something is the way it is before you make a change. Progress is not achieved unless changes are made! Hopefully, the readers of this article who are serious about jet speed will absorb the information presented here and be more competitive in that event, whether by utilizing the airplane presented here, or applying some of the ideas to their own design of jet airplane.

Power Unit: It is impossible to be competitive in jet speed without a well designed and well constructed power unit, the power unit being defined as the jet engine and fuel system. A strong engine will never reach its true potential thrust in the air if the proper amount of fuel is not delivered to it. Conversely, a well designed fuel system will be of no use if the fuel which it delivers to the jet engine cannot be burned in combustion. The power unit presented within this text has been proven to be both reliable and fast.

Two quite different head designs are

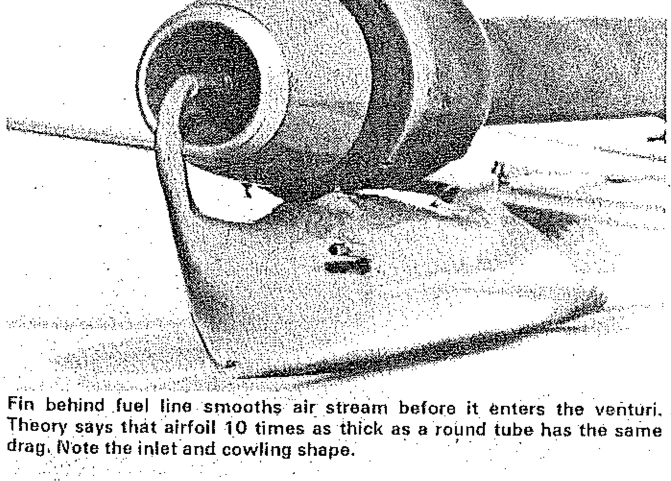
Left: Pit crew demonstrates proper positions during starting. Above: Bill demonstrates proper technique for launching the aircraft. Ignition probe —heavy electric stove oven element, used with "buzz box" to create spark for ignition—seen behind plane, blows out of the pipe after engine ignites. Fuel 50% nitro, 50% propylene oxide.

Start equipment. Buzz box connected to probe. Probe placed up tail pipe to start engine. Truck tire pump introduces air into combustion cham ber via intake to draw fuel into intake.

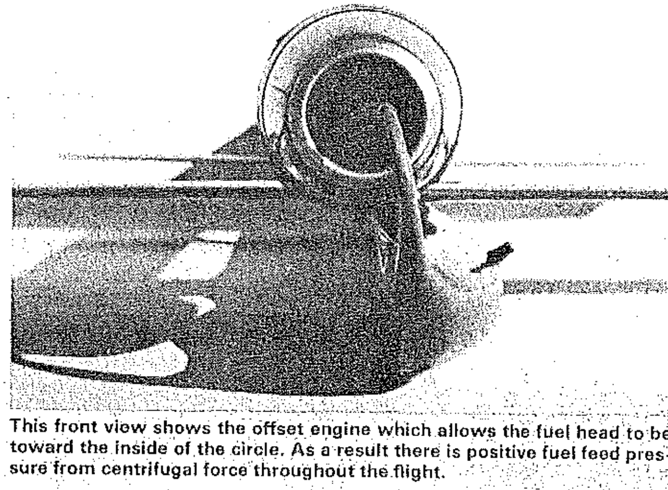


This photo shows different contour Series II head, left. The Series I head is on the right.

being presented here. One is the original (series1) extended head which holds the present Senior jet record at 204.93 mph and held the Open jet record at 205.63 mph before the (series 2) head also presented here broke that record with a flight of 211.18 mph. The (series 2) head is a low drag head and, subsequently, a low static thrust producer. The head is a bit difficult



Fin behind fuel line smooths air stream before it enters the venturi. Theory says that airfoil 10 times as thick as a round tube has the same drag. Note the inlet and cowling shape.

