# THE BASICS OF PAPER MODELING: TOOLS AND EQUIPMENT

GLUE

There are a variety of glues and adhesives on the market, some of which are nicely suited to building paper models. White glue (also known as PVA glue), glue sticks, Uhu office pens, tacky craft glue, and sometimes even superglue (cyanoacrylate adhesives) all have their own uses. For the great majority of the time, however, you can get by just fine with white glue alone.

SCORING AND CUTTING TOOLS

You'll want to have, at the very least, a sharp hobby knife for cutting parts out of the printed sheet. Scissors are not recommended. For scoring, you can either gently drag the hobby knife across the fold (not recommended), or use specialty tools for scoring without cutting into the paper. Embossing tools such as the ball stylus, an empty ballpoint pen, a scrapbooking bone folder, or even secondhand sculpting tools with smooth and dull blades are great tools for scoring without breaking the paper.
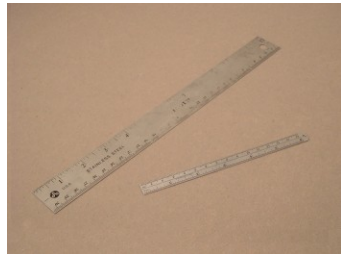
STEEL RULERS

To precisely guide your cuts or scoring, steel rulers come in very handy. Unlike plastic or wood rulers, steel rulers are resistant to sharp hobby knives. You can get by with just a normal 12-inch steel ruler, but you may find that a smaller 6-inch steel ruler is a lot handier and easier to deal with when making small cuts. Along larger parts, steel rulers can also be used as a bending aid.

HOBBY TWEEZERS

Sometimes you'll encounter folds that seem too small to do with your fingers alone. In this situation, a pair of hobby tweezers like the one shown to the left is very handy. In effect, they act as a set of tiny fingers and an effective folding tool, allowing you to crisply fold very small parts.

THE BASICS OF PAPER MODELING: TOOLS AND EQUIPMENT

BLACK, GRAY, OR DARK GRAY MARKERS

When you cut parts out of the sheet, the edges are naked white. This generally results in a less than pleasing visual effect when the model is fully built, and this is dealt with by a technique called "edging". When edging parts, you will be doing two things: coloring the actual edge itself, and coloring in a portion of the glue tabs. The best marker to use for edging is one that has a soft chisel tip, and which doesn't bleed through thin cardstock. The markers pictured to the left are calligraphy markers with 2mm and 3.5mm chisel tips.

CUTTING PAD/MAT

A good self-healing cutting mat will help your hobby knife blades stay sharp longer, and protect your work surface from damage.

CARDSTOCK

The most commonly chosen building material is a stiff, heavyweight cardstock available at most office supply stores and some department stores like Wal-Mart. Cardstock comes in several weight grades, usually expressed in pounds or grams per square meter, and tends to be sold in packages of anywhere from 50 to 250 sheets. 110lb cardstock is the cheapest and the most common, and feels like a thick index card. 67 and 65lb cardstock feels practically identical to index card stock, and tends to be thinner and easier to form into complex parts.

PHOTO PAPER

Photo paper yields an amazing finish and brings out detail normally not visible with plain cardstock. However, not all photo paper is suitable for building models with, since some brands of photo paper tend to be too "soft" and do not hold creases very well. One of the notable exceptions is Canon's Matte Photo Paper, which is a pleasingly stiff 47lb stock with excellent folding characteristics, and brings amazing clarity and vividness to the model's surface finish.

COVER STOCK

Cover stock tends to be thicker and stiffer than cardstock, with a surface finish somewhere in between cardstock and photo paper. Due to its thickness and stiffness, cover stock is not really recommended for anything but the largest and simplest of shapes.

THE BASICS OF PAPER MODELING: ADOBE ACROBAT READER

ADOBE ACROBAT READER

All cardstock models distributed in Adobe PDF format are intended to be opened by Adobe's free Acrobat Reader software, available from the Adobe website at http://www.adobe.com.

Other PDF reading software exists, but for the purposes of this document, we will focus on Acrobat Reader itself.

