

CHAPTER ONE

MODELING TIPS AND TECHNIQUES

Over the years I have discovered techniques for working with plastics that have greatly advanced my modeling skills. I've condensed and refined them here so anyone can use them successfully. The topics presented in this chapter are cataloged and grouped so you can quickly find a technique or tip dealing with a particular issue. They have all been tested and proven and used in building the models pictured in this book.

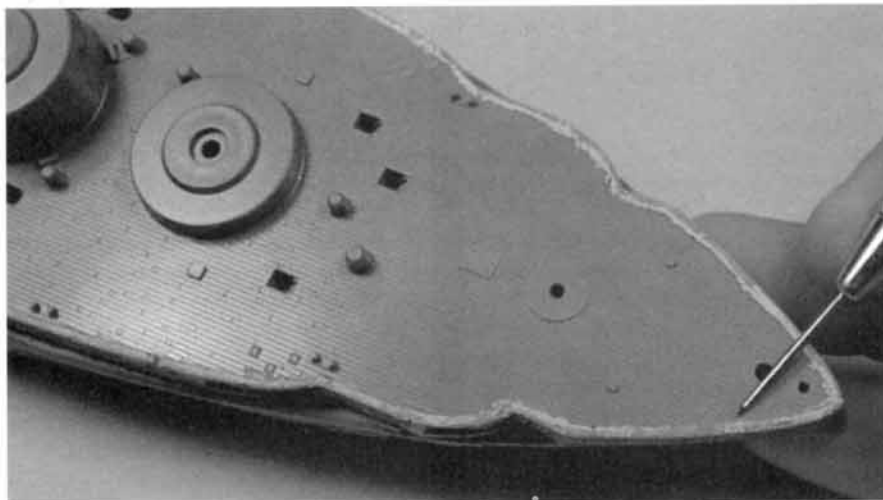
USING PUTTY AND SANDPAPER AND DETECTING MINUTE FLAWS

To apply putty, squeeze a small amount onto a piece of paper. Allow it to flow from the tube while retaining its round shape, and squeeze out a line about $\frac{1}{4}$ " to $\frac{1}{2}$ " long. For most putty applications use either a number 18 flat-ended X-Acto blade or a number 16 angled X-Acto blade, and slice off small amounts of putty. This will give you greater control of it.

Try to use the minimum amount of putty to accomplish what you are trying to achieve. Piles of putty increase your sanding work and also your chances of marring surrounding detail while sanding. When applying putty be sure the seam is well secured with glue. Any flexing of the seam during curing or sanding and scraping will cause putty to crack and separate from the plastic.

Mask around the work area before applying putty to guarantee that putty will touch the plastic only where you want it. Tape along both sides of the seam, getting it as close to the seam as possible. This resulting thin putty line will reduce your work and limit damage to detail. I recommend 3M painter's masking tape because of its excellent strength, adhesion, and easy removal.

When you apply the putty don't worry about getting it on the tape, and work in sections that are no more than



The thin putty line along the edge of the deck area of Revell's 1/426 scale *Arizona* was achieved by careful masking and putty application.

2" or 3" long. Apply it quickly and after you have finished, remove the tape by pulling it back over itself and away from the putty. It is important to remove the tape while the putty is still moist, although you will need to let it dry before you putty the next section along the seam line. Before sanding, again mask those areas around the putty line to save surrounding detail.

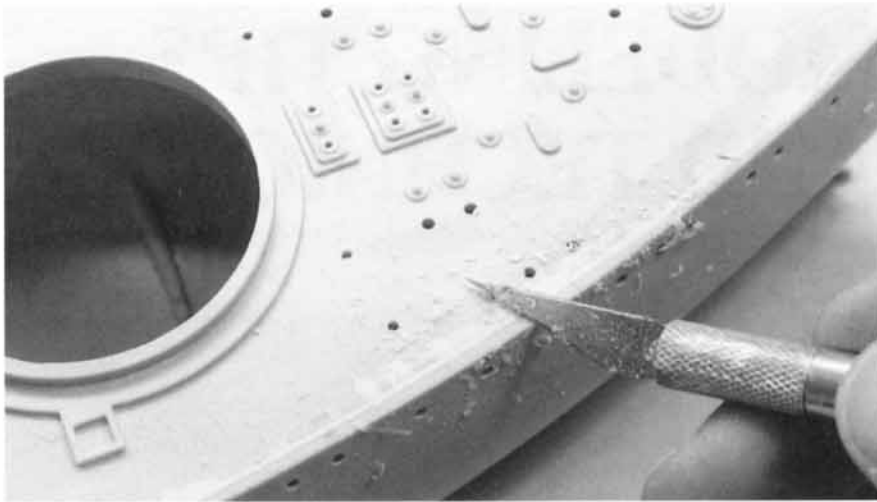
To conserve sandpaper, cut the sheet into three or four strips. Working with smaller pieces reduces your chances of damaging surrounding detail. Another way to reduce damage, which will in turn reduce the amount of sanding you do, is to wet-sand. Wet-sanding is just what it sounds like—you dip the sandpaper in water and sand as you normally would. In addition to extending the life of your sandpaper, the water acts as a lubricant and helps facilitate the sanding process, reducing your efforts.

When using sandpaper be careful not to destroy surrounding detail. On hulls this is usually not a problem, but the area where the decks are mated to the hull requires some extra care. I

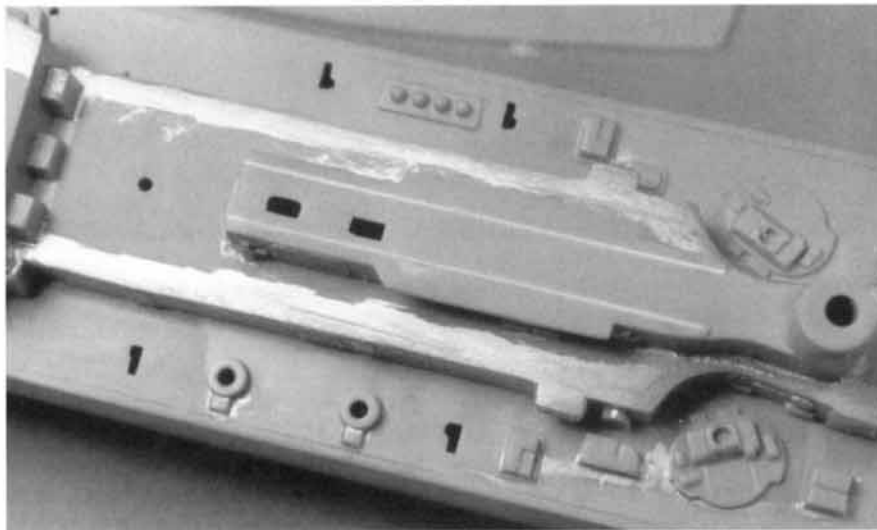
always mask the area I'm sanding, getting the tape as close as possible to the seam so only a small amount of detail is lost. Sandpaper has a tendency to abrade the tape, so you might have to replace tape more than once. When you plan your sanding be aware that the rougher the grade you use, the more work will be required to smooth the surface.

To detect flaws where you have done seam work or surface repairs, paint the area with Testor's silver paint. It will highlight fine seam lines, scratches, bumps, and tiny bubble holes in putty. Remove the paint before you apply any more putty, however, because it will not stick to the paint. The best paint remover is Polly-S Paint and Decal Remover. Apply a small quantity to a soft cotton cloth and wipe.

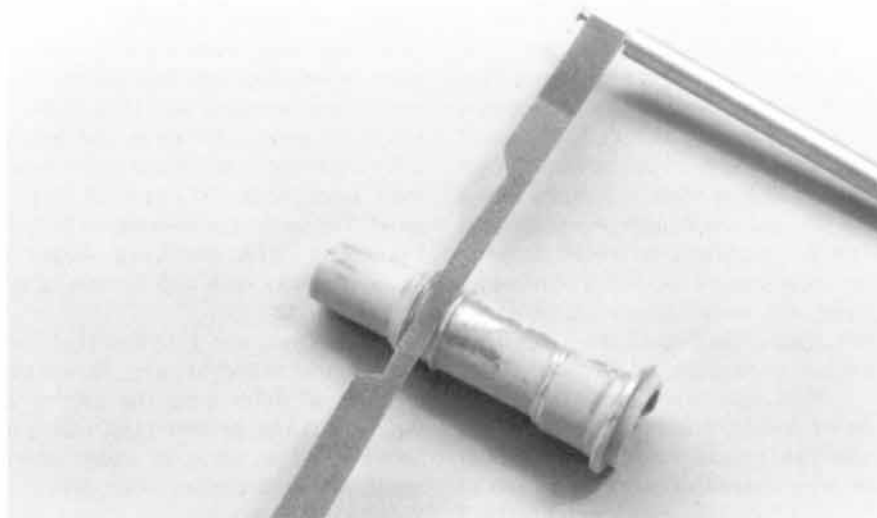
When you are satisfied that the areas you sanded are flawless, remove all paint from the model. If you don't, the primer coat will not adhere well. In addition, those silver areas will be a deeper color and the finish will be uneven.



The putty line on Glenco's 1/225 scale *Oregon* is being scraped down using a number 11 X-Acto blade. Testor's Putty responds well to scraping so long as the deck is securely glued to the hull.



The putty along the seam line of the side superstructure sections of Monogram's 1/400 scale *Halsey* still needs a little extra work, which is easy to detect thanks to Testor's silver paint.