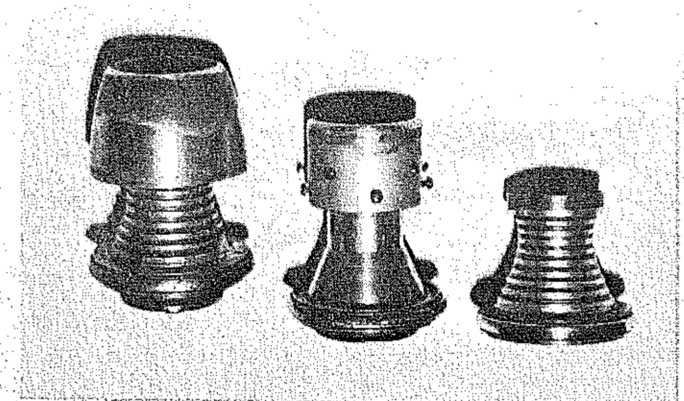


This front view shows the offset engine which allows the fuel head to be toward the inside of the circle. As a result there is positive fuel feed pressure from centrifugal force throughout the flight.

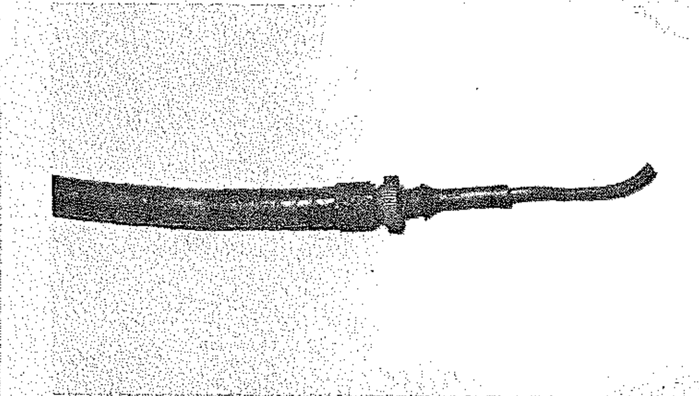
to operate because of the low static thrust and low static fuel drawing capabilities; that is, the head is difficult to keep running on the ground. Therefore, it would be advisable to build a (series 1) head first (especially if you have very little jet experience) and get all you can out of it before going to a (series 2) head. The (series 2) head is about 6 mph faster than a (series 1) head with nearly all variables being equal. Both heads were flown on the same airplane, using the same fuel and also the same tail pipe.

was offset in order to use the centrifugal force to feed additional fuel to the engine while in flight.

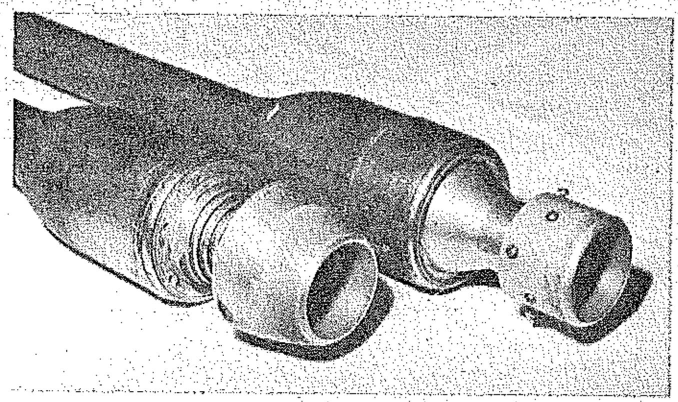
Head Construction: The construction of the (series 1) head will be explained first. The first step, after having purchased all materials, is to cut the head extention tubing to the proper length. The radius on the nose portion can be machined before or after the tube is glued into place. It is best to at least rough out a radius on the tube before it is glued into place as this makes laying up and contouring the epoxy. After the epoxy has cured it is necessary to chuck this apparatus in an electric drill or lathe to rotate it while sanding it to a very smooth finish, and also to remove any high spots which may have not been properly contoured during the lay-up procedure. If the radius had not been turned on the leading edge of the intake before laying up the epoxy, it is now necessary to do so; it is also necessary to turn the fins of the head off, if this has also not been done previously. The spray bar must be drilled in