PRINT DIALOG SETTINGS

One common problem encountered by beginners to cardstock modeling is the incorrect scaling of printed models. The cause is often Acrobat Reader itself, which by default rescales the page content to fit the printer's capabilities. Disabling this feature usually solves scaling issues, and is done in the print dialog box that appears when you click on the Print command under the File menu entry.

The print dialog box is pictured to the right. In the "Page Handling" frame, you should see a dropdown box labeled "Page Scaling". Choose "None" from the list of options, and make sure the "Auto-Rotate and Center" checkbox is marked. Because all of our models use a 7.5 x 10 inch page area as standard, they can be printed on both ISO A4 and US Letter stock, and the purpose of enabling the "Auto-Rotate and Center" feature is to ensure that this 7.5 x 10 inch rectangle is correctly centered within your printer's printable area.
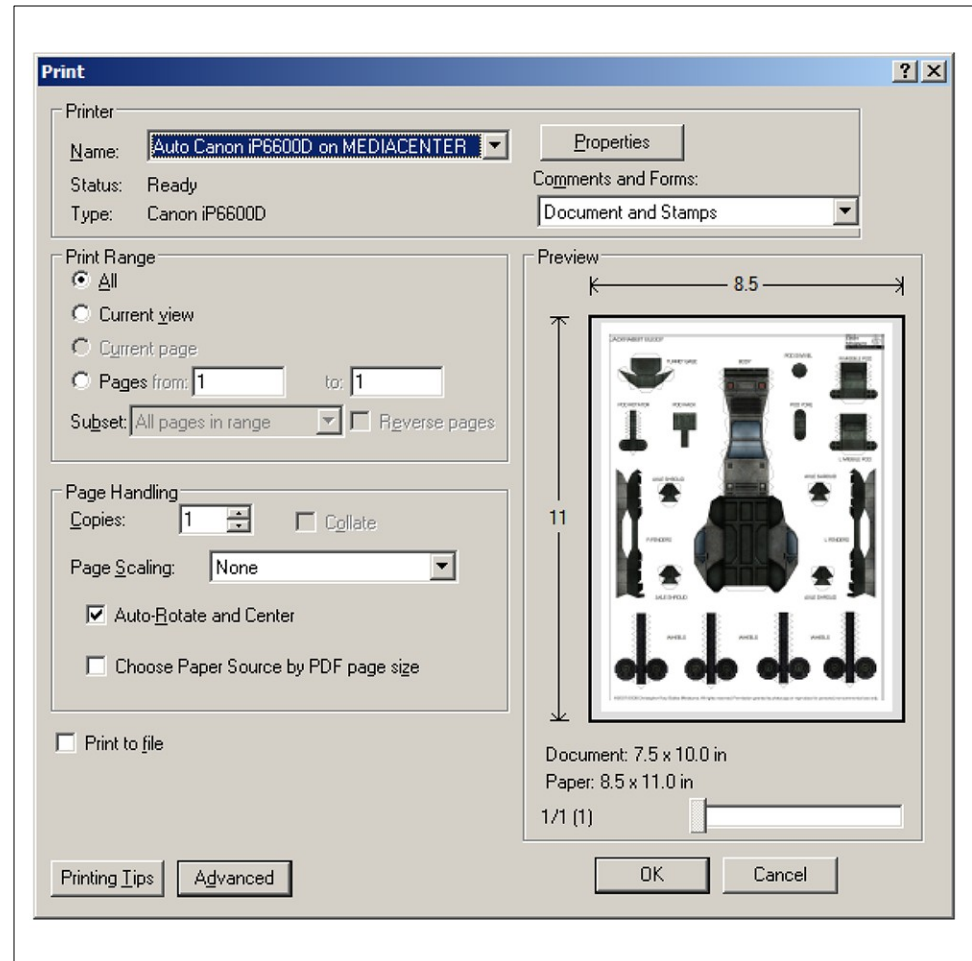
THE BASICS OF PAPER MODELING: COMMON STEPS
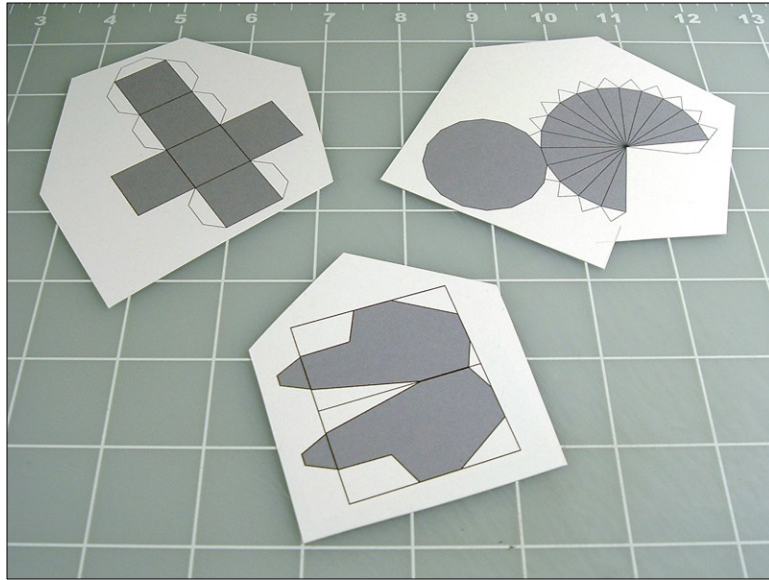
TRIMMING OUT THE PARTS