The primer coat will also detect flaws and areas where seams are still present. This is your last chance to repair problems before the finish coats. If you try to repair flaws after you finish painting the model your chances of blending in the surface paint are not good, so do the hard work up front. If you have to sand the primer, let it dry for at least 48 hours. The harder the paint, the easier it will be to sand smooth.

After you have finished repairing problems detected by the primer, sand the paint surrounding the problem areas with 600-grit sandpaper so the primer will blend into the plastic surface. Clean the entire model with Polly-S Plastic Prep to remove plastic residue and skin oils, and spray primer on areas that were repaired. Concentrate on covering the exposed plastic first so you will have an equal buildup of paint. In other words, if the model has two coats of primer, give the exposed plastic two coats and blend the area together with an overcoat. If you did a good job smoothing the surrounding paint and if you cleaned the surface with the Plastic Prep, you will not be able to detect where you repaired, sanded, and repainted.

MINIMIZING SEAMS

For all gluing and most seam work I recommend Duro's white and blue tube super glues. The glue doubles as seam filler, it can be sanded and scraped like plastic, and you can't detect the difference between the glue and the plastic once it has been painted. One seam-filling technique uses Duro's white tube super glue and takes advantage of the glue's capillary action. But before you do any seam work it is important to minimize the seam.

Flex-I-Files are great for contour work and reshaping curved areas. If the sandpaper width is too large just cut it to size with a sharp X-Acto blade.

Some parts have raised mold lines on the gluing surfaces. They can be removed easily by carefully scraping them off.

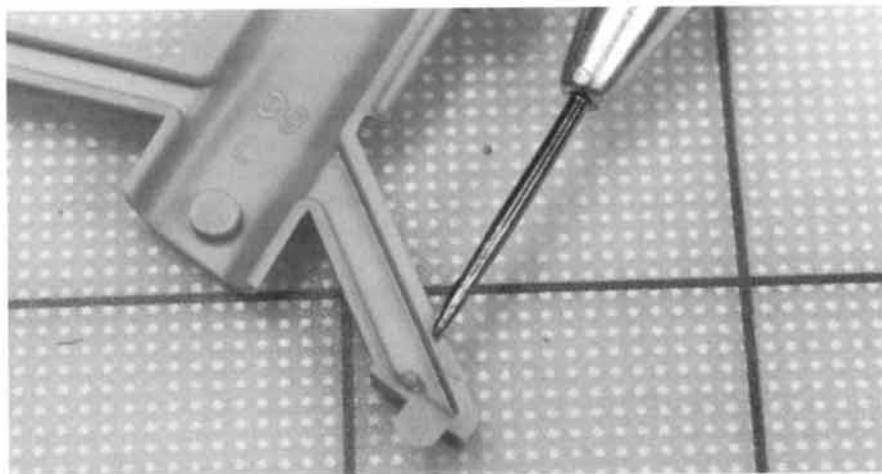
Removing parts from trees. Ship models, even in 1/200 scale, have numerous small delicate parts that can break easily, so be careful when removing them from their trees. Sometimes small ship model parts do not have tiny tabs that attach them to the trees and consequently it can be hard to remove them without damage. Never snap a part off, as this may leave an indentation where it was connected to the tree or, even worse, may break it. Always cut the tabs that connect parts to the tree using a pair of small wire cutters and be sure to leave a small amount of the tab on the part. It is much easier to remove the excess tab after the part has been removed from the tree.

In cases where the tabs are thick and cutting them may damage or break the part, cut them using a jeweler's saw or a small circular blade and your Dremel tool. A good example of a kit requiring this is Tamiya's 1/350 Iowa class battleships. The 40 mm gun shields are so delicate that using a set of cutters would almost certainly break them.

After all the necessary parts have been removed from trees, lay them flat, carefully cut the remaining tabs, and clean them of excess plastic or flash. A number 11 or 16 X-Acto blade works best for this. Be careful not to mar the plastic parts or remove any raised detail when removing flash.

Checking the fit. After you have cleaned the parts of excess plastic, check the fit of the two halves. Tape them together to ensure that any corresponding aligning pins and holes line up correctly. Do this on hulls as well as superstructure parts before you start working. Tape as much of the superstructure to the deck as possible. This will help you plan the assembly and, most important, identify problem areas, seams, and voids that must be dealt with. It is better to identify problems at the start of a project than to find a major fit problem when it is time to assemble the superstructure.

After checking the aligning pins and general fit of the parts, check the



matching surfaces of both halves for flatness. Sometimes there are mold lines or bumps on these surfaces, and if they are not removed the halves will not sit flush against each other. The easiest way to remove these bumps is to scrape them flat with a number 11 X-Acto blade. Another approach is to sand the part's gluing surface flat by running it across stationary sandpaper. This is a sure way to get a flat gluing surface, although it does remove the location pins.

Taping and gluing. As you tape, identify areas that need work and check contours and details that are formed when the parts are glued. Raised detail such as exterior piping that may cross seam lines should be lined up correctly. Corners and edges also require extra care to ensure that they are aligned; otherwise you will be doing a lot of scraping, sanding, and shaping.

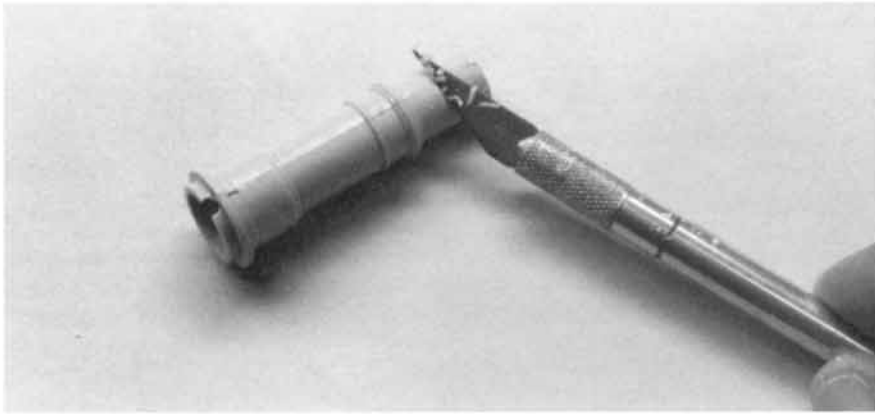
When you are ready to begin gluing parts tape them together with masking tape. Tape the halves securely and use as much tape as necessary to hold them the way you want them. For gluing parts with super glue use Duro's white tube super glue and a .5 mm lead pencil or a thin length of wire as a glue applicator. I usually use the .5 mm pencil for thicker applications, such as those along hull seam lines. For precise applications of small amounts of super glue, use a thin wire as an applicator.

Make a small puddle of glue on a piece of paper. When you put the glue on paper for the first time the paper will absorb most of it, so let the first puddle dry and then place more on top of it. Dip the tip of the lead pencil or wire into the puddle and run the tip

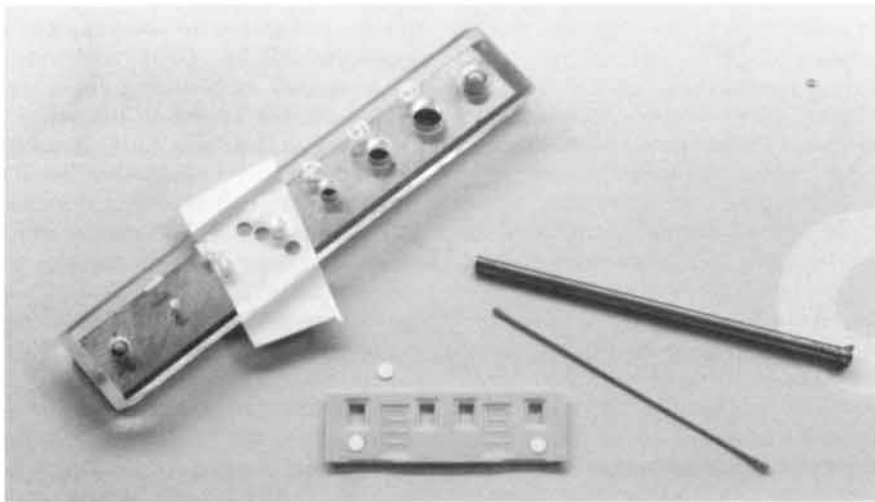
along the seam line, between the edges of the masking tape. Do not let the tip get closer to the tape than approximately 1/16" to 1/8" inch. This will keep glue from getting under the tape, making it adhere to the plastic. Capillary action will pull the glue between the parts along their gluing surfaces. You will also find that the glue acts as a filler. You may need to apply several layers to get the glue to cover the surface of the seam. The applicator tip will tend to build up dried super glue, so scrape this buildup off occasionally.

After the glue has dried—approximately five minutes—you can remove the tape and glue where the tape was located. Small amounts of glue work better than large amounts, so don't be concerned about the small volume that appears along the seam line—this stuff is strong.

