

ADVANCED TECHNIQUES

BUILDING WITH STYRENE



by JOHN BELL

CENTER SEAN. 250 + 010

A NOTE ABOUT THIS PAMPHLET...

The pamphlet was made up for the Florida O Scale meet, held in Florida, in November. Examples of my work can be seen on the B.T.S. website. Models include BL2 diesel locomotive, in S gauge, bulldozers, logging arch, and depressed center flat car. The web site address is: www.btsrr.com

Under Reference Sources, note that the 1922 Locomotive Cyclopedia of American Practice, is now available on CD-ROM, for \$29.95.

Under Building Supplies, on page 3, you will see some high lighted supplier addresses. You may not have heard of these companies.

Craftsman Specialty Supply sells many hard to find scratch building supplies.

Engineering Model Associates, Inc., is the parent company of Plastruct. You can get large plastic tubing (up to 9 in. dia.) and many other plastic items that Plastruct doesn't list.

Chicago Golf, is a supplier of the best double face masking tape you can find.

MSC is a large industrial supplier. Get their "Big Book". It's free.

The Kingston Vacuum Works, makes vacuum formers.

This instructional pamphlet is a work in progress. Hopefully, it will be expanded, and I will let you know when future editions are available on the web group lists.

John Bell

jbelle03@verizon.net

BUILDING SUPPLIES

Craftsman Specialty Supply
6567 Forty Mile Point
Rogers City, MI 49779
Ph. 989-734-3184 *NO E-MAIL*

Plastruct
1020 South Wallace Place
City of Industry, CA 91748
Ph. 626-912-7016 *Plastruct @ Plastruct.com*

Engineering Model Associates, Inc.
1020 South Wallace Place
City of Industry, CA 91748
Ph. 626-912-7011 *NO E-MAIL*

Evergreen Scale Models, Inc.
18620-F 141st Avenue N.E.
Woodinville, WA 98072
Ph. 877-376-9099 *evergreenscalemodels.com/*

Micro-Mark
340 Snyder Avenue
Berkeley Heights, NJ 07922-1595
Ph. 800-225-1066 *micromark.com/*

Special Shapes
P.O. Box 7487
1160 Naperville Drive
Romeoville, IL 60446-0487
Ph. 630-759-1970 *specialshapes.com/*

Small Parts, Inc.
13980 NW 58th Court
P.O. Box 4650
Miami Lakes, FL 33014-0650
Ph. 800-220-4242 *smallparts.com/*

John Bell
9925 Ulmerton Road #252
Largo, FL 33771
Ph 727-584-4003 *jbelle03@verizon.net*
For small pieces of resin wood

Chicago Golf
13710 49th St. N.
Unit #C
Clearwater, FL 33762
Ph. 727-571-1556 *NO E-MAIL*
Double face tape supplier.

Babbitt Railway Supply Co.
715 Barger
Mayfield, KY 42066
Ph. 270-247-0303

TOOL SUPPLIERS

Micro-Mark
340 Snyder Avenue
Berkeley Heights, NJ 07922-1595
Ph. 800-225-1066
www.micromark.com

NorthWest Short Line
P.O. Box 423
Seattle, WA 98111-0423
www.NWSL.com

MSC Industrial Supply Co.
75 Maxess Road
Melville, NY 11747-9415
Att. Dept. MC-04
www.mscdirect.com

The Kingston Vacuum Works
P.O. Box 3301
Kingston, NY 12402
www.warmplastic.com

North Yard
P.O. Box 27 368
Mt Roskill
Auckland
New Zealand
northyard@extra.co.nz

Slater's Plastikard
Temple Road
Matlock Bath
Matlock
Derbyshire
DE4 3PG
slaters@slatersplastikard.com

The difference in scale between
UK 1:43.5 and US 1:48 means that
if you want a US 60" then it will
be a UK 54" diameter.
(60 x 43.5 / 48 = 54.375).

US 63" would be UK 57"

Stevenson Preservation Lines
c/o Bob Stevenson
2326 230th Street
Boone IA 50036
Ph 515-292-8469
bobdiesel@aol.com

REFERENCE SOURCES

PLANS and DRAWINGS for LOCOMOTIVES

1922 Locomotive Cyclopedia of American Practice, CD-ROM

Order from: P.I. Engineering
101 Innovation Parkway
Williamston, MI 48895-1663
Ph. 800-628-3185
www.raildriver.com
Price: \$29.95

The Locomotive Cyclopedia, Vol. 1, Robert L. Hundman.