The first thing to do after printing out the model is to separate the parts from the page. Trimming them out means that you can work with smaller, handier portions of the page in later steps. Leave some margin around the parts, as shown to the left. If possible, try to include the part name or part number in the margin for reference in later steps. Alternatively, you can mark the unprinted side with the part number or name.

Parts can be trimmed out with a hobby knife, or separated from the page with a pair of scissors.
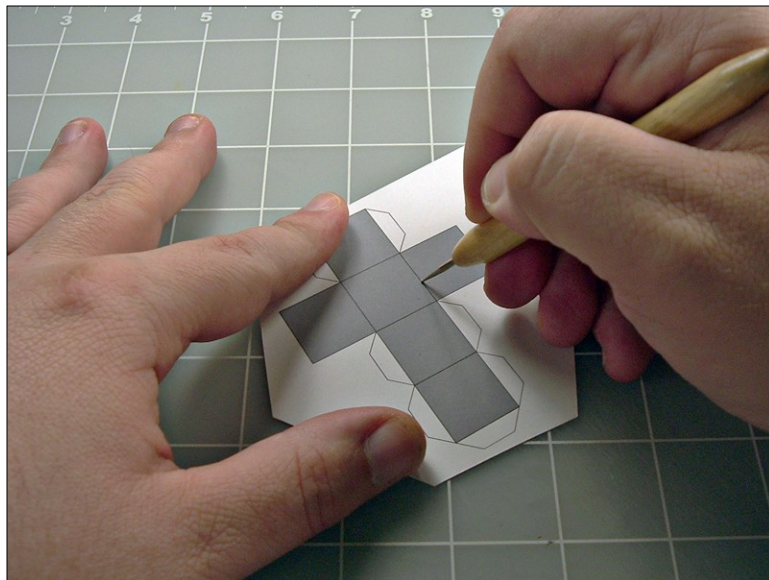
CREASING THE FOLD LINES

The next step after trimming out the parts is to crease the fold lines. In the photo to the left, a ball-tipped embossing stylus is being used to crease the fold lines. You can use a ball tipped stylus, an empty ball-point pen, a sculpting tool with a dull blade, or a scrapbooking bone folder.

The objective is to compress the cardstock along marked fold lines **without** cutting through the paper. Creasing the fold lines, rather than scoring with a knife blade, results in a cleaner looking model and less headache in later steps.

THE BASICS OF PAPER MODELING: COMMON STEPS

CUTTING OUT THE PARTS

Once the parts have been creased, the next step is to cut them out. In the photo to the left, a part is being cut out with a hobby knife and a 6-inch steel ruler. The steel ruler guides the blade along a straight line, and results in a cleaner cut.

