



# Scale Model Instructions And Refresher

Introduction to Scale Modeling | A Beginners Guide

This instructional is divided into ten individual course sections. The information presented takes you through the basic tools, resources, construction and painting of a scale model along with tips and techniques.

## [Introduction](#)

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**Introduction:** The original 10 part series is authored by [Bill Zuk](#) and was presented to an Air Cadet Squadron in our city by IPMS Winnipeg. It has since been posted at various times at **rec.models.scale**.

## **Lesson 1 - Introduction to Scale Modeling**

Models and young builders seem to have always been around but the way models were built fifty years ago would have been very different. Model builders in the World War II era built out of balsa wood and tissue. A few more ambitious modelers carved their creations from solid wood using a plan as a guide. About this time, the solid plastic (Bakelite®) models began to appear. They were used to help pilots recognize Allied and Axis aircraft. In Europe, the simple styrene plastic models issued pre-war from the FROG Company began to be manufactured again and distributed worldwide. In North America, companies such as Revell®, Aurora®, and Monogram® began making plastic model kits in the late 1940's.

That was the basis for the story of injection molded plastic (polystyrene) scale models begins in the early 1950's when two businessmen (Lewis Glasser in America, founder of Revell) and (Nicholas Kove in England, founder of Airfix) decided independently of each other to use their injection molding equipment to produce toys that the purchaser would put together with a suitable adhesive. Initially, painting the toy or model was an option only if the purchaser was able to obtain suitable household paints or artists oil paints.

Although the scale detail was crude by today's molding standards both businessmen were surprised by the sales reaction of people who readily accepted their offerings and soon a wider range of model types began to appear.

Neither of the two men were model hobbyists in any sense of the word and Lewis Glasser was even to boast that he had never made one of his company's model kits. Their interest in model kits was purely profit driven and particularly in the early years of Revell it could be safely said that the interests of scale detail and accuracy never interfered with profit making.

In fact Revell's scale policy at the time was to make the kit fit one of several sized card boxes that resulted in very unusual scale variations.

That said, it is difficult to understand how at the same time, Revell produced an excellent series of well detailed 1/90 scale sailing ships even by today's standards, complete with rigging cord and long lengths of chain. (Incidentally, this chain was coveted later on by AFV modelers). The Cutty Sark ship model was probably the most popular of the range and countless kits were bought and stored by purchasers to build in their retirement many years to come. In fact by the time retirement came around many of the builder usually had shaky hands and poor eyesight and induced younger people to build the kits for them.

The model kits at first were very toy-like and other than they required assembly, did not resemble modern models.

Today, a well-constructed and accurately painted model kit is a miniature replica. The main difference between a toy and a model is the model builder who takes the time and care to make the model look real. If you have never built a plastic model kit, what you purchase is actually a complex set of detailed parts that have been designed to fit together precisely. The manufacturer typically provides a set of instructions that often contain suggestions, color references for markings, and color schemes.

You need to take into consideration several factors before purchasing your first model:

- What scale should be used? Models are miniature replica that is scaled down versions of the real thing. In aircraft modeling, you have a choice over the popular 1/72 and 1/48 scales along with larger 1/32 and even 1/24 scales. Smaller scale aircraft in 1/144 or smaller scales are also available. The general rule is that the larger the scale (1/32 or greater), the more detail you will have due to the model kit being much larger.
- What complexity do you want? Many model kits now have complete interiors and fine detailing. There is a bigger money and time investment to finish a complex kit carefully.
- Finally, what subject do you want to model? Although this text concentrates on plastic scale aircraft models, there are many different types of models available. There are also cars, trains, figures, tanks, spaceships, buildings, animals, etc., etc. to choose from.

Model building is a learned skill. With help and practice is can be fun to learn.

The actual construction process is basically two-stage: The model kit is assembled by gluing parts together and then painted or finished. Having a more experienced modeler as guide may be much more useful than any of the kit information sheets. The skills you learn in building your first models will make each future model project "much better" and more realistic. Displaying or entering competitions hones your skills even more quickly. Above all remember it's the fun of modeling that really counts. Don't be overly critical of your own or others first efforts, everyone starts that way!