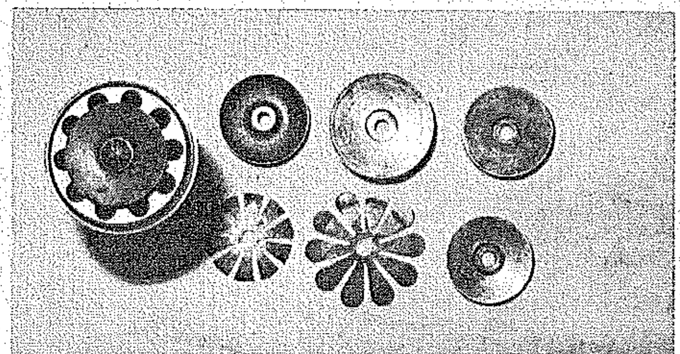
L to R: Stock head, fins turned off. Series I head without cowling; note machine screws, thought needed to hold extension securely to the head, later found unnecessary. Series I head with partial cowling.



Truck tire pump hose fitted with tubeless tire valve, drilled for 1/8 I.D. brass tubing soldered in place. Object of bent tubing tip is to draw maximum fuel from tank during starting sequence. Accomplished by directing stream of air over spray bar hole in 3 o'clock position.



R to L: Series I head with cowling; pipe seen here is equipped with an experimental extended combustion chamber. Chamber is extended 1/4 in. Series I head with partial cowling.



Left, back of head, retainer in place. Clockwise: Homemade .060 retainer. Homemade .060 oversize retainer. 1.750 dia. stock retainer. Stock retainer, back dished out, front turned .060. Backup valves made by cutting stock valves. Backup valves placed behind stock valves.

I believe, however, that the (series 2) head has a bit more potential speed in it because of two factors. One is that both the record flight and the backup flights were made with a ¼ lap of glide at the end of the flight; therefore, if the fuel tank were larger; more speed could have been registered. Also, because of not enough fuel capacity, we were limited on metering jet size. That is to say, we could not run a richer metering jet because we would have run out of fuel even earlier into the clocking.

A word of advice is in order at this point. If you intend to run the (series 2) head on your Super Burp, a larger fuel tank than the 6 oz. tank presented on the plans should be fabricated. It is advised that one use at least 7 oz. tank for a (series 2) head; however, for a (series 1) head a 6 oz. tank is just fine. The tank is of the "uniflow" type in design and the engine laying up the PC-7 epoxy easier.

The next step is to lay up the PC7 epoxy in the intake of the engine. First remove the head from a ¼-20 bolt (or use threaded rod stock), then thread this "headless" bolt into the back of the jet head. Jam the bolt with a nut so it will not work loose, being cautious not to scar the back surface of the head. Mount a mechanical hand drill in the jaws of a bench vise and then chuck the threaded rod in the drill, using it as a shaft to slowly rotate the head. This setup will enable you to contour the epoxy in the head by wetting your finger and molding the epoxy as the head is revolving about its center, similar to the method used to make clay pottery.

One helpful hint is to undercut the area of the intake where the epoxy feathers out, this being the throat section. An undercut of .030 inch should be made so a well defined ending point can be achieved when the three positions as they are denoted on the plans, using a number 52 drill, and the directed air nozzle must be removed.

It is now necessary to fabricate a cowl for the head which you have just constructed. There are many cowl fabrication methods. I will mention some of them but only explain the actual construction procedures for one. The cowl may be made by molding fiberglass, turned out of aluminum or any other lightweight material, spinning thin aluminum over a form, or just finding something that will fit, such as a plastic glass or an old "super squirt" cowl with the proper shape. Probably the easiest method for most people will be the fiberglass molding, which has been fully explained in many model publications in the past, so we will stick to that method for explanation purposes.