The Locomotive Cyclopedia, Vol. 2, Robert L. Hundman.

Model Railroader Cyclopedia, Vol. 1, Steam Locomotives
Linn H. Westcott

Model Railroader Cyclopedia, Vol. 2, Diesel Locomotives.
Bob Hayden

PLANS and DRAWINGS for CONSTRUCTION EQUIPMENT

Crawlers and Dozers, Vol. 1. Roger V. Amato
Donald J. Heimbürger
Heimbürger House Publishing Co.

Motorbooks. www.motorbooks.com

John Bell, 9925 Ulmerton Rd #252, Largo FL 33771
Ph. 727-584-4003

PLANS and DRAWINGS for AIRCRAFT

The Great Book of WWII Airplanes, Rikyu Watanabe.

Bob's Aircraft Documentation

Order catalog from: Bob's Aircraft Documentation
3114 Yukon Avenue
Costa Mesa, CA 92626

John Bell, 9925 Ulmerton Rd #252, Largo, FL 33771
Ph. 727-584-4003

TOOLS and TECHNIQUES

MICRO-MARK, 10 IN., PROFESSIONAL DISC SANDER
Micro-Mark catalog No. 80849

This disc sander is a must, if you want to do some serious model building. Besides it's top quality, and size, the best feature of this tool is it's speed range, which is from 280 to 400 RPM. Compare this to the ear splitting 1750 to 5000 rpm of most tools of this type. The slow speed enables you to work with styrene, and other plastics easily. This machine has enabled me to build the models shown here, plus many others. Choose the 240 grit self adhesive sanding disc (No.80865) for working with styrene. The next grade, 180 grit (No. 80864) is ideal for wood projects.

In addition to squaring off stock, the sander can be used for reducing the thickness of styrene stock, rounding off ends, and making multiple pieces. Once you have used this machine, you will see that it will enable you to build models you have only dreamed about building.



**Professional Model Maker's
10" Disk Sander**

There's never been another sander this well made or versatile. The electronic variable speed control lets you run the sander at extra slow speeds so overheating is virtually eliminated. You'll never again have a melted, gooey glob when sanding plastics. And metal won't distort from the burning heat most sanders produce. To sand wood, just turn up the speed to the correct setting for the hardness of the wood you're working in. The disk turns at only 280-480 rpm, compared to other sanders that run as high as 5,000 rpm. These slower speeds allow the sander to run smoothly and quietly with almost no vibration. For mitering, sanding to a line, smoothing and shaping, no other power tool we've tried works as well or is easier to use. Includes 3 assorted grit sanding disks and miter gauge.

Features

- High torque, electronically rectified DC motor produces more power than many motors rated 1/2 hp and higher.
- Variable speed 280-480 rpm.
- Cast aluminum housing.
- 10" cast aluminum disk.
- Vacuum cleaner attachment.
- Compact size. Only 11-1/2" wide x 13-1/2" high x 9-1/2" deep.
- 4-5/8" x 10-3/4" machine finished aluminum table with miter gauge slot. Table tilts to 45°.
- Plugs into standard 110v AC outlet.

#80849 Disk Sander List \$259.95 Our Price **\$199.95**

10" Aluminum Oxide Cloth-Backed Self-Adhesive Disks - \$3.55 ea.

#80862 80 Grit #80863 120 Grit #80864 180 Grit #80865 240 Grit

ADHESIVES

There are many adhesives that work well with styrene. I prefer TESTORS Liquid cement, because it takes a little longer to set up. This allows a little time to re-position "goofs".

I have found that bonding dissimilar materials is a little more complicated. Seems that I have tried everything, and I finally settled on SINBAD Medical Glue*, which is a super, super CA glue. Be sure to roughen up the parts to be joined with sandpaper.

Epoxy is acceptable, but I only use it when positioning a part accurately is difficult. Wet epoxy can be cleaned up with naphtha. Not much epoxy is needed for a secure bond.

3M Super 77 is good for overlaying, and a technique for using this is described elsewhere in the booklet.