For very short cuts or glue tabs, the cuts can often be made freehand, without the aid of a steel ruler.
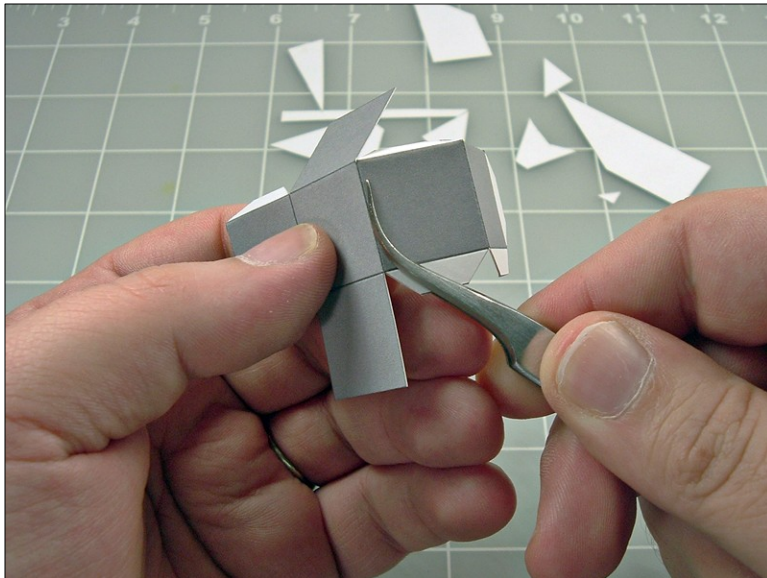

BENDING AND FOLDING

Bending and folding relatively small parts is best done with a pair of hobby tweezers, as shown to the left. In the photo, note how the jaws of the tweezers are aligned along the fold line, and the tweezers are being used as a bending brake.

Tweezers are very versatile tools, and are also useful for clamping, getting into tight spots, and acting as miniature fingers.

THE BASICS OF PAPER MODELING: COMMON STEPS
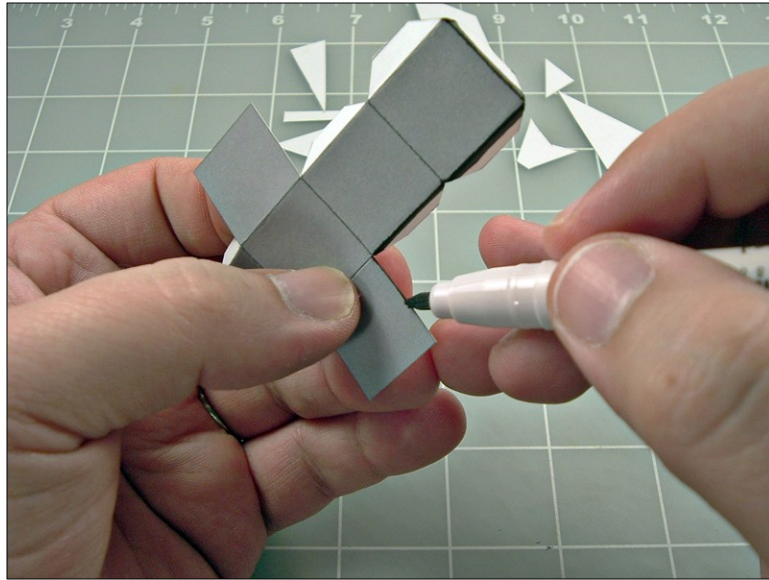
EDGING THE PARTS

After you have bent and folded the parts, you may want to take the opportunity to edge the parts with a black or dark gray chisel-tipped marker. There are three areas you will want to consider during the edging process:

1. The edges

2. The glue tabs

3. The unprinted side where a flap attaches to a glue tab

In the photo to the left, note how the glue tabs have had a 1-2mm border colored in where they meet the printed side, as well as how the marker is being used to color the edge of a flap.