Carve or turn a form out of a medium

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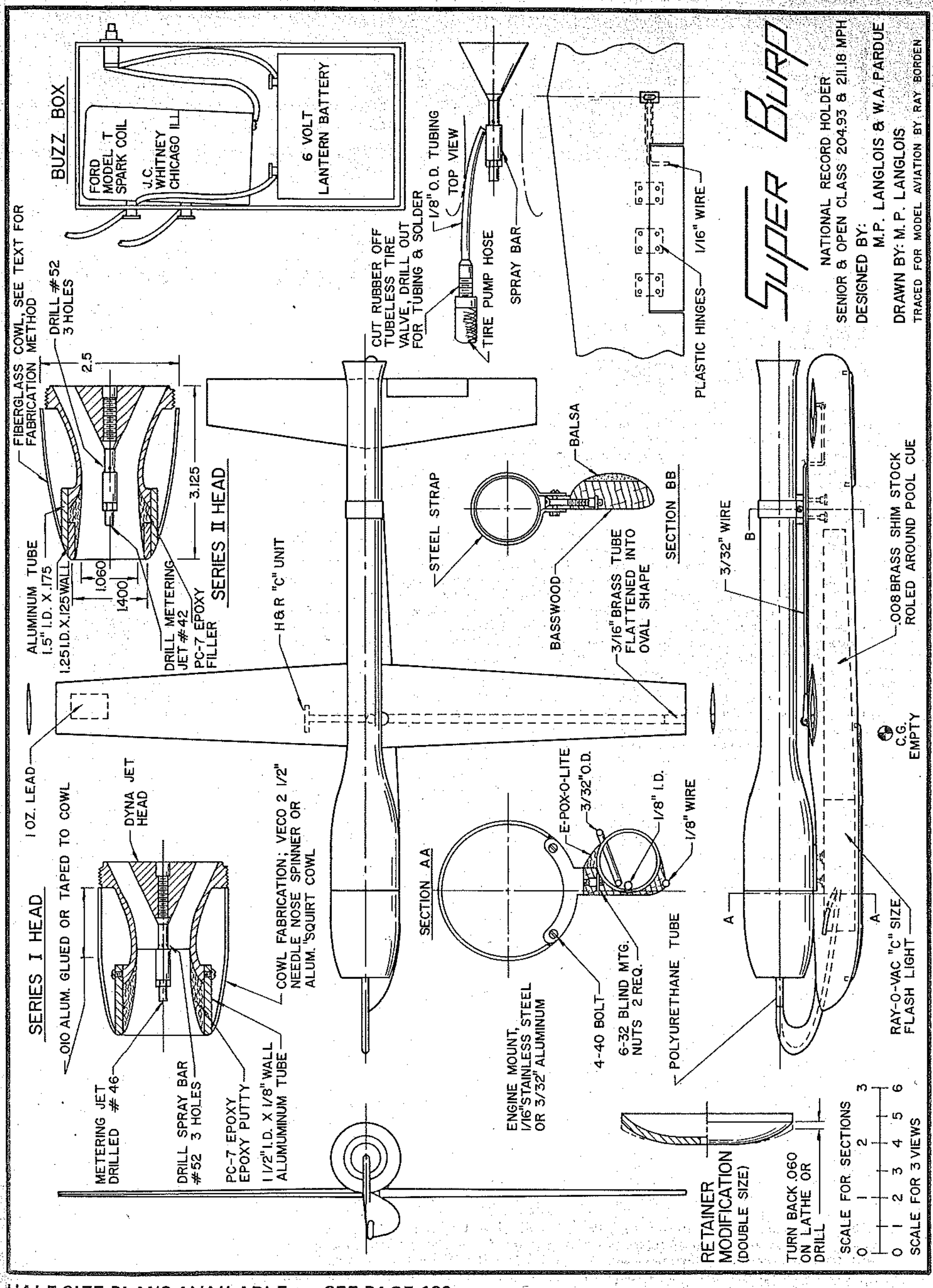

HALF-SIZE PLANS AVAILABLE . . . SEE PAGE 120

that HLG designs have also come a long way since the concepts of the 30's. . . . I would say that most progress has been made in recent years. Could it also be said that the Sweepette is the Zipper of HLG? (Someone care to tackle that one? I'm no expert on the subject.) Anyway, it proved to be an interesting diversion, and git'em ready for next year fellas! You've got all winter to thumb through all those auld mags and books."