Here's a little tip: Brush marks, from liquid styrene glue, can be cleaned up by scrubbing the part with Soft Scrub, which is available at grocery stores.

*

Sinbad
P.O. Box 1688
Palmetto, FL 34220
Ph. 877-332-1296

DOUBLE FACE TAPE

Double face tape is the miracle "third hand". You can use it for the following:

1. Taping squaring blocks to your work surface.
2. Taping styrene pieces together, for making duplicates.
3. Temporarily holding assemblies together.
4. Placing hard to reach nuts, and screws.
5. A million other things.

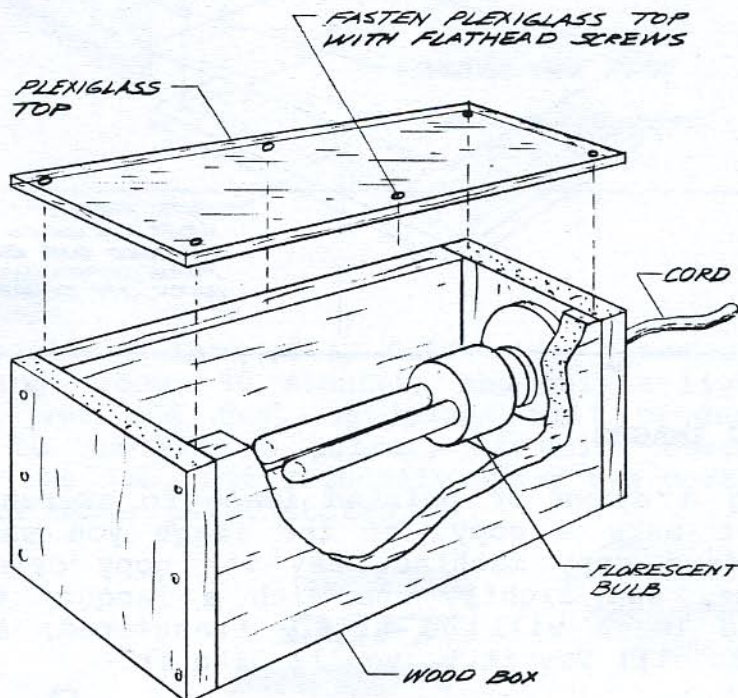
The best double face tape is the kind golf club repairman use for slipping grips onto golf clubs. Get it from Chicago Golf, in Clearwater, Florida (address under Building Supplies list). A 60 ft. roll costs \$5.60.

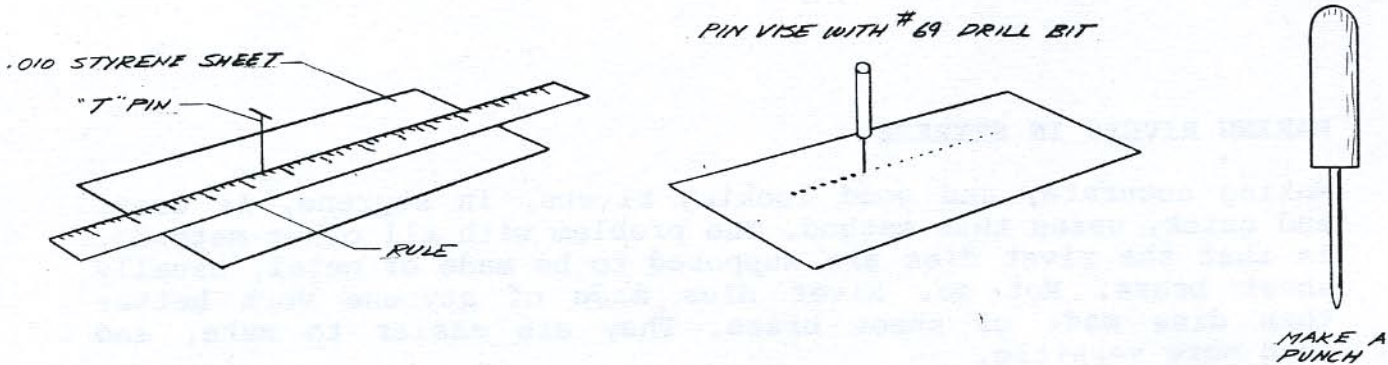
MAKING RIVETS IN STYRENE

Making accurate, and good looking rivets, in styrene, is easy, and quick, using this method. The problem with all other methods, is that the rivet dies are supposed to be made of metal, usually sheet brass. Not so. Rivet dies made of styrene work better than dies made of sheet brass. They are easier to make, and much more versitle.