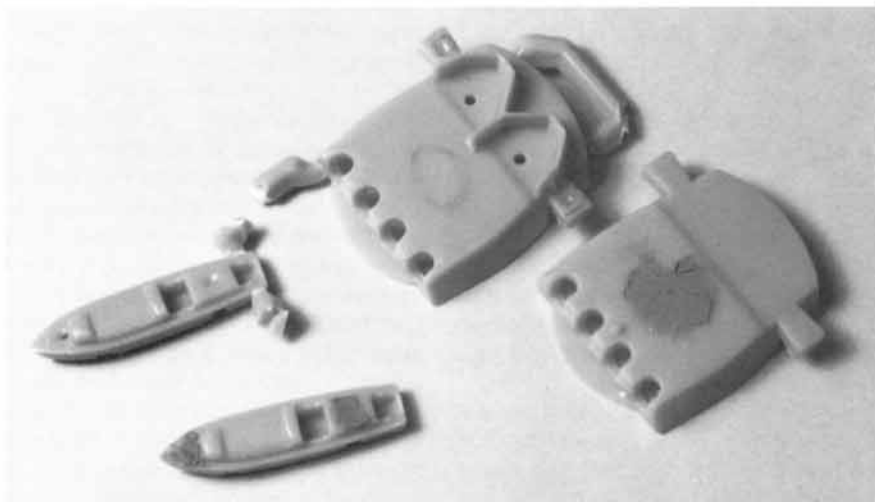
Cleaning up the seams. To remove excess glue and contour and smooth the glued surfaces, scrape with a number 11 X-Acto blade, mask along the edges of the seam to protect surface detail, and sand. Check the seam for cracks and imperfections by applying silver paint to the area as well as to other areas where you applied super glue. Apply more super glue where needed and remove the paint after the glue has dried. Painted areas that you applied the super glue to will remain silver. As you sand them the silver paint will slowly disappear, which indicates that the imperfection is filled and sanded smooth. You may have to repeat this two or three times to get rid of all the imperfections. When using super glue remember that it is clear, and because the amount of glue



A light scraping action using a number 11 X-Acto blade removes most excess super glue. Scraping the super glue flat also reduces your sanding work.



Waldron Product's punch tool is great for fixing indented injection marks. This tool is as valuable as an X-Acto knife.



Although dimples can easily be fixed with super glue, you can also use putty, as long as you are careful to sand the putty smooth.

is so small, it may appear as if there is none there at all.

EJECTION MARKS AND DIMPLES

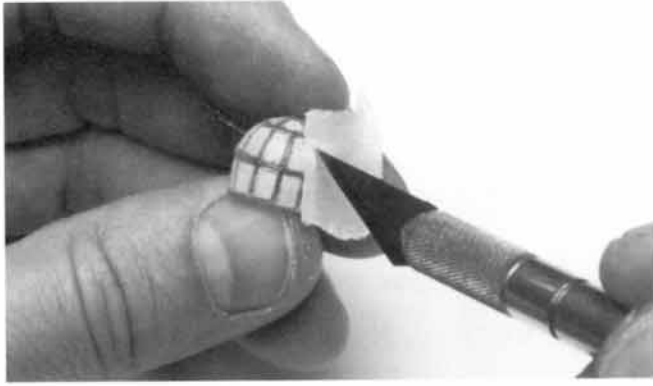
Ejection marks can either be indented or raised, are almost always round, and are usually in places that are hard to get at and correct. The first step in dealing with them is to determine if you need to do any work at all, so check to see if they will be noticeable when the part is positioned. Although this takes a little time and some creativity with masking tape, it is well worth the effort. If the marks aren't noticeable don't waste time correcting them.

You can fill ejection mark holes with either quick-gel super glue or putty and sand them smooth. If you use putty, apply it with a flat-tipped X-Acto blade and then run the blade across the ejection mark to smooth it out as if it were super glue. Another method is to use Waldron Product's punch set to punch out a plastic disk. Although this tool was designed for aircraft modeling it has hundreds of uses with ships. Place a small drop of super glue at the center of the indentation, insert the disk, and sand it smooth. Even if the hole is slightly larger than the disk, gluing it into the indentation and filling the remaining area with super glue is the best way to deal with it.

Raised ejection marks are usually easier to correct because you are removing plastic instead of replacing and filling in. You can either scrape the plastic flat with a number 11 or 16 X-Acto blade and sand the surface smooth, or just use sandpaper. If the raised mark appears near raised or scribed detail, mask these areas to protect them.

Dimples on ship models usually appear on small parts and are generally located on flat surfaces. Apply a small drop of Duro's quick-gel super glue to the dimple and sand smooth after it dries. To speed up drying, add a drop of super glue accelerator. Check the dimple with silver paint after you've sanded it flat. If there is still a slight indentation, apply more glue and sand smooth. Generally, two applications of glue will do the trick.

Ship models sometimes have minor blemishes. A good example of this is on Revell's 1/426 scale *Arizona*.



If you have a steady hand you can skip using a pencil to push the tape down and just cut around the base of the raised framing. Model by Tony Shoemake, photo by Glenn Johnson.



The 1/72 scale Airfix patrol boat gun turret is ready for painting. Note that all the masking tape panels have been pushed down with a pencil to ensure that they are covering the clear panels along the edges. Model by Tony Shoemake, photo by Glenn Johnson.

The forward section of the wooden deck has some raised plastic on it and the scribed deck lines are slightly marred. The best way to deal with this problem is to sand the raised plastic off, rescribe the lines as best you can, and hide the remaining minor flaws with some deck weathering. In this case a combination of plastic work and tricking the eye with some paint hides most of the problem. This example illustrates the need to be creative in problem solving.

MASKING, PAINTING, AND ATTACHING CLEAR PARTS

Although most ship models don't have clear parts, larger scale kits such as Revell's or Airfix's 1/72 scale patrol boats do. I have found that the best way to achieve a realistic finish is to use masking tape to cover the clear panels between the framing and airbrush them.

There are two basic techniques for using this tape, and the method you choose depends on the framing on the clear part. All framing on clear parts is raised, but some manufacturers design their parts with a high relief between the clear panels and the framing. While this sometimes appears unrealistic, once it is painted it's hard to notice.

This type of framing offers a quick and easy approach to masking as long as you have a steady hand. Lay a section of tape over an area of the clear part so the tape covers a clear panel and overlaps the framing. Next, follow

the edge of the framing with the tip of a .5 mm lead pencil. This does two things: it outlines the location where the framing meets the clear panel, and it provides a line for you to follow when you cut the tape. As the pencil tip pushes the tape up against the edge of the framing you will also notice that the tape stretches slightly.

After you have finished outlining a section run a number 11 X-Acto blade along the edge of the framing where it meets the clear panel by following the pencil line. Because of the high relief the edge of the knife will follow the edge of the framing easily. Cut through the entire section of the tape so when you remove the excess you will not peel off any tape covering the clear panel. After you peel off the excess you will notice that the tape sits up against the base of the framing where it meets the clear panel. This will also allow you to paint the sides of the framing, which would be impossible if you were painting by hand. Once you have outlined the entire clear part, run the pencil along the edges of the tape one last time to ensure that all the edges are seated properly.

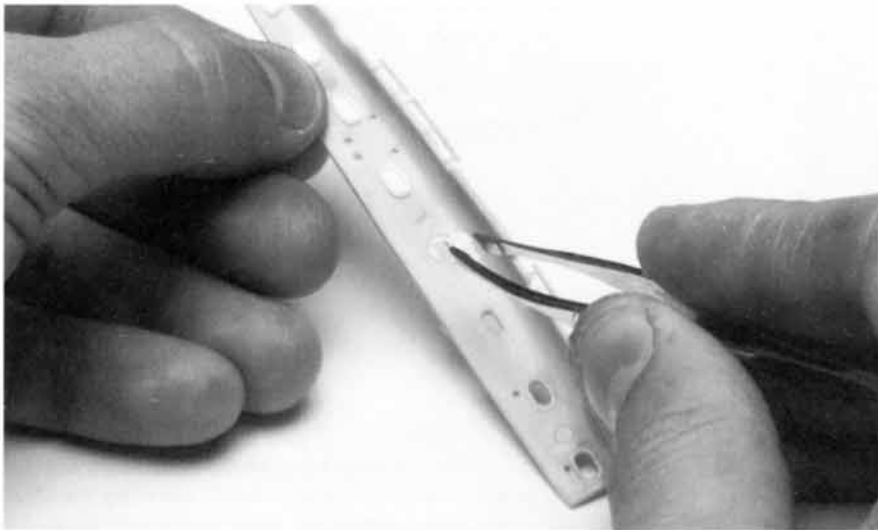
The second technique is for clear parts without a high relief, or for clear parts that already have been installed. In these instances you must cover the clear panels with very small pieces of precut masking tape. To do this, lay one strip of masking tape on your workbench and then lay another right on top of it. This top layer will be used as the masking for the clear parts.

Next, cut long thin strips, using a small triangle as a cutting guide so the lengths of masking tape have straight edges. For covering small areas or when running the masking around curved framing cut the strips approximately 1/16" wide. Next, use the triangle to cut the masking tape perpendicular to the long cuts, making each cut about 1/16" to 1/8" apart. Cut various lengths so you can use the small ones to run along framing and the larger ones to cover the large areas outlined by the tape along the framing.

When you are ready to start, peel up a piece using the tip of a number 11 X-Acto blade. Be sure you aren't lifting both layers of tape. Start anywhere along the framing edge and work your way around the entire clear panel. As you work along a framing edge, overlap the sections of tape. To ensure that the overlapped tape is attached to the plastic all along its length, press it down with a round toothpick. Once you have completed outlining a frame you can mask the center area with the larger strips.