What's in a Name: It's interesting to note the names attached to various contests. Here in the Northwest, various clubs have established traditional meets with unusual names: the "Strat O Bats" of Seattle and their "RAG Meet" (rubber and glider), or the Boeing Hawks "Power Bash," an all-power contest with prizes clear to last place based on a 6-flight total. "The Misery Meet" held in February under "unusual" weather conditions varying from fog to sunshine with everything in between. This meet is approximately 20 years old. Or how about the "Silents Please" sponsored by the Willamette Model Club of Albany, Oregon where silence is golden and the loudest sound tolerated is the woosh of a Jetex or the flap of an unwinding OT rubber ship.

It would be interesting to hear from some of the Clubs out there who also have unique names for their contests.

In the dark about free flight? The USFFC at Taft has offered night flying for several years. Just last year at the "Power Bash" the event was flown for the first time here in the Northwest. Bob Petro of Athol, Idaho, not having an appropriate AMA gas ship, flew his Madewell-powered Clipper in the competition. While somewhat handicapped flying against AMA ships in essentially dead air it was exciting to hear the old Madewell grinding skyward in the black night air!

The chemical lights sold in sporting goods stores can be conveniently banded to the landing gear of your favorite OT ship, or you can rig up a flashlight bulb and dry cell for your "navigation" lite. Don't hook it into the ignition circuit and shut off the light when the timer opens the circuit!

Pick a dark moonless night for best results. Use plenty of light in the pit area to avoid any accidents. It's eerie to operate an engine at night. Don't forget to light the DT fuse since there can be lift around at night if the ground was heated up during the day and the night is cool.

It's fascinating to see the light and the glow of the DT fuse spiraling upward, and then silence as the engine quits and the light bobs around in the night sky. Try it. It's a great change of pace!

Clarence Haught, Rt. 5, Box 16, Coeur d'Alene, ID 83814.

Super Burp/Langlois

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hard piece of wood and make a copy of the cowl's shape. Split the form in half and cement it to a piece of hard wood which is about ½ inch larger overall than the section of the cowl. Finish the form and base with fiberglass resin and polish to a high luster. The fiberglass cloth is now layed up on the mold, but be sure to use a good release agent first. Best results are obtained if three layers of ¾ oz. fiberglass cloth are used.

When the resin has dried, half the cowl can be pulled from the mold. It is impossible to mold the cowl as one unit, unless air or water pressure is used to force it away from the mold after it has cured. By molding the cowl one half at a time, the release problem is solved. When both halves have been fabricated it is necessary to join them. Use small strips of fiberglass cloth on the inside of the cowl, as well as a bit of resin to make a good union of the two halves. When all has dried, remove all rough edges and sand smooth.

The only remaining operations are to turn back the stock valve retainer and to fabricate back-up valves. The retainer may be turned to match the plans on any lathe or electric drill, but be sure to make the contours smooth and even. The back-up valves are simply valves which have been cut off to 75% of their original radius. This can be done by cutting with scissors after scribing the correct diameter around a spare valve retainer and trueing the diameter, using a sanding belt, or a grinding wheel. Be sure to remove all burrs raised during this operation by lapping the valves, using oil and 400 sandpaper on a smooth flat surface. Valves may last from 10 to 20 flights depending on how rich or lean the engine is run. This sure beats a prop and glo plug each flight and you will find that jet is actually the most economical of all control-line speed events to maintain and fly.

The fabrication techniques of the (series 2) head are exactly the same as the (series 1) head. The only difference in the two heads from a material stand point is the addition of the reducing sleeve in the nose of the (series 2) head. There will be no discussion of construction of the (series 2) head because of its similarities with the (series 1) head. The only word of advice is to study the plans and take whatever time is necessary to do a good job.