1. Build a light box. The drawing shows a simple way to construct one, and it only costs a few dollars.
2. Tape a piece of .015 sheet styrene to a work surface.
3. With a straight edge, and T pin, lay out a row of rivets, 1/16 in apart, or what ever spacing you desire.
4. Use a No. 69 drill bit, to drill through the pin marked, rivet locations, on the styrene sheet. Clean up the holes with a razor blade, and 400 grit, wet or dry sandpaper.
5. Tape the die to the clear surface of the light box, and turn on the light.
6. Tape a piece of .010 styrene over the die.
7. Use a small prick punch, with a slightly rounded point, to emboss the rivets in the .010 styrene. To keep a perfectly straight line, it is helpful to guide the punch with a straight edge.
8. Fill the back of the rivets with a slurry of Bondo.

Using this method, any sized rivet, and any spacing is possible. Dies can be made from .010, and .015 styrene. Experiment to find a proper sized punch.

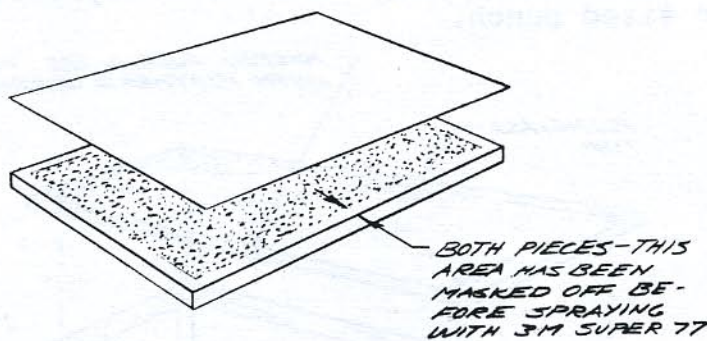




OVERLAYING THIN STYRENE SHEET

Overlaying thin styrene sheet, such as rivet embossed .010 sheet, can be tricky. The problem is solvent entrapment, which will in time, eat through the embossed overlay, and ruin it. Many suggestions have been made for avoiding this problem but none are fool proof, except this method, which doesn't use solvent at all, but a spray contact adhesive, such as 3M Super 77. The drawings below show how this is done.

1. Attach masking tape 1/16 in. in from the edges of the pieces to be overlaid.
2. Spray a light coat of 3M Super 77 on both pieces.
3. CAREFULLY, remove the masking tape.
4. CAREFULLY, put the pieces together.
5. LIGHTLY, seal the edges with styrene solvent.



TRANSFERING IMAGES

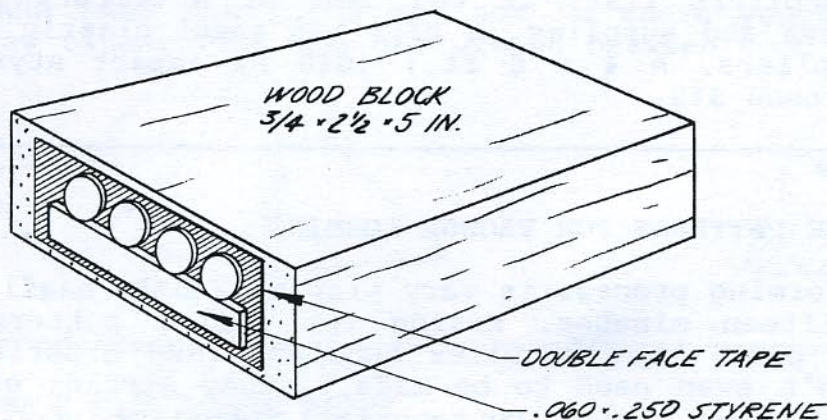
Transferring a drawn or printed image to styrene (and wood) is easy. First make a copy, of the image you want to transfer, on a standard copy machine. Lay the copy print side down on the styrene, and lightly rub with a lacquer thinner dampened tissue. The image will be nicely transferred, and as a bonus, it won't rub off! Try it,...you'll like it.