When you have finished masking, go back over the areas where the tape meets the framing and be sure it is pressed down. To check the tape on large areas push it down with a pencil eraser. When you have finished masking the entire surface, be sure you haven't overlooked any areas and that not even a sliver of clear plastic is showing.

If the clear part can't be seen from the inside then you don't have to



To position clear parts in tight places use a pair of tweezers. Model by Tony Shoemake, photo by Glenn Johnson.

worry about masking and painting the back side. If the back side needs masking you will not have any framing to guide you, but you do have the outlines of the masking tape over the clear panels. Simply follow the masked lines and cover the center areas.

Once you have finished masking you can begin airbrushing. If you are going to prime the framing be sure you can't see the primer color from the back side of the part. This can be a problem if you have masked both sides and the lines do not exactly line up. I usually paint the framing the color required and skip the primer coat so I don't have to worry about any gray showing.

When you are ready to attach a clear part, squeeze a small puddle of Elmer's onto a piece of paper and use a toothpick to apply the glue. Position the clear part in its correct location and wipe off excess glue with a damp Q-Tip. For interior clear parts such as windows, apply glue to the perimeter of the opening, install the window, and wipe off excess. If you masked the window before you installed it you should still wipe excess glue from the masking tape so when you peel it off you won't remove any dried glue along with it.

Another nice feature of Elmer's glue is that it doubles as a filler. After it has dried you can apply more to fill voids between the clear part and the surface. It can also be used to contour the perimeter of a clear part so it looks

more like an integral part of the ship instead of an add-on.

PAINTING TIPS

Use an airbrush. For a good-quality paint finish on models, invest in an airbrush and a reliable air source such as a compressor or a CO₂ tank. An airbrush will allow you to produce the artistic effects necessary for realism and a perception of depth. With an airbrush you can apply very thin coats of paint that will not cover or hide minute detail. You can mix different colors or different shades of the same color and achieve superb weathering effects that are impossible with spray cans or a brush.

Perception of depth is the technique artists use to achieve a three-dimensional effect on flat canvas by applying various shades and tones of the same color. If a ship model is all gray and you paint it all one shade of gray your eyes will not be able to pick up the many scribed and raised details. To prevent that masterpiece from appearing as a gray blob, I recommend using different shades of the same color. Aircraft modelers use this technique to accentuate the detail inside a cockpit.

For a perception of depth pour some paint of the same color, like flat gull gray, which we will call the base color, into several 3/4-ounce airbrush jars so they are about half full. Add a drop or two of flat white to one bottle

to lighten the paint and a drop or two of flat black to the other to darken it. You are trying to achieve subtle shades of the same color, so you only need to add a few drops of lighter and darker paint to achieve this. Next, decide what parts will get what colors. For example, you could spray the hull with the lighter shade of flat gull gray, the superstructure with normal flat gull gray, and the small details such as the guns, masts, searchlights, cranes, and catapults the darker color. Once you add the red to the hull with the black boot strip and paint the deck a wood color (if it has a wood deck), the model will really stand out. Be sure to label the paint jars and keep notes on what shade was applied to what parts in case you need to do some touch-up work.

Thinning paint. As a rule I use the paint manufacturer's thinner or the thinner they suggest and I generally follow the manufacturer's recommendations for paint-to-thinner ratios. For example, I use Testor's Model Masters airbrush thinner for their Model Master paints and Testor's normal thinner in the small 1/4-ounce bottles for thinning Testor's paint in 1/4-ounce bottles. The same holds true for water-base paints. If you can't find the manufacturer's water-base thinner I recommend Polly-S thinner. Testor's Metalizer paints and their Dullcote and Glosscote paints are lacquer-based, so if you need to thin them use a lacquer thinner. Humbrol or Floquil paints are designed to be mixed with Humbrol or Floquil thinner, and if you use any other it will ruin the paint.

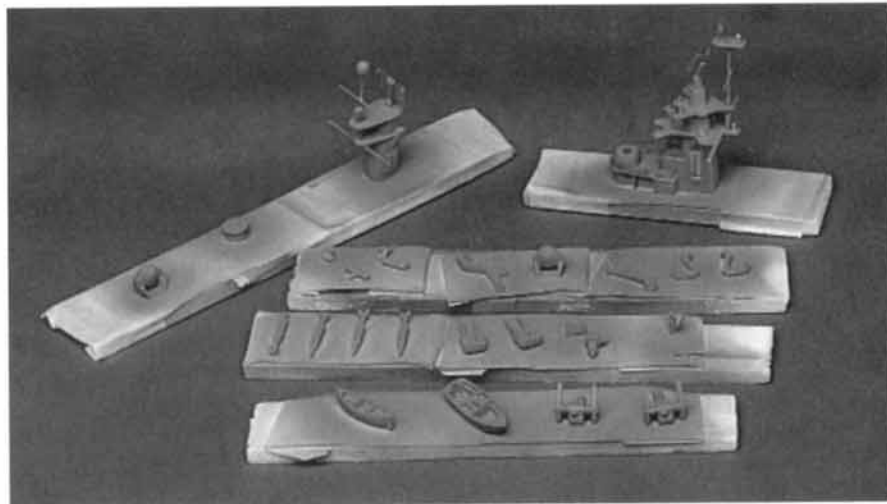
Since paint pigments tend to settle onto the bottom of the container over time, it is important to mix paint thoroughly before each use. An easy solution is to drop a few copper BBs into the paint and shake for a few minutes. I recommend copper covered BBs because steel ones will rust in water-base paints, changing the color. Sometimes I stir the paint as well as using the BBs to get the thick pigment from the bottom of the jar into solution. Another good practice is to clean the neck and top of the paint bottle and the inside of the bottle cover. This the first thing I do after I shake paint and open the bottle. It ensures a good cap seal and a longer shelf life for paints.

The easiest method for mixing proportions of thinner and paint is to start with equal volumes of paint and thinner in separate jars and use an eyedropper to add small amounts of thinner to the paint. I use Badger ¾-ounce airbrush jars for mixing paint, and by starting with equal volumes of both paint and thinner the most the paint can be thinned is 50 percent. I also mark each bottle of thinner so it corresponds to the color paint I am mixing. This way I can keep track of paint-to-thinner ratios. Be sure the paint doesn't fill more than half the mixing jar, because if it does you won't be able to get a mixture of half paint to half thinner.

I usually add about a third of the thinner that I poured into the ¾-ounce airbrush jar so I have an approximate mixture of three parts paint to one part thinner. I shake the paint and thinner until they are well mixed, then test the paint. If I need more thinner I add just a few drops at a time. If there is too much thinner some enamel paints get a dusty appearance when applied (sometimes called an orange-peel effect). What is happening is that the paint is drying just as it touches the surface of the model. If this happens, mix a new batch of paint and reduce the amount of thinner. Usually a three-to-one mixture of paint to thinner prevents this.

Pressure and temperature. Another problem that can cause the dusting or orange-peel effect is too high a pressure setting. While this is usually not a problem with small compressors, large volume compressors and CO₂ tanks with pressure adjustments can dry the paint before it hits the surface of the model if pressure is set too high. If you are getting a dusting effect, reduce the air pressure. Mixing paint is not an exact science and factors such as temperature and humidity can also affect paint. This is why it is important to test your paint before you apply it to a model. If you have problems, try the simplest fix first, such as reducing the air pressure. If that doesn't work, try a different paint-to-thinner mixture.

If you are using enamel paint, warm it before you use it. Warm paint will flow, spray, and adhere to a surface better than cold paint. Use a coffee cup warmer plate. It warms paint



Always prime your parts and give them one last check for seam flaws. Balsa wood strips make excellent parts holders for all your painting needs, and the low-tack glue used on 3M painter's masking tape will leave no glue residue on the parts. Photo by Glenn Johnson.

in a few minutes and is easy and safe to use. When you place the paint jar on the plate, loosen the cap so that the paint will not pressurize the air in the jar as it warms up and expands. After warming the paint, shake it again so the hotter paint at the bottom of the jar will mix with the cooler paint at the top.

Storage. When I am finished with the paint, I leave it in the airbrush jar and label it with the manufacturer's name, the color name, a federal stock reference (FS) number (if applicable), and the approximate proportions of paint and thinner.

I usually end up with 10 or so jars of thinned paint when I am finished with a model. Since they do not have a long shelf life I usually pour them into a large container and clean the jars and caps. When this container is full I take it along with any empty or unused paint containers to the local recycling center for disposal.

When you first open a bottle of paint, write the date on the label. Once the bottle has been open for 4 to 6 months it goes into the recycle box. I never use an already-opened bottle of paint on a new ship model.

Surface preparation is important for a good finish. When you first open the box, give all the trees a mild scrubbing with warm water, Ivory soap, and a soft toothbrush. This will remove oils and release agents. Before painting,

the surface should be free of sanding dust, polishing residue, and the oil from your fingers. I recommend Polly-S Plastic Prep for this. It cleans plastic, leaves no residue, and makes the plastic static-free so dust won't be attracted to it.

Before painting, mask areas that have been pre-painted or need a different color. All plastic surfaces should receive a primer coat first. The primer will also act as a final detector for cracks, imperfections, and scratches. Although you should have corrected these before now, this will be your last chance to do so.

If you are using a primer or some other color to check for defects, it is important to give the plastic an even coat before the final coat. Without this the paint finish may have a slightly different color on areas that have no undercoat. It's also important that the plastic itself is at the proper temperature. Paint will not adhere properly to cold plastic.