Tail Pipe Selection: When choosing a tail pipe, keep in mind that it is impossible to determine whether or not it will run fast until it is actually flown on the airplane. However, a few words of advice may help you select a pipe with which you will feel confident to begin your experimentations. The first area to examine is the length. A length of approximately 19-7/32 inches is what the record pipe measures; however, I have seen longer pipes run fast. The combustion chamber on the record pipe is smaller than any other pipe I have ever measured. However, this is not to say that larger combustion chambers have not worked on some other combinations. Many people prefer to run a new pipe every contest. But the pipe I have set all the records with is about 20 years old. When selecting a pipe I look for a "fat" combustion chamber, one which has small radius of curvature in the combustion chamber. In conclusion, the only steadfast advice that can be given about pipes is to keep trying different pipes until you find the best pipe for your particular combination. It is interesting to note that the record breaking Super Burp (205.63 mph) airplane and engine, including the valve retainer, were constructed without the use of a lathe, only an electric drill. The theme of the Super Burp project from the beginning has been go fast and yet keep it simple. Anyone with an average workshop can build a Super Burp.

Airframe Construction: Begin with the fuel tank. If the necessary materials needed in the construction of the fuel tank can not be purchased at a local hobby shop or at any local specialty shop, then please use the materials index appearing at the end of the article.

Start by dismantling the flashlight, sand the open end of the flashlight as well as the switch area so that the solder may flow out properly. Next, locate a form which will enable you to shape the rear section of the tank properly. A pool stick works well. If one cannot be obtained, it will be necessary to locate an alternative form or to fabricate one yourself. After the tank has been formed, locate and solder the vent and pickup lines in the flashlight part of the tank. Join the front and rear parts of the tank and solder. Having not sealed the rear portion of the tank at this time, it is advisable to boil the tank in water in order that all remaining flux be eliminated from the interior of the tank. After the tank has been boiled and checked for proper line placement, the rear cap can be formed and soldered in place.

Assuming the head and cowling have been fabricated, begin work on the engine mounting system. This text will only concern itself with the installation of the engine setup presented here. The only word of advice that can be given to one who wishes to use an alternative mounting system is that it should be made strong enough to easily withstand the required 40-lb. AMA pull-test.

Select a rigid piece of material for the engine head mounting bracket. A piece of .060" stainless steel, or any material of equivalent strength, will suffice. Make a pattern which represents the shape of the engine head mount presented on the plans. Transfer the shape of the mount onto the material which is to be used to fabricate the mount. Saw the general shape of the mount with a hacksaw or a bandsaw. Finish shaping the mount with a file and drill the mounting holes such that they correspond to the holes drilled in the engine head; also drill the holes which affix the mount to the airplane. Bend the mount so that the engine is located at the proper height above the airplane.

The fuselage is now begun. Select a good hard piece of pine or basswood for the fuselage. Make a pattern of the fuselage shape and transfer it to this piece of wood. Saw out the shape of the fuselage and hollow in such manner that the tank fits snugly in the proper place. Also hollow the rear section for control movement. When the fuselage has been shaped and hollowed properly, fasten the forward engine mounting bracket.

Start by locating the bracket in the proper place and drilling holes in the fuselage to correspond to the holes on the mount, then groove out the body for blind nut placement. Pull the blind nuts into position and cement them in place. Cement the tank into place, using a good quality epoxy cement to secure the tank to the wood. When the glue has dried, work begins on fairing the tank to the fuselage.

It would be best to make all fillets with balsa wood, but in the interest of time a good epoxy filler will suffice. Take all necessary time needed in contouring and filleting the fuselage as this will add considerable strength and durability to the airframe, not to mention the effects of streamlining. When all filleting and contouring has been done, cover the entire fuselage, except where the wing, fuselage cap strip, and the stabilizer are to be mounted with ¾ oz. fiberglass cloth and resin.