MAKING DUPLICATE PARTS FROM STYRENE

This requires the use of the Micro-Mark, Professional Model Maker's, 10 in. disc sander.

The example shown here, shows how to make four, identical, .060 in. x .250 in. diameter, round discs. Start with a .250 diameter, styrene rod, about 4 in. long. Set the disc sander on slow speed, and using the miter, square off both ends of the rod. Slice off two pieces, one from each end, slightly thicker than .060 in. Square off the rod ends again, and slice off two more pieces.

Prepare a squared off block, from fine grained hardwood, 3/4 in. x 2 1/2 in. x 5 in. You can make this block, using the disc sander. Lay a piece of double face tape, on the block, as shown. A piece of rectangular, styrene strip, .060 in. x .250 in. is positioned on the tape. Stick the flat, squared off ends of the discs, above the styrene strip. With the disc sander miter gauge, set at exactly 90 degrees, slide the block to the sanding disc, and sand the discs down, until you see slight sanding marks on the styrene strip. Carefully remove the four discs from the tape, and you are done. Any number, and shape of identical pieces can be made, using this method.



SEALING WOOD PARTS

The best wood sealer I know of is DEFT, semi-gloss wood finish. It is fast drying, about 30 minutes, and only a light sanding, with 400 grit, wet and dry, sandpaper will produce a great surface, prior to applying a primer, or color coat. One coat will usually do the job, but I usually apply two coats. Purchase it at Walmart, or other paint stores.



*America's Favorite Wood
Finishes & Stains*

VACUUM FORMING, ...THE BLACK ART

Longer ago than I care to remember, I kept running into an almost insurmountable problem, when scratch building WW2 fighters. The bubble canopies, of these aircraft, were next to impossible to duplicate. I tried using commercial versions, trimming them to size, but they never quite looked right. I had read about vacuum forming, but had never done anything about learning the so called "black art". Then one day, tired of the hassle, I decided it was time to learn about vacuum forming. I ordered a plan for a homemade vacuum former, and set to work building it. I used an old canister vacuum cleaner as a vacuum source. The table was made completely of wood, complete with 640, tiny, hand drilled holes. When the big day came to try out the machine, I placed a hand craved canopy pattern on the table, and heated a clear plastic sheet, which was held in a frame over an oven burner. When the plastic began to sag, I switched on the old vacuum cleaner, slammed the warm plastic over the pattern, and lo and behold, my first try was a perfect success!

Since then, I have made hundreds of vacuum formed pieces. Later on, I acquired a commercial, 12 x 18 in. machine, and now use it almost all the time. Parts made include, canopies, airplane spinners, and cowls, bulldozer blades, bulldozer tracks, locomotive cab roofs, fireboxes, locomotive boilers, steam and sand domes, and many other varied and unusual parts.

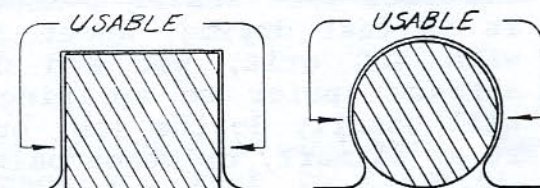
If you are a serious model builder, you might want to learn vacuum forming. There is much information available, and in the Tool Suppliers list, is the name of a company that sells vacuum formers and supplies. A tip: buy sheet plastic from large plastic suppliers. A 4 x 8 ft., .040 hi impact styrene sheet will cost around \$12.

MAKING MASTER PATTERNS FOR VACUUM FORMING

The vacuum forming process is very simple, and is easily mastered in about fifteen minutes. Making the master patterns is the "Black Art" part, that requires knowledge and experience. Some patterns don't even need to be made, ...they already exist, such as pieces of pipe, long, rectangular pieces of wood, plastic, or metal, and other odd shapes, that only your imagination can come up with.

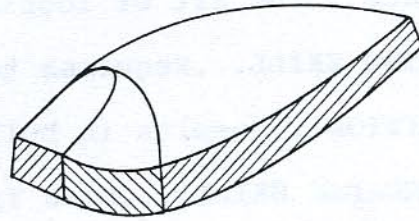
The most important thing to know, is how vacuum formed pieces will come out, when using these items as patterns.