Use a hair drier to warm the plastic and to get rid of dust that attached itself to the plastic while the model was sitting in the spray booth. I have also had great success using a hair dryer to accelerate drying of water-base paints. (The technique does not work very well on oil or petroleum base paints.) Don't let the hair dryer get too close to the plastic, however, or the plastic may warp or melt.



Rough-cut all decals and then start trimming them. Cutting out individual numbers and removing any excess clear film eliminates the possibility that any of the clear film between the numbers will have bubbles, wrinkles, or a slight amount of frosting because of air trapped under the film.

One final note—clean your airbrush after every use. If you are doing a lot of painting with different colors you can save cleaning time between color changes by cleaning the parts associated with the airbrush jar and then running thinner through the airbrush. After you have done this, remove the jar filled with thinner and spray some more to clean out the remaining thinner. Wipe the tip of the airbrush to remove excess paint. After you have finished painting take the airbrush apart and clean all the parts. Take care of your airbrush and it will give you excellent results and dependable service.

DECALS

The secret to preventing the clear sections of decals from acquiring a silver appearance is to apply them to a gloss finish. Since almost all ship models have a flat finish, you must airbrush a coat of clear gloss, apply the decals, then airbrush a coat of clear flat to restore the dull appearance of the paint. When you apply the clear coats, apply them to the entire model, because if you don't you will be able to detect the difference under certain light conditions. Just about every paint manufacturer markets clear gloss and flat finishes, but I have had the best success with water-base clear gloss

and flat finishes applied to either enamel or water-base colored paints. Another advantage to a gloss finish is that the decals slide easily, which is helpful when positioning them or if a decal folds under itself.

Cutting decals. To cut out decals, rough-cut first with scissors or an X-Acto knife. In most cases you can use scissors, but if the decals are close together and you have to bend the sheet to cut around one, use a sharp number 11 X-Acto blade. Bending the sheet while decals are dry may crack and fracture the inks, so be careful. Do all knife cutting on a glass plate.

I leave a border of approximately $\frac{3}{16}$ " to $\frac{1}{8}$ " border around decals, and I cut them as I apply them. In other words, cut out one decal, trim the excess clear film, apply the decal, and repeat the process for the next one. Nothing is more frustrating than cutting out several decals and misplacing one. This can easily happen because the process is messy, and as you cut out and trim decals your workbench will be littered with bits and pieces of the sheet.

After you have rough-cut a decal, remove as much clear film along its outer edges as possible. If the decal is a series of numbers such as those found on hulls and it is small, remove the clear film from the perimeter of

the entire series. If the series is large and the numbers are spaced far enough apart you may want to cut them out separately, trim around each number, and apply them individually to the model.

If the decal has clear film surrounded by a colored portion, as does the upper portion of the number 9, you don't have to remove the film from the central areas. If you applied the clear gloss paint correctly the clear film will blend in.

If you decide to remove all excess carrier film from the perimeter of a number there are several problems to be aware of. First, it is time-consuming. When the numbers are applied they must be lined up and evenly spaced. Although this isn't difficult, you need a good eye to be able to judge the spacing.

Whether you are cutting along straight or jagged edges, use a sharp number 11 X-Acto blade. If you are cutting small areas with the X-Acto knife you can get away with doing it free-hand, but for long cuts use a straight-edge to help guide the blade. Sometimes when you are cutting into tight corners along a decal's edge the cutting lines may not connect, leaving a tiny area uncut. If this happens, don't tear the carrier film from the decal because this may tear some of the inked area. The film should fall free from the decal. If it doesn't, identify the problem spot and do some more cutting.

If you are cutting large shapes like aircraft carrier flight deck numbers and you feel confident with your scissors you can cut the excess carrier film by rotating the decal as you cut along its edge. Another tip is to practice cutting out the shapes before you actually cut the carrier film from the edges of the decal. Make a photocopy of the decal sheet for practice cutting.

Applying decals. Fill a clear glass container with lukewarm water, add a few drops of Elmer's white glue, and stir the mixture until it becomes slightly milky. Prior to picking up a decal with your tweezers, wrap the tips with small strips of masking tape to prevent damage to the decal. Keep your sheet away from the glass jar so wet decals won't drip into it.

Dip the decal into the water-glue solution. If it is small, dip it for no more

than 5 or 6 seconds. If it is large, let it sit for about 10 seconds. When you dip make sure the entire decal is submerged, and when you are ready to take it out let the excess solution drip onto a tissue. Don't let the decal float in the solution—the glue that holds it to the backing paper may dissolve quickly, allowing the decal to lift off the paper or, worse yet, sink to the bottom of the glass. If the decal does slide off the backing you can just about kiss it good-bye, so watch it carefully once you immerse it. After you have removed it from the water let it sit until it will slide freely across its backing.

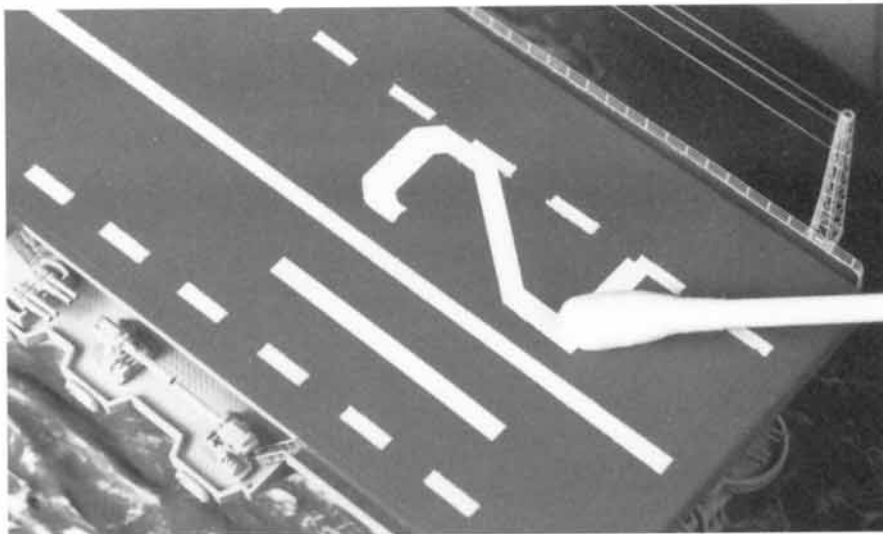
While you are waiting, apply decal-setting solution to the model's surface. Use Q-Tips—they absorb just enough solution and will not damage decals. If you use a two-step process like the Microscale System, separate the bottles by putting them on either side of the workbench. This way you will not mix up the Q-Tips you are using as applicators, although you must be sure to return the Q-Tip to the correct side.

When the decal is ready to be applied, slide it slightly off the backing with a damp Q-Tip and grab the backing with the tweezers. Place it next to the surface of the model with the tweezers in one hand and a damp Q-Tip dipped into setting solution in the other. Lay it on the surface of the model, place the Q-Tip onto the decal, and pull the backing away from the Q-Tip. Use the Q-Tip to position the decal, but be careful not to put too much pressure on it.

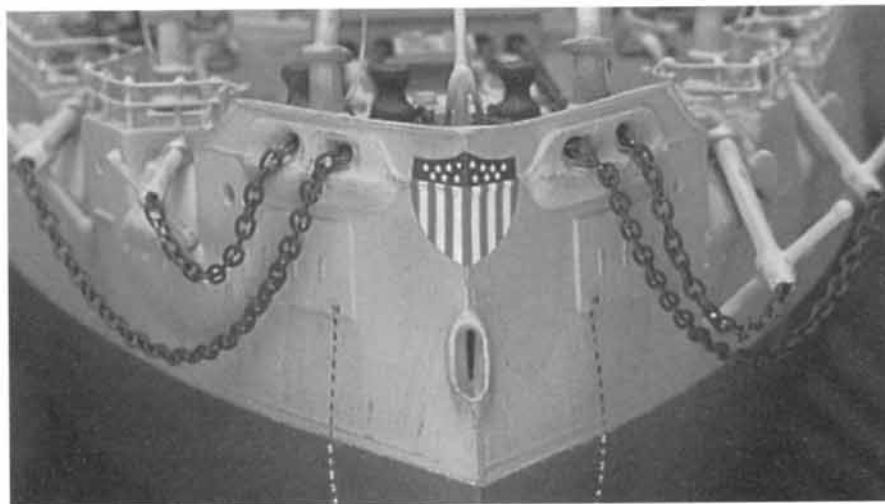
Once the decal is positioned correctly, press it with a damp tissue or foam sponge. Keep the decal wet while you are working with it, and if it starts to dry, apply more setting solution.

After you have applied a decal and are satisfied with its appearance and position, soak up excess water and setting solution before it dries. Water that dries on the model will usually leave a stain, which can be removed by washing the affected surface with a damp Q-Tip dipped in water and drying the surface with tissue paper.

To get the decal to really snuggle down around detail you will have to apply several coats of setting solution. I usually apply at least three or four coats of setting solution and let each coat dry completely. Apply setting



Use a Q-Tip moistened with decal-setting solution to position the decal, to remove any wrinkles, and to apply successive coats of setting solution.