Install the nose and tail skids. Bend the skids to the contour of the lower fuselage, and make 90° bends on each end of the skids, so that the ends protrude approximately ¼ inch into the fuselage. Be careful not to puncture the fuel tank during this operation. Use a good epoxy to fasten the skids to the fuselage.

For the wing construction select a very rigid piece of basswood, pine or poplar. It is of the utmost importance that the wing be as rigid and as thin as possible. Furthermore, rigidness should not be sacrificed because of thinness. A considerable amount of speed can be lost if wing flutter or flex is taking place. On the record setting airplane the wings were covered with three layers of fiberglass cloth since the airplane has been fabricated—an attempt to improve wing strength, and rigidity. After having selected the proper size and strength piece of wood, begin construction.

Start by transferring the outline of the wing onto the chosen piece of wood, saw the wood to shape, and block sand all edges to remove irregularities in outline. Transfer the center line of the wing and split the wing along this line. It is advisable to utilize the smallest blade in your collection because this will make rejoining the wing less difficult, and better in both construction and appearance. Groove the wing to accept the monoline unit and the control line attachment.

Be sure to install both the tip weight and line bearing. If this tip weight is not used, takeoffs are almost impossible, as the model has a tendency to spin-in on the launch. If one considers using a takeoff dolly, the tip weight is omitted. Take the necessary time to make a neat installation of the torque unit, as well as making the line groove the proper size. An airplane with stiff control is very difficult to fly, not to mention the grief of having spent so much time on an airplane and it not be airworthy. The shaping of the airfoil is also very important. It is necessary to have no positive or negative incidence in the wing, as well as no wash-in or wash-out. The wing is set up zero-zero. From rough to finish shape, a sanding block is used to maintain an even contour throughout the wing. Finish sanding the wing with a medium grit sandpaper. Note that the center section of the wing is left unairfoiled, because this makes easier aligning and mounting the wing to the body.

Construction of the stabilizer is much the same as that of the wing. Again, rigidness, thinness, alignment, and free-moving controls are of primary importance. The only required discussion of stab construction is that plastic hinges are not sacred. If you have an alternative hinging preference, use it if it can be considered to be of equal strength. Jet hinges usually have to take more abuse than others because of ground contacts that may or may not shut the engine off, and also unusually hard landings by inexperienced jet fliers who are fooled into thinking the ship still has gliding speed when it is actually settling rapidly towards the ground.

Begin assembly by fabricating a pushrod to link the torque unit to the elevator control mechanism. The pushrod is fabricated from 3/32" music wire and fitted with a Kwik Klip so that the controls may be adjusted. Mount the engine on the fuselage and rubber band the stabilizer and wing in their approximate position on the fuselage. Adjust the wing location, as well as the stabilizer location, so that balance is ⅛ inch ahead of the C.G. location denoted on the plans. Take note that all C.G. location references are made relative to the wing and not the fuselage.

When proper balance is achieved, the flying surfaces may be glued in place. Use a slow hardening epoxy glue to cement the wing and stab in place. It is advisable to dowel pin the wing to the fuselage. This is done by drilling three 3/16" holes through the center section of the wing, about ¼ inch into the fuselage, whereupon the drilled holes are fitted with hard wood dowel pins glued in place.

At this point the wing and stabilizer are filleted to the fuselage. Fiberglass is the recommended material. The rear cap strip is added to the top rear of the fuselage, and contoured to the shape of the fuselage.

Fabricate a rear engine mounting bracket. The bracket is constructed from ¼ or 3-16 aluminum stock and airfoiled to shape. The bracket can be mounted in many ways, however, the suggested methods are as follows: Drill the mounting bracket in the positions denoted on the plans with a 6-32 clearance drill; also drill into the fuselage at least to the center position, or all the way, through to the bottom. At this point the blind mounting nut is pulled into place (if the hole has been drilled all the way through the body; if not, then the body must be hollowed in the proper place to accommodate the blind nuts).