## Lesson 2 - Modeling Tools

To build plastic models, you will want to create a "tool kit" of basic tools and materials along with some more specialized tools and materials. For the most part, inexpensive tools and materials are available and you can even find household and hardware items to fill up your tool kit. The basic tool/material list is:

- Hobby knife (standard #11 pointed blade)
- Sandpaper (#400 grit or finer wet or dry sandpaper)
- Liquid or tube cement (white glue, "crazy" glue)
- Masking tape (various sizes, frisket paper)
- Modeling paints (selection of colors, flat, gloss)
- Paint brushes (#00 and #1 size brushes)
- Putty or filler (A+B putty, crazy glue)
- Clamps or vises (number of different types)

Additional tools and materials can include files for sanding various surfaces and opening holes, pliers for cutting and holding pieces, and drills and various drill bits for making holes. A great number of homemade tools can be used including adapting common items to do another job, for example, twisting a wire coat hanger into a holder for painting models or using rubber bands as a means of holding parts together while gluing. These easily obtainable tools and a suggested use are:

- Scissors (cutting decal sheets)
- Nail clippers (separating parts on the sprue)
- Toothpicks (to replace small plastic parts, to hold parts like wheels for painting or for stirring paint)
- Swizzle sticks (for paint stirring and mixing)
- Dental picks (just ask your dentist for old picks which are great for cleaning up filler and carving plastic)
- Kitchen cleansers (for washing plastic parts)
- Small plastic or glass tubs or containers (to hold parts, for decal solutions and paint mixing)
- Transparent plastic tapes (for masking or for holding parts)
- Plasticize or clay (for holding parts and weight distribution)
- Black ink (for detailing parts such as panel lines)
- And tweezers (great for holding parts and positioning them).

The big challenge is to learn to use each of the tools and make the most of them. Remember the old adage "A good workman (or craftsman) never blames his tools".

## Lesson 3 - Research and Planning:

To make a model a miniature replica, the builder must take the time and care to

build the model to look real. You must first plan out the project from start to finish. Research for specific details is what will make your model a more precise replica.

The kit manufacturer typically provides an instruction sheet (or guide), often including suggestions for ease of assembly along with color references for markings and color schemes. Understanding the guide will help in planning out the final model as well as determining the stages of assembly, painting and detailing. If you need model building information, a general source such as a book or magazine may help. If you require exact details about your modeling project, then specialized research may be necessary. The best source of information is a first-hand collection of data such as seeing the original item in person to take notes, drawings or photographs. The next best sources are specialized research materials such as manuals, photographs, interviews and other second-hand sources. After these sources are reference sources such as books, magazines or other materials that cover the subject in a more general manner. Consider a [model club](#). You may find that you can benefit from a group of friends getting together to talk and learn about modeling. You can share experiences, swap stories as well as parts and tools and find that you will gain much more from modeling!

General Sources		Specialized Sources	
TITLE	PUBLISHER	TITLE	PUBLISHER/SOURCE
Hints and Tips for Plastic Modeling	Angle, Burt, ed., IPMS USA, Kalmbach Publishing, 1980	Fine Scale Modeler	Wakeusha, WI, Kalmbach Publishing
The Best of the Basics from Fine Scale Modeler Magazine	Wakeusha, WI, Kalmbach Publishing, 1992	RT, IPMS Canada	PO Box 626, Str. B, Ottawa, Ontario, Canada K1P 5P7
Scale Modeling Tips and Techniques	Hembree, Mark, ed., Wakeusha, WI, Kalmbach Publishing, 1992	Squadron/Signal Publications	1115 Crowley Dr., Carrollton, Texas, 75006
The Modelmaker's Handbook	Jackson, Albert & Day, David, New York, Knopf, 1982	IPMS USA	P.O. Box 6138, Warner Robins, GA 31095-6138
Building Plastic Models	Schleicher, Robert, ed., Wakeusha, WI.	IPMS CANADA	P.O. Box 626, Station B, Ottawa, Ontario.

## Lesson 4 - Construction

**Work Space:** You will need a room with a flat working space- the larger the better. Avoid bedrooms if you can, as they are too dusty for painting. Most often a garage, basement room or recreation room will be the workspace but a custom-designed room will be the best! You will also need lots of light, preferably from windows or from a high-intensity light. Try to find an area where you can work for several hours without being bothered, as you may have to leave glued or painted parts in place overnight without moving them.