Edging your models makes them look much cleaner, and it is easiest to edge the parts before gluing them together.
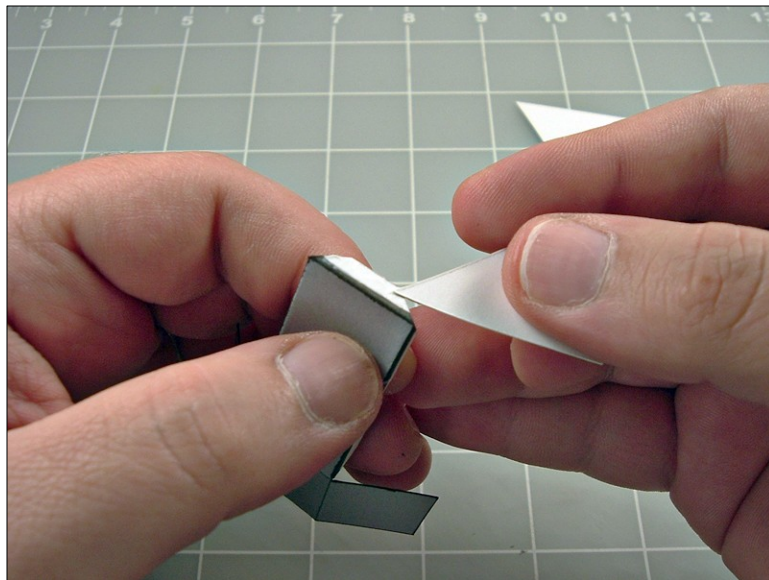
APPLYING GLUE

The best way to apply glue is to use a piece of scrap cardstock as a glue palette. First, squeeze some glue onto the palette, then use a toothpick, coffee stirrer, bamboo skewer, or another piece of scrap cardstock to transfer glue from the palette to the glue tab. In the photo to the left, a nicely shaped piece of scrap cardstock is being used to apply a dab of glue and spread it evenly across the glue tab.

Never apply glue to a glue tab directly from the bottle. You have much more control over the quantity, spread, and tackiness when you apply glue as described above.

One other reason for using a glue palette rather than direct application from the bottle is to control the tackiness. Some glues, fresh from the bottle, have too much water, so using a palette allows you to let the glue sit long enough for some of the excess water to evaporate.

THE BASICS OF PAPER MODELING: COMMON STEPS

CLAMPING GLUE TABS

Pictured to the left is another handy use for tweezers. In this step, the tweezers are being used to firmly clamp a glue tab to a flap. Clamp the glue tab in this manner until the glue sets (usually within 10 or so seconds).

Incidentally, the glue palette referenced on the previous page is no longer hidden by the author's giant sausage fingers, and is now visible in the background.
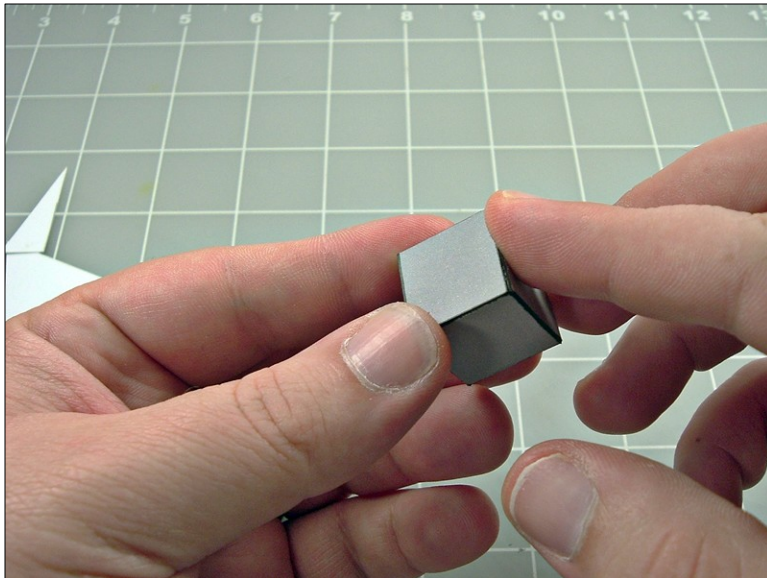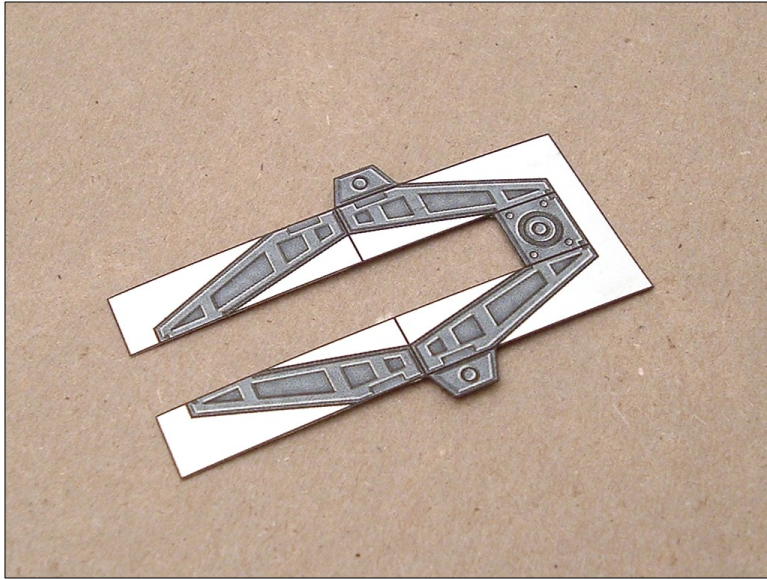