Shown here are cross sections of what a piece of styrene will do, when heated, and pulled by a vacuum over a square, or round piece of material used as a pattern.



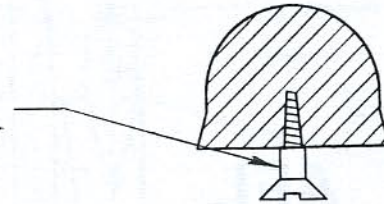
The portion of the vacuum formed plastic, that is usable, is shown by the "usable" brackets. You can see that for a desired usable depth, the pattern must be "over deep". Keep this in mind when making custom made patterns.

Shown here is an example of a pattern for an aircraft canopy. The shaded part of the vacuum formed canopy will be cut off. Other patterns such as domes, fire boxes, and cab roofs, will be similar.

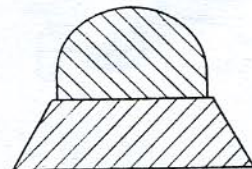
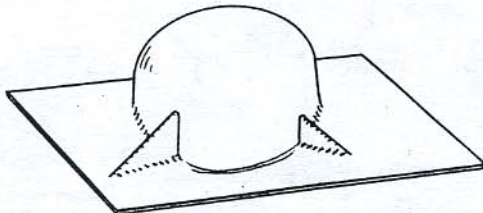


It is not necessary to be able to slip the vacuum formed part off the pattern. It can be cut off, but be careful to not damage the pattern. If you are going to make many parts, from the same pattern, try to design it with negative draft, as shown here.

Screw for pulling pattern out of part.



A problem you may run into, is called webbing. A picture is shown below. This is caused by too much styrene, having no place to go, and it bunches up, in the web form. To eliminate webbing, make a tapered, removable wood base, as shown. Such a base is easily cut from wood, using a band saw. BE CAREFUL CUTTING ANGLES WITH A BAND SAW! The blade may not be where you think it is, and the saw cannot tell the difference between wood and fingers. OUCH!



STRAIGHTENING CAST RESIN PARTS

Easy to do. Fill a tall glass with ice cold water. With a heat gun, set on low, warm the resin part. Be careful. You only want to warm the part enough to make it very slightly pliable. The part can then be bent by hand, to straighten it out. Plunge the part into the glass of ice water, and prest-o, change-o, the part will be permanently straightened!

RESIN WOOD

Resin wood is a product that is made (I think) from fine wood particules and resin. The result is a wood like substance, that has NO grain. It is great for carving complex parts, and patterns. It sands easily, and can be sealed with Deft. Only one problem: It's really expensive. It can only be purchased in 2 in. x 12 in. x 36 in. boards, for around \$300. I have a stash, and can send you a small amount for that special part you may need. Call me for more info.

SCRATCH BUILDING A MODEL REQUIRES:

DESIRE...Something you really must have!

DETERMINATION...Don't give up!