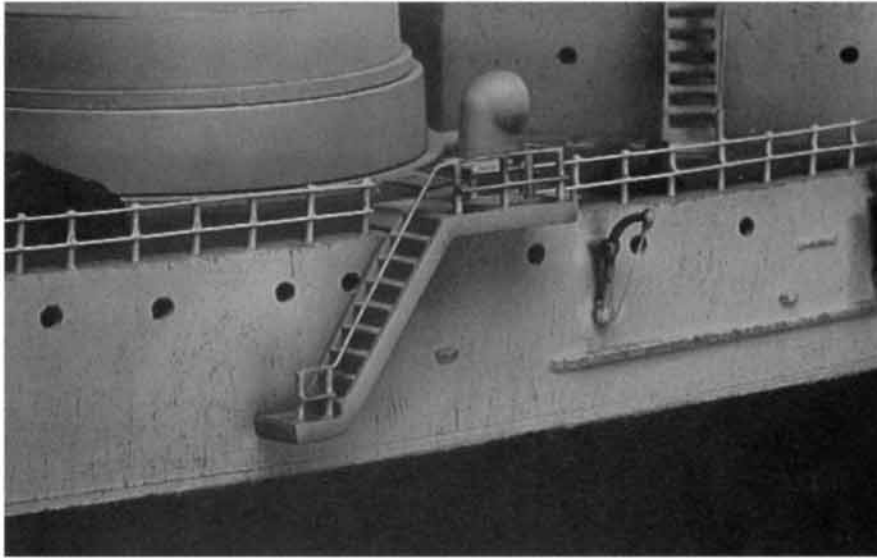
The bow decal on Glenco's 1/225 scale *Oregon* looks as though it was painted on, thanks to good decal application techniques and setting solution. Photo by Glenn Johnson.

solution with a Q-Tip, only wetting the surface of the decal. As the solution dries it will pull the decal down around detail, and it should flatten out. If tiny air bubbles appear, pop them with a pin, apply some more setting solution, and press down where the bubbles were. Each successive coat of solution will pull the decal down around detail until it appears painted on. If the decal is lying against a surface with no raised detail, don't waste your time applying setting solution because there is nothing for it to conform to.

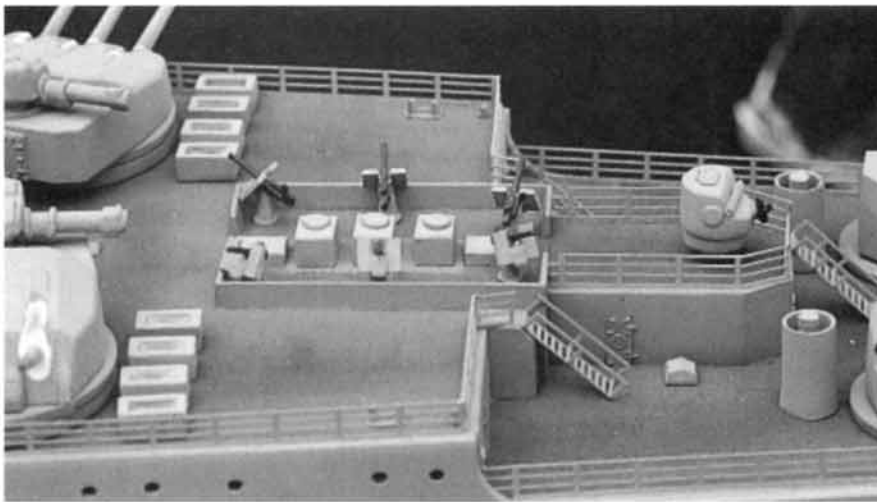
After you have applied all decals

and removed water and setting solution stains, decide if you want to weather them before applying a protective coating. If weathering is not in your plans then give the decals a coating of clear flat paint to protect them. If they are on the ship's hull give the entire hull a shot of clear flat. If the model is an aircraft carrier, cover the entire flight deck with clear flat. The point here is to be consistent with the application of paint so the colors are consistent over the entire model.

The next step is to weather the ship and then weather the decals, so



Areas on ships that have a lot of wear or are constantly exposed to the sea always have hints of rust. Photo by Glenn Johnson.



Weathered wood decks always look much more realistic than perfectly painted ones. Weathering also allows you to hide flaws by playing tricks on the human eye with paint colors, shading, and weathering. Photo by Glenn Johnson.

let's talk about general ship weathering first and then discuss decal weathering techniques.

WEATHERING SHIPS AND HIGHLIGHTING DETAIL

Besides using various shades of paint to create a perception of depth, keep in mind that paint colors appear darker on scale models than they would on the actual ship. This is commonly referred to as the scale effect of paint. Recently, paint manufacturers have been marketing paints that

account for this by offering colors that have been lightened. The selection of lightened colors is limited for ship modelers, but you can achieve the same effect by adding a lighter color to the base color. For example, if you are using sea blue for the deck, lighten it with a few drops of white. Test the new color by applying the base color to a sheet of plastic and then applying the new shade next to it to see the difference. You may need to experiment with the number of drops until you get the shade you want.

Also, all horizontal surfaces on ships fade in the sun. So in addition to the drops of white you added to achieve a scale effect you may want to lighten the color some more to account for this. Wood deck surfaces as well as any steel horizontal surfaces fade a lot, especially if the ship has been at sea for any length of time in the Pacific. The addition of the lighter color to account for the sun's rays is the first step in weathering a ship.

Hints of rust are common on warships, especially around the bow and stern and along the edge of the main deck. Generally, any location where there is a lot of deck activity that wears away paint will start to show signs of surface rust. Areas that get a lot of saltwater spray also tend to have hints of rust.

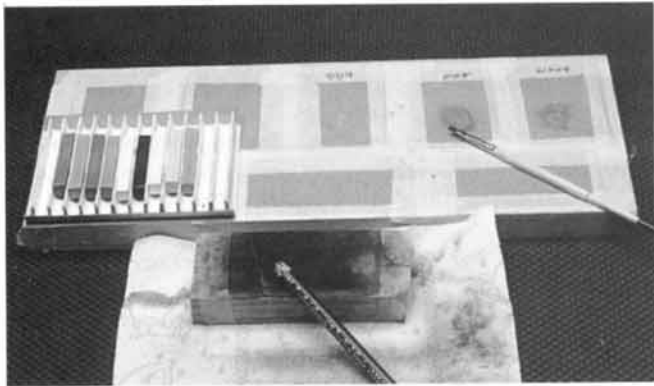
Weathering can also be applied around the smokestacks. Soot from the stacks can give everything in the area a sooty color. This is especially true if the ship has been at sea for any length of time and under high-power runs.

I have found that the best way to represent rust and soot on ship models is to use pencil pastel dust. These pencils can be found in any art supply store, but don't confuse them with chalk pastels. There is a difference between pencil and chalk pastel dust, and the pencil dust definitely provides a better visual effect of rust or soot.

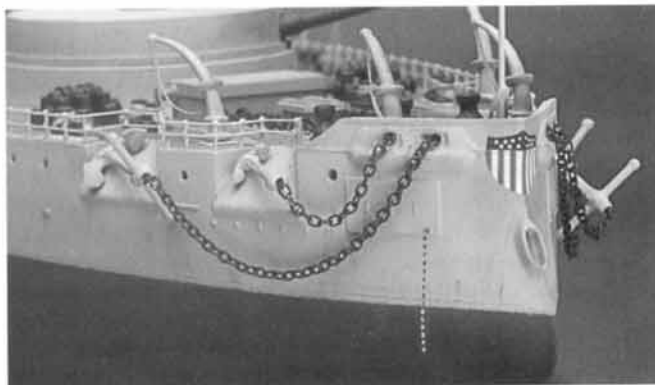
To highlight the wood deck and to weather it I use a combination of pencils and pencil pastels. If the wood detail is raised and the wood planks are close together I sometimes use a soft, thick pencil with a flattened end. I let the end of the pencil run along the raised lines and lightly rub it with my finger. I also use pencil pastels to highlight scribed wood lines and to simulate weathered and dirty decks.

To apply pastel dust, set up a grid of sandpaper sections and use one section for each color. I have a large piece of flat pine with sections of sandpaper taped to it, and each grid is marked with the pastel number that is stenciled on the pencil.

Before working with the pastels you must do some surface preparation on the model. Give the surface a coat of a water-base clear gloss. This will allow you to brush on the pastel dust and blow away the residue, leaving only a faint amount of the pastel



Organization is the key when you're using different colors and shades of pencil pastels. This type of arrangement also keeps you from mixing up colors as you apply them. Photo by Glenn Johnson.



There are always hints of rust around the bow area of a ship, especially where the chains touch or rub the hull. Photo by Glenn Johnson.

color. When you are done, give the surface a coat of water-based clear flat to seal the pastel and blend it. I recommend applying a clear gloss finish before you apply pastels. If you apply pastels to a flat surface the rough surface of the paint will capture a lot of the pastel dust, resulting in a heavy coloration.