CLOSING OFF PARTS

At some point during the gluing process, you will have closed off the part and can no longer get to the flaps with tweezers. In this case, use your fingers and gently hold the flap against the glue tab until the glue sets. Again, this often only takes a few seconds.

# THE BASICS OF PAPER MODELING: FRAMED SANDWICH FOLD PARTS

TRIMMING OUT THE PART

Sandwich fold parts are often contained within a thin black frame. The purpose of this frame is to make the build process easier in the following ways:

1. By reducing the number of small, detailed cuts by almost half

2. By simplifying alignment-aligning two rectangles is easier than aligning two funny shapes.

The photo to the left shows an example of a sandwich fold part contained within an U-shaped frame.
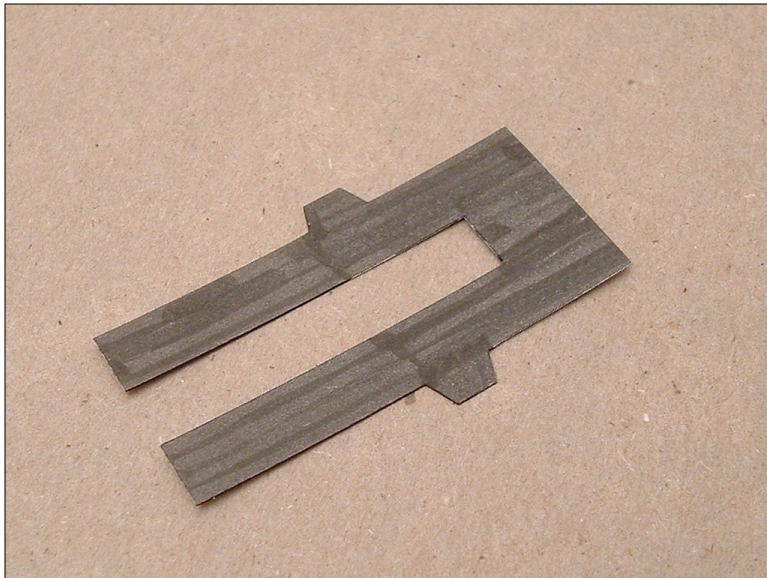

BACKCOLORING THE PART

The next step after cutting out a framed sandwich fold part is to flip it over and color the whole unprinted side with a black or dark gray chisel-tipped marker. The purpose of backcoloring is similar to that of edging: to hide ugly naked white cardstock.

If you need to backcolor a very large sandwich fold part, go to the nearest window and place the part against the glass, with the unprinted side facing you. You should then be able to see the outline of the printed side. Trace along the contours with the marker so that there is a 2-3mm border of black or dark gray running all around the final cut lines.