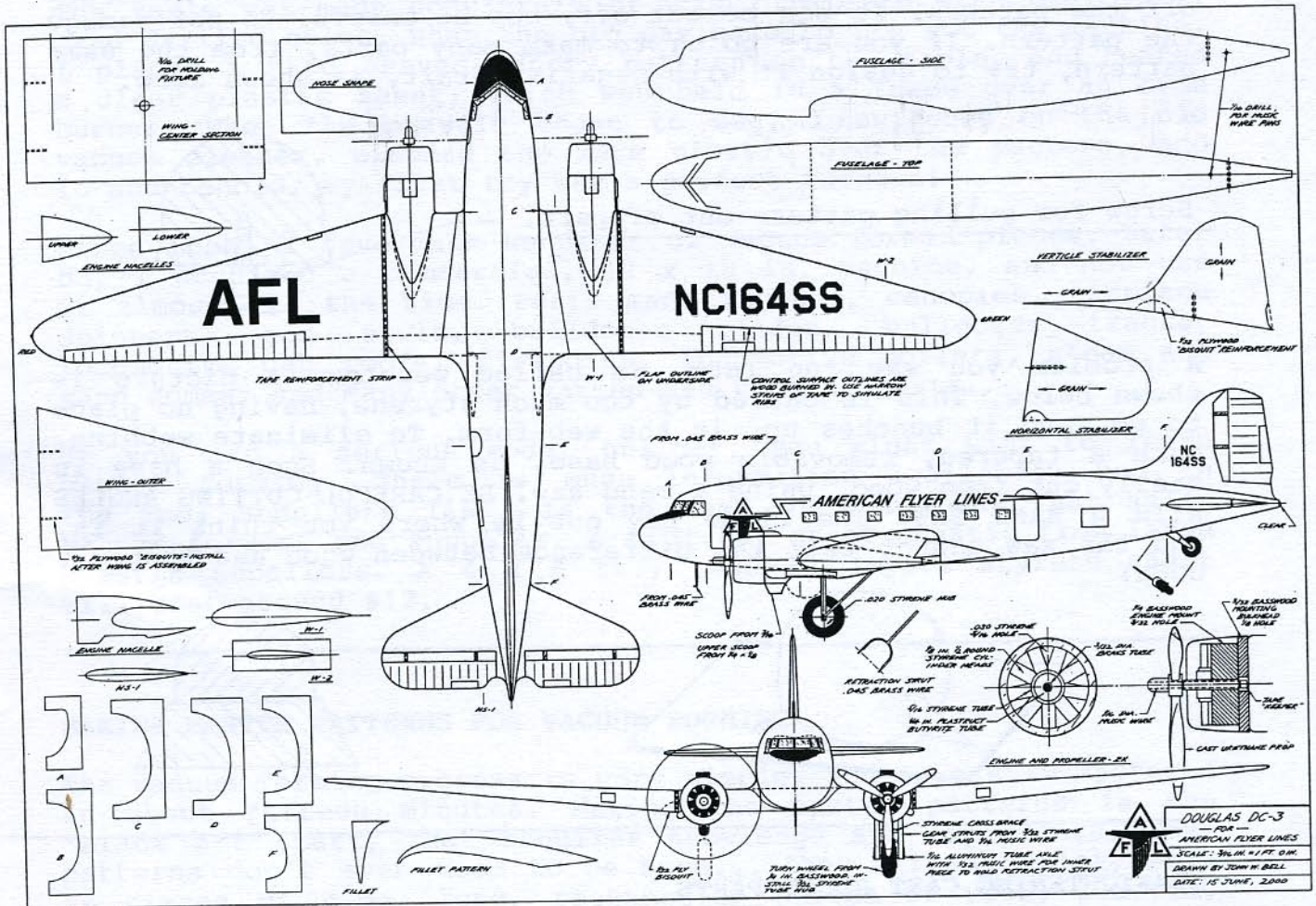
PATIENCE...The art of loosing your temper slowly!

BUILDING SKILL...Requires technique, and persistence!

REPETITION...Results in building skills!

ENGINEERING SKILL...Comes from your imagination!

EXPERIENCE...Is your best teacher. Anything can be built!

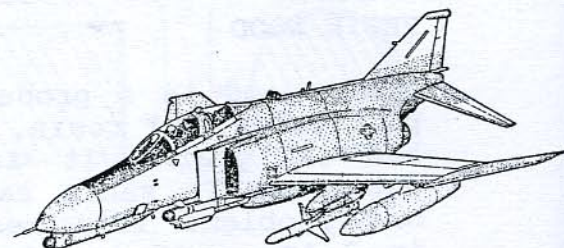
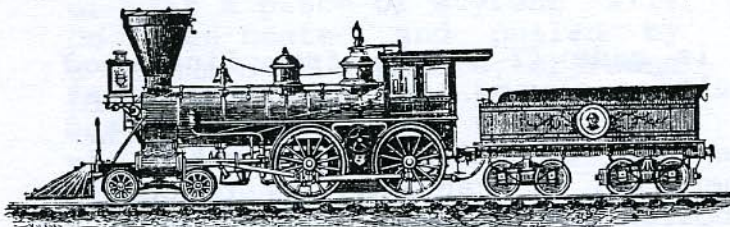


JOHN BELL

9925 Ulmerton Road #252

Largo, FL 33771

Ph. 727 584-4003 E-mail jbell03@verizon.net



PGA GOLF PROFESSIONAL * MODEL AIRCRAFT DESIGN * MODEL RAILROADING