To apply pastel, rub the pencil onto the sandpaper so you get a healthy pile of dust. Take a small flat sable brush and dip it into the pile. Run the brush across a piece of paper to remove most of the dust and apply it to the surface of the model, using a soft, even stroke in one direction. For rust, streak the pastel from the edge of the deck downward and with a slight sweep toward the stern. At the bow where the anchor is, rust can appear as streaks where the anchor or the chain rubs against the hull. The

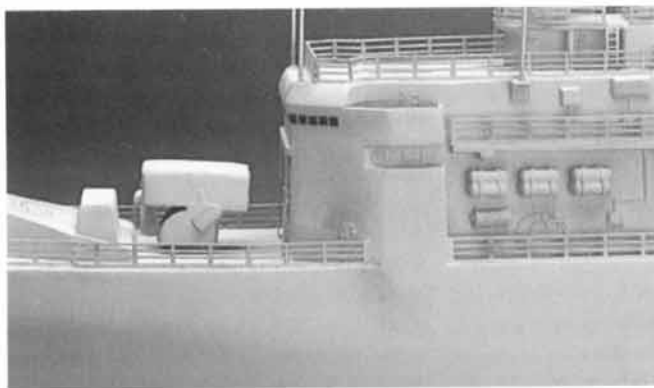
anchors would also appear to have a slight hint of rust, as would the deck areas where the chains lie, and around the capstans. Salt spray sweeps from the bow to the stern, so your brush strokes should simulate this. Once you have used brushes for pastel work, don't use them for anything else.

Soot should appear as a sooty layer heavier at the stack and more subtle as you move away from it. Areas to the stern of the smokestack have heavier deposits of soot than those forward because most of the smoke blows toward the stern. When you apply the clear flat to these areas the pastel dust will blend in.

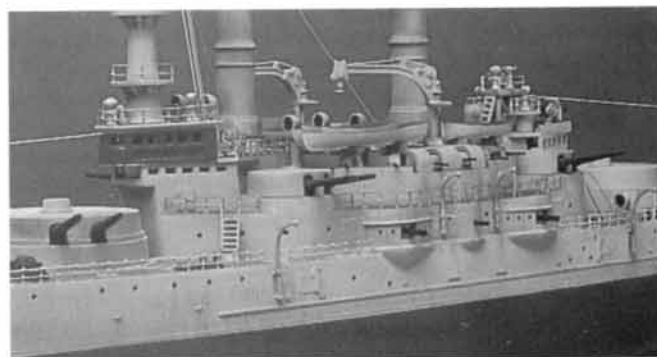
To highlight surface detail such as fire-fighting equipment, ladders, piping, and hatch clamps you can use drybrushing. To drybrush add a drop of white or black to the superstructure base color so there is a subtle shade

difference between the original color and the color you will be drybrushing. Next, dip the tip of a small flat sable brush into the paint and run it across a piece of paper until only a hint of the paint is left on the brush. Lightly run it across the surface detail, stroking in one direction. The brush will deposit fine particles of paint onto the detail. Don't press hard on the paintbrush because you don't want paint on the surface of the superstructure.

You will only be able to cover small areas at a time, so you must repeat this several times until you get all the raised detail highlighted. It is easy to overdo the drybrushing technique, so remember you are only trying to highlight detail by giving it a hit of a different color so the eye can pick it up. The brush will become clogged with dry paint quickly, so clean it frequently and be sure it is free



Rust also occurs along the deck line of the hull, especially in areas where the water sweeps along the deck and then drains back into the sea. Photo by Glenn Johnson.



Smokestack soot can be very heavy on ships that have been out to sea for a while, so if you plan to heavily weather your model don't forget the stacks and the areas around the stacks. Photo by Glenn Johnson.

of thinner before you use it for dry-brushing again.

WEATHERING DECALS

Decals applied to warships may include numbers on the hull sides and the ship's name on the stern, but ships with flight decks are another story. There can be numerous decals on these, especially if the ship model is a modern aircraft carrier. Flight decks get extensive use, which results in wear and tear on painted surfaces. These areas also have the sun beating on them all day, so paint will fade.

The first step in weathering decals is to apply a coat of clear gloss paint. This will provide a protective coating for decals and a good adhesion surface for additional paint. For all weathering I recommend water-base paints. When you weather decals you will be using paint mixtures that are almost all thinner. If you use water-base paints the thinner will not affect the surface paint even if it is a water-base color. It is important to be sure the surface paint is dry, so let the model sit for a few days.

The fading effect on the decals is subtle, so mix a very dilute solution of flat white, light gray, or a dust color. Polly-S weathering paint colors are great for this. Use a paint-to-thinner ratio of no more than 25 percent paint to 75 percent thinner. Before you spray the model, test the paint to ensure that it will not coat the model's surface with paint particles. What you want is a hint of the light color on the model's surface. When you airbrush with this consistency of paint to thinner you will find that the surface will be coated with almost all thinner and little paint pigment. Don't disturb the wet surface. The water-base paints will dry in a few minutes, leaving behind a subtle dusting of a light color.

Be careful when applying paint that is mostly thinner. Generally the airbrush should be held farther away from the surface than usual. When you are finished, give the surface another coating of clear flat to seal. The last coat will also help blend the paint particles into the surface.

REQUIRED TOOLS AND EQUIPMENT

Listed below are the tools and equipment you will need to build and

detail your model. All the items listed are mentioned throughout the book. Where appropriate I have included the names of suppliers or recommended manufacturers.

Glues. The fillers and glues I use include Testor's modeling putty, Squadron Shop's Green Stuff, the white and blue tube super glues marketed by the Duro Corporation, two-part epoxy adhesive marketed by the Devcon Corporation and Elmer's or Kristal Kleer's white glue. Duro's super glue and Devcon's two-part epoxy can be found in just about any hardware store. To apply Duro's white tube super glue or other super glues, I use a .5 mm mechanical (lead) pencil for thick applications and a thin wire for precise applications. You will also need to purchase a super glue accelerator. I have found that a 2-ounce bottle will last a long time. Duro's blue tube super glue is called Quick Gel and is an excellent filler. Elmer's and Kristal Kleer white glues are also excellent crack fillers for tight areas, and they can be used to attach small parts if both contact surfaces are painted with flat colors. The glue seeps into the rough surfaces of the paint resulting in a strong bond.

Sanding. For sanding I use the sandpaper from the Testor Corporation or K & S Engineering Company. It comes on a waterproof backing and can be used wet or dry. It can even be cleaned with soap, water, and a brush and reused. The grades range from 150 to 600 grit, come in 3" x 4" sheets, and are color-coded for easy identification. Flex-I-Files and Flex-I-File sanding sticks are also handy sanding implements. They're great for forming and shaping plastic and are useful in scratchbuilding and removing small surface detail such as ladders and hatches. Nail file emery boards are also useful and come in various grades. For sanding blocks I use small pieces of pine, wood dowels, balsa wood, plastic stock, or even the handles of my files. Balsa wood is especially useful because it conforms to compound areas such as wing and fuselage connection points.

Cutting tools. You can't do without an X-Acto knife and numerous blades, and I keep an ample supply of numbers 11 and 16 blades, as I use them more than any other size. I also recommend

X-Acto's stencil knife. This small-bladed knife is handy for scraping molded ship chain and for cutting stainless-steel photoetch. You will also need single-edged razor blades for general cutting, cutting photoetch, and for bending photoetched parts such as cranes, catapults, and antenna masts. Invest in a small pair of wire cutters to remove parts from their trees. Testor markets a micro shear sprue cutter, which is also a handy tool.

Waldron Products Inc. markets an excellent punch set for their aircraft instruments and placards, and you will find a thousand and one uses for it in ship building and scratchbuilding. It simplifies many projects and is great for making disks for filling indented ejection marks.

You will need an X-Acto miter box for cutting plastic stock, various-size razor saws, and a jeweler's saw. Blades for jeweler's saws come in various sizes for micro-cutting.

For cutting and reproducing small parts invest in a "chopper." They are manufactured by NorthWest Short Line Inc. and can be purchased from Micro Mart. A chopper is great for reproducing things like support braces on platforms and gunshields. You will need a supply of single-edged razor blades for the chopper, and these are also great for cutting photoetched parts. Micro Mart sells single-edged razor blades in batches of 100. To ensure that small parts you cut in a miter box are square, purchase a True Sander, also manufactured by NorthWest Short Line, Inc., and sold by Micro Mart.

You will need a glass plate for cutting decals and photoetched parts. I recommend that you duct-tape the edges to keep from getting cut. The tape also acts as a cushion between the glass and your workbench.

If you do a lot of scratchbuilding I recommend a self-healing cutting board. This is the best cutting surface ever created, and it has a lined surface, which helps in cutting and measuring. It is also great for bending photoetched parts such as cranes, catapults, and antenna masts. The contact surface of the board provides enough friction with the photoetch so it will not move as you bend it. Photographers and graphic artists use these boards for precise picture cutting, and

they can be found in arts supply stores.

Scribing. For scribing I recommend Bare Metal Foil Company's scriber. It removes the plastic instead of pushing it aside as needles do. You will also need a sewing needle scriber, which is nothing more than a sewing needle installed in a pin vise. These needles are great for rescribing wooden decks. You will need templates for drawing parts that you intend to scratchbuild. For rescribing lines such as deck detail use labeling tape for Dynmo Label Machines. Labeling tape is also useful for setting porthole lines and guiding Bare Metal's scriber. To clean out sanding dust from scribed lines use a soft toothbrush or a round toothpick.

Drilling. For drilling you will need a variable-speed motor tool, a motor tool drill press, and a motor tool vise. Various-size cutters and drill bits from 12/24 up to number 80 are a must. Larger-size drill bit sets can be found in hardware stores, and micro bits from number 60 to 80 can be purchased from Micro Mart in sets. You will also need a drill bit gauge to measure the size of the drill bits. This gauge is also great for matching plastic rod sizes to individual drill bits. For manual drilling use a twist drill designed for micro drill bits. These are great for drilling stanchion holes for railings. For hollowing out gun barrels I recommend a pin vise. I also recommend a motor tool chuck, which can also be purchased from Micro Mart. Last but not least, you should have a pair of safety glasses to protect your eyes whenever you do any cutting or drilling.