A second method is to drill and tap the bracket for two 6-32 machine screws; the body is drilled all the way through with a clearance drill, whereupon the machine screws run up through the fuselage and thread into the bracket. The second method was used on the record setting airplane and is of equivalent strength to method one, and a bit easier to install. The pipe retaining clip is formed of .020" steel stock or stainless steel stock. Stainless steel stock is the preferred material because it will not rust and is more durable. The clip is fastened to the bracket by one 4-40 machine screw.

Sand the entire airplane smooth. Fill any nicks, cracks or holes with a filler and resand. If you have a preferred finishing technique use it, provided it is fuel-proof. The finish on the record airplane is two coats of Hobbypoxy clear, sanded between coats, and two coats of Super Poxy color, the first coat being brushed and sanded and the last coat just sprayed on.

Flying: The fuel with which all of our speed records have been set is 50% nitromethane and 50% propylene oxide, although some others have had success by varying the nitro-propyl ratio slightly to possibly suit the weather conditions on a given day. A number 46 (.081" dia.) drill is the size metering jet which seems to work best on a (series 1) head and a number 42 (.0935" dia.) for a (series 2) head. Drill 12 metering jets #42 thru #53. Larger metering jets can be made from Dooling needle valve fittings or similar brass fittings, as long as they seat properly in the spray bar or an "O" ring is used to seal them.

Only trial and error will determine which metering jet size will work best on your particular engine airplane combination. Make your first flight attempts with the richest metering jet that will run while the ship is hand held on the ground. If the engine cuts off after release, try the next size smaller metering jet until it keeps running. Usually, the rule with an "upright" engine design is the richer you run the faster you go. Uprights usually lean out from start to finish, although the "uniflow" fuel tank of the Super Burp tends to minimize this change. This is not a 100% rule on every engine/airplane combination, so try leaning yours down on one metering jet after you have run it as rich as you can.

To start the engine we use a truck tire pump as a source of air. Any other source of compressed air will work equally well. A "buzz box" in conjunction with a "probe" is used to supply the spark needed to ignite the fuel-air mixture entering the combustion chamber during ignition. The "probe" we use is an electric stove oven element, so cut that the end will protrude to the approximate spark plug location in the tail pipe. A used element can be obtained from your local used furniture and appliance store.

When flying the airplane make sure the line is taut on takeoff, and be ready to pull the airplane from the pitman's hand as he releases it. The airplane can be skidded off without the use of a dolly. If you wish to use a properly designed dolly for takeoff, I am sure it would work very well. After takeoff, get in the pylon as soon as possible, and fly the airplane in as near a perfect groove as possible. Jets are much more susceptible to an extreme loss of speed due to deviating from a perfect groove than is the case with propeller aircraft.

Good luck with your Super Burp and if you have any questions feel free to contact me: Mike Langlois, 2408 W Cornwallis Dr., Greensboro, NC 27408.

FF Duration/Meuser

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Pirelli was the 1964 material which gave 3520, whereas average Pirelli was near 3300. Current FAI Supply rubber is running 3545, an excellent average. The new Pirelli is not to be confused with Filati. A 1977 batch of Filati tested out at only 1570."

The graph shows the results of some of Fred's recent tests. Note that the fall-off in tension of the new Pirelli is more gradual than that of the other kinds of rubber. Fred points out that a too-rapid fall-off can be treacherous; if the torque falls off too rapidly the model is unable to readjust its climb attitude rapidly enough, resulting in mushing or a stall shortly after launching.

All of the test data shown were measured during mid-1978 except those for the 1972 Pirelli, which were measured in mid-1977. Note that the 1977 FAI rubber is slightly "harder" than the 1978 FAI rubber, but that the specific energy is about the same. Fred thinks that the rubber was actually about the same when it was manufactured, and that the difference is simply the typical effect of aging. Test curves for the 1977 material made during 1977 look about like the 1978 test curves for the 1978 material.

Anybody know where I can get some of that 1977 Filati? I'd like to have some to give to my friends.

CO-2 Duration, a New Indoor Class? Bob Bailey in England, writing in *Aeromodel-*