THE BASICS OF PAPER MODELING:
FRAMED SANDWICH FOLD PARTS
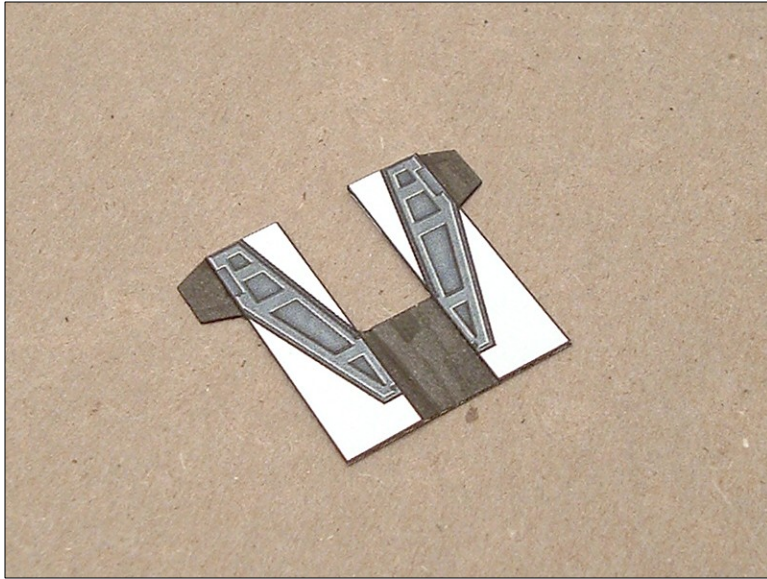
GLUING THE PART TOGETHER

Fold up the frame and glue it together.

TRIMMING OUT THE REMAINING WHITESPACE

Once the glue dries, go ahead and completely cut out the remaining frame whitespace. At this point, you have a part that is ready to be folded up into its final shape.

THE BASICS OF PAPER MODELING: ESSENTIAL TIPS

Use Tweezers For Small Folds

For best results, use tweezers as a bending brake when dealing with small folds and tabs. Tweezers have the effect of acting as tiny fingers, and make the process of building small parts much easier. Tweezers are also excellent clamps, and allow you to hold tabs in place tightly until the glue sets.

Don't Score, Crease Instead

Some model designers recommend that you score the fold lines of their models, while others will recommend that you crease instead of folding. This may lead to some confusion regarding which is the correct approach. The answer is simple: do what the designer recommends for THEIR models. Sometimes one size does not fit all!

For our models, creasing works better than scoring for several reasons. If fold lines are scored, exposed white cardstock or harsh edging will ruin the visual effect. Additionally, the very close spacing of some folds at this size means that scoring will actually greatly weaken the model and obliterate a lot of visual detail. Creasing also eliminates the need to edge each and every fold line, and saves a lot of build time in the end.

Backcolor Open Volumes

To make the build process much simpler when using thick cardstock, some model parts are simple open volumes, which are much easier to build for small parts. However, a side effect of using open volumes is that the unprinted side will be visible. If you color the unprinted side of these open volumes black before folding and gluing them together, there will be no exposed whitespace showing, and these open volumes will actually look solid.

Backcolor Sandwich Fold Parts

Some parts are simple 2-ply sandwich folds. In order to hide any alignment problems when cutting out these parts, you may want to backcolor the part before folding it over on itself. This way, you will eliminate the majority of obvious whitespace peeking out from misaligned cuts or folds.

Edge Before Assembling

The best time to edge your parts is immediately after cutting them out and creasing them, and before gluing them together. This way, you will be able to better control where your edging marker goes, and you will not need to worry about hard-to-reach areas.

Don't Sweat The Small Cuts

Small parts mean much shorter cuts, and using a steel ruler to align your cuts is usually not necessary for most small parts, because the cut lengths are short enough that freehand cuts are easier to do. Many small parts lend themselves well to freehand cuts due to their lack of long, straight lines. The trick is to take your time and follow the contour of the cut lines. With a small amount of practice, you would be surprised at how accurately you can freehand small cuts.

The same principle applies to creasing, since many of the fold lines are also short enough to easily freehand.