Precision equipment. You will need a good selection of drafting templates. At a minimum you should have circles, squares, rectangles, and ellipses. A set of small, clear drafting triangles is also a must. You cannot effectively scratchbuild unless you invest a few dollars in these items.

For transferring measurements or setting the spacing on railing stanchions get a good pair of dividers.

Classic Warships markets scale rulers for model ship scratchbuilding. Rulers for scratchbuilders of aircraft models also come in handy for large-scale ship kits because the rulers have small, precise increments, which are helpful when measuring sections of plastic.

Painting tools and supplies. To clean plastic prior to applying a primer coat use Polly-S Plastic Prep. This stuff can also be used between coats to remove dust and skin oils. Polly-S also makes an excellent decal and paint remover for repair of painting disasters.

For masking I recommend Scotch 3M painter's masking tape. This tape is especially helpful for masking superstructures and deck fittings because it can be cut into small sections, it stretches, and it has great adhesive qualities.

For airbrushing I use various Badger airbrushes, but my favorite is the Badger 200. I just like the weight and feel of this airbrush. I also like single-action brushes because my hands are not that steady and I have found it difficult to keep the button in the same place as I airbrush. After each airbrush session clean your brush and let the parts soak in a jar of mineral spirits. I also recommend a compressor or a CO₂ bottle with a pressure regulator. Having a reliable air source is vital.

For general hand painting use a good supply of quality sable flat and round brushes of various sizes. I use small round brushes for detail and touch-up work, and I use small flat brushes for wood deck painting and touch-up where airbrush spray has seeped under the masked surface.

If you are going to weather your model, I recommend Polly-S weathering paints and pastel pencils. I run the pencils across a piece of sandpaper and apply the residue with a soft, flat brush. I recommend a good supply of quality flat brushes of various sizes for application of pastel dust. Once you have used brushes for pastel work, don't use them for anything else.

For mixing thinner with paint invest in some eyedroppers. They reduce the mess and save you clean-up time.

To detect flaws and scratches on plastic surfaces, joints, and seam lines use Testor's silver paint applied with a soft brush.

Decals. For great-looking decals you will need a decal setting solution, but be sure the solution you purchase is compatible with your decals. I use the Microscale system and it has never failed me.

For proper application of decals you will need clear gloss and flat

finishes. Testor and Polly-S make the best water-base clear flat and gloss finish products.

Photoetched parts. Gold Medal Models, Flagship Models, Toms Model Works, and Classic Warships, as well as other manufacturers, produce photoetched brass ship railings, radars, safety nets, communications towers, cranes, catapults, watertight doors, and aircraft parts such as propellers, wheels, and tailhooks for a variety of scales from 1/200 to 1/700. I don't recommend these fittings in scales larger than 1/300 because the thin brass has no depth and appears two-dimensional. In the larger scales I recommend scratchbuilding your own railings, ladders, cranes, and catapults, or modifying the kit parts. Gold Medal Models uses photoetched stainless steel for its smaller ship fittings. The advantage to stainless steel is that it is a lot stronger than brass, but it is hard to cut and it doesn't respond well if you try to flatten a bend.

To make sharp bends on photoetched railings and ladders you need a pair of flat-nosed needle pliers. Regular needle-nosed pliers have angled tips, while the flat-nosed ones are straight. This is important when you are bending railings at an angle because you want the bend to be crisp.

Plastic. Evergreen Scale Model Products markets the widest selection of plastic sheet stock, strips, rod, and tubing sizes. Their plastic is soft and easy to use, responds well to sanding and shaping, and accepts paint better than any other after-market plastic. These are great replacements for wooden decks. Plastruct Inc., which makes scale model plastic construction supplies for architects and industrial engineers, markets plastic strips and sheet stock, although the variety of sizes and shapes is limited. Their plastic is harder than Evergreen's, but their plastic rod responds well to shaping and filing when you're making gun barrels using a Dremel tool. A good supply of various-size round stock is a definite must if you plan to scratchbuild guns or replace gun barrels.

Brass wire and tubing. You will need various sizes of stiff brass wire and brass tubing for scratchbuilding masts and railings and for replacing propeller shafts. Brass tubing is also great for mounting ship models to a wooden

base. K & S Engineering, besides supplying train accessories and scratch-building materials, sells a variety of diameters of brass wire and tubing, and these can also be found in hobby and crafts stores. The diameters range from micro-thin, which is great for antennas, to 1/2" for tubing. Spools of soft, flexible brass wire in various micro diameters are a must for making railings. Arts and crafts stores carry various diameters on small spools, labeled beading wire.

Ship accessories such as chains, stanchions, davits, and bits can be purchased from ship scratchbuilders catalogs such as Model Shipways or Bluejacket shipcrafters. These accessories can also be found in well-stocked hobby stores. You can also use HO scale train chain accessories, which can be found in hobby stores that carry model railroad supplies. If all else fails, use cheap jewelry chain, which can be found in arts and crafts stores.

Cables and general rigging needs can be filled with stretched sprue or clear nylon sewing thread. Clear nylon thread can be found in sewing supply stores and also comes in other colors such as black. Unlike thin stretched sprue, which has a tendency to dissolve when it comes in contact with super glue, nylon thread responds well to super glue and bonds almost instantly. In the smaller scales use the thread without painting it, but in the larger scales paint it for a thicker appearance.

Miscellaneous tools and workplace helps. You will need a good supply of various-size tweezers and micro files. Micro Mart carries a full line of file and tweezer sets.

Round toothpicks and Q-Tips are also valuable. Toothpicks make good applicators for white glue and are great for cleaning sanding dust from scribed lines, corners, and crevices. They are also great for picking up small photoetched parts off the glass cutting board. Q-Tips come in handy for everything from cleaning your airbrush to shaping white glue. The Bare Metal Foil Co. also markets a parts placer that is excellent for placing ship fittings in tight places.

A supply of various-size wood dowels for sanding and shaping plastic

is a must. These are also great for forming curves in photoetched railings and for shaping photoetched radars. A bag of various-size dowels can be purchased from any crafts store.

Ship models have a lot of small parts and subassemblies like those found on large scale kits by Heller or Tamiya. As you assemble parts such as 40 mm Bofors or 20 mm Orlekins guns, you will need to store them until you are ready to paint and glue them in place. To keep them from getting lost or damaged, purchase a few parts bins with tops. These can be found in arts and crafts stores or fabric stores.

Two-part resin is a must for filling interior areas of models and for displaying them. Resin can be purchased from hobby stores, Micro Mart, or the Bare Metal Foil Co. in various size containers. You can extend the shelf life of two-part resin by keeping it in the refrigerator, but you have to let it warm up to room temperature before you can use it. I have had great success with resin lasting eight months to a year by keeping it cold, cleaning the caps on the bottles after every use, and making sure the caps were on tight.

For good lighting I use two-arm adjustable desk lamps.

Displaying your models. For displaying ship models, invest in good-quality wood stock or purchase ready-made wood bases from model ship suppliers such as Model Expo, Inc., and Model Shipways, Inc. You can also make them if you have access to an electric drill and a circular saw and router. I use red oak, teak, mahogany, or hard rock maple for my wood bases, and I stain them with Minwax wood stains and sealers. I also recommend using lamp finials, which can be found in just about any hardware store, for ship display pedestals. They are solid brass, are turned so they have various shapes, and are inexpensive.

There have been many articles in model magazines over the years on different ways to make water dioramas, but I have found that keeping it simple works best for me. I use Liquitex acrylic gel medium for making water. It has the consistency of thick white glue, is nontoxic, cleans up with water, and responds well to being applied with a brush. Arts and crafts stores

and artist supply stores carry this gel medium in various-size containers.

Reference works. Last but not least is a good supply of reference material. There are numerous inexpensive publications on individual warships and classes of warships. Your local library or school usually has good books with photos and color renderings. Several companies such as Classic Warships have begun to market scale top- and side-view renderings of warships. These are great for detailing efforts and are beautiful when framed.

The Floating Drydock company and Pacific Front Hobbies both market an extensive line of scale ship drawings of either official military blueprints or drawings by experts. If you are planning any scratchbuilding or superdetailing these drawings are a must. Ship drawings come several ways. You can get detailed drawings that include side, front, and top views and provide for detail such as the superstructure shapes and levels, arrangements of deck fittings, guns, hatches, and piping.

Most ship plans also contain what ship designers call the sheer, body, and half-breadth plans. Serious scratchbuilders and designers of master patterns for resin ship models use these to make the hull and superstructure parts. The body plan shows the front and rear view of the shape of the hull. One half of the drawing shows the hull shape from bow to midships and the other side of the drawing shows the hull shape from stern to midships. The sheer plan shows the side view of the ship's general outline, shape, and the curves of the deck, which are technically referred to as the deck sheer. The half-breadth plan shows the hull looking from the centerline of the keel up towards the main deck. There are a series of curved lines on this drawing representing the shape of the hull at a given height above the keel.

All have a scale noted on the actual drawing. They are usually in 1/96 or 1/192 scale. If you need a set of ship drawings in another scale you can have them increased or decreased in size by taking them to a blueprint shop. As long as you know the scale the drawings are in, the shop can scale them up or down for you at little cost.