THE BASICS OF PAPER MODELING: TERMINOLOGY AND NOTES

BASIC TECHNIQUES

1. Scoring: Scoring is a technique used to make folding easier by pre-creasing the paper along a fold line. The most common method of scoring is to lightly drag a knife blade across the fold line, slicing through the upper layers of the paper. The recommended method is to instead use an empty ballpoint pen or a ball stylus tool to gently compress the paper along the fold lines. This prevents the appearance of unsightly naked edges and makes for a much stronger model.

2. Cutting: Cutting may seem to be a glaringly obvious technique, but a few pointers are essential. For the majority of cutting where paper models are concerned, a sharp knife and a steel ruler are far more precise and efficient than a pair of scissors. Save the scissors for separating individual parts or groups of parts from the rest of the sheet.

3. Burnishing: Often, you will be building parts that are composed of flat fold-overs. In order to ensure that they stay straight and do not delaminate after building, you will want to burnish the two halves together. You can use your finger, a smooth and flat tool, or even a little rolling pin. Burnishing forces the two layers in a flat fold-over together, spreading out the glue even further and squeezing it into the paper fibers for additional bite.

4. Edging: Edging improves the appearance of paper models considerably by hiding the naked edges of cut parts. Anything from color markers to soft pencils and various types of paints may be used to edge parts. However, in most cases, matching the color exactly is less of a concern than simply matching the contrast. For most purposes, three or four shades of gray from lightest to darkest will more than suffice.

5. Backcoloring: For parts that are open volumes, which expose the unprinted side after assembly, you may want to use backcoloring to cover the unprinted side. Backcoloring is similar to edging, except the entire unprinted side of a part is colored in the desired edging color after cutting out and before assembly. Backcoloring is effective at making open parts appear solid. Backcoloring is also very useful for masking alignment errors when cutting out flat fold-over parts.

6. Folding and Gluing: Depending on the thickness of the paper or cardstock used, some parts may be difficult to assemble with fingers alone. In this situation, a pair of tweezers is worth more than its weight in gold. Tweezers come in a wide variety of sizes and jaw shapes, and some of the more exotic shapes are fantastically useful for assembling tiny parts. Tweezers can be used to fold tiny flaps and clamp them in place while the glue sets, as well as making it much easier to attach small parts to other parts.

SPECIAL NOTES

1. Gluing Tabs: Our models include integral gluing tabs for joining certain parts together. However, the utility of gluing tabs decreases proportionally as the thickness of the paper or cardstock increases. Thick cardstock or paper can be used for printing our models, but it is recommended that you try a test assembly before committing wholly to assembling a model. If the gluing tabs won't fit or otherwise throw off the tolerances of the finished test assembly, leave them off the parts entirely and cut your own gluing tabs out of scrap cardstock.

These separate gluing tabs should overlap both of the parts to be joined, and glued to the unprinted surface along the joining edges of both parts. This is called "backing", and a side effect of this is that parts will fit more or less flush. Backing parts with separate gluing tabs also generally yields better modeling results, but the integral gluing tabs are retained for the convenience of beginners and those who prefer to use thinner media for their paper models.

2. Reinforcing: At times you may need to reinforce large pieces, either to make them heavier or to increase their strength. To do this, you may wish to glue toothpicks, craft sticks, or other suitable items to the interior of a model.

THE BASICS OF PAPER MODELING: TERMINOLOGY AND NOTES

SPECIAL NOTES, CONTINUED

3. Weighting: If you find that your models are too light, you can weigh them down by gluing various ballast items to the inside of the model. Some items that come to mind include pennies, ball bearings, and washers. Affixing these items to the unprinted side of a model before folding and gluing it into shape will give the model a significant amount of heft and weight.

4. Sealing: In most cases, sealing the model with varnish or other form of spray sealant isn't necessary. However, if you want to add further detail to the model with decals or paint, you may want to seal the model with several light coats of a waterproof glossy clear sealant first. This will protect the model from a moderate level of moisture, and the smooth surface will facilitate the application of decals. You can also apply a final coat of a matte clear sealant to kill the gloss afterwards. Keep in mind that the simple act of sealing a model does not necessarily render it waterproof, and that any application of waterslide decals needs to be done with great care.