**Assembly:** Protect your working area by spreading a newspaper or drop cloth under the model. This will protect the table surface from spilled glue or paint. Read the kit manufacturers instructions carefully before starting and familiarize yourself with the way the kit will be assembled. The following are the general assembly steps to model kit construction:

1. Examine the parts of the kit while they are attached to the parts tree. Keep In mind that parts can be painted while still attached. Review the "finishing" section of your kit before painting.
2. Remove flash or extra bits of plastic from the parts with your hobby knife or sandpaper. Small rough spots should be scraped off with the edge of the blade end and smoothed over with sanding. Do your trimming on a piece of flat scrap wood or glass and never hold plastic pieces against your hand when cutting. Cut the parts off carefully with a saw, pinchers or sharp blade.
3. Try fitting pieces together without gluing first in case adjustments must be made. Painted parts must be thoroughly dry before gluing. Do not get paint on surfaces to be glued.
4. Usually assemble parts in the order shown in your instructions. Sometimes to paint certain sections you may want to assemble them first. For example: interior areas should be assembled and painted before final assembly.
5. Both tube type and liquid type plastic model cement is available. Tube cement can make a strong joint but should be used carefully. It is critical to use only enough cement to do the job. Cements for plastic models contain a "welding" agent, which actually fuses the plastic together so only a small amount is needed. Remember to scrape away paint or chrome plating from surfaces to be joined. Liquid cement is used differently: Hold the parts to be joined together then dip a brush into the liquid cement and touch the joint. The glue will flow along the opening to fuse the parts together. Some modelers prefer liquid cement for some applications because it can produce a cleaner bond. "Crazy glue" or cyanoacrylate glues are another alternative for strong, long-lasting bonds. For

- clear parts you can use white glue which is easier to work with and dries clear. Be aware that white glue does not actually "glue" the parts together and cannot be used on parts that need strength.
6. Try to get the glue to work the first time. Use tape, clamps or rubber bands to hold parts together while the glue is drying. Glued sections, which support a lot of weight, must usually dry overnight before stress is placed on them. Use tweezers to hold and move small parts and a toothpick to transfer glue.
  7. Fill cracks between sections with plastic putty. It shrinks when drying, so build up a little ridge along fill lines so that it can be sanded flush with the surface later. To smooth putty when it is wet, use your finger dipped in rubbing alcohol. When thoroughly dry, sand carefully with fine sandpaper until flush, and then smooth it with wet and dry paper. Allow 24 hours for drying. When the putty has set, file down the excess with sandpaper using wet or dry for the final smoothing. If any gaps or uneven spaces remain, fill them again and allow another 24 hours for drying. Then paint over the puttied area with flat gray before applying final colors.
  8. Avoid getting cement on clear plastic pieces but if they become scratched or clouded, these areas can be removed by polishing them carefully with toothpaste, fine grit sandpaper or even car wax. Try attaching clear pieces with white glue which although not as strong as plastic cement will hold the parts in place and dries transparently.

## Lesson 5 - Painting

**Brushes and Paint:** Be sure your brushes are soft, clean, and flexible. Keep them that way by cleaning with brush cleaner or mineral spirits. Bottle paints should be stirred completely with a stick handle or toothpick. Spray paints must be shaken thoroughly- you can hear the agitator ball in the can. Two types of paint are usually used: Oil based enamels which spread thinly and spray very well and water based acrylic which are easy to clean up and cover very well. Match your paint thinners to the type of paints. Follow these steps in painting:

1. Wash all plastic parts in warm, soapy water especially any flexible polystyrene parts, such as some HO scale figures before painting. Dry parts thoroughly. If they have been stored for a while, brush clean of dust with a tack rag available at automotive supply stores.
2. For best results, paint plastic surfaces with a neutral or gray primer before final color application. This is very important if you are painting light colors over dark plastic. Coat metals with an appropriate primer before painting. Some miniature metal figures come already primed so check their instructions. Small parts can often be painted directly on the plastic tree or sprue before being cut off. Touch up the parts after detaching them.
3. You may want to pencil in outlines shapes of such things as camouflage or separate colors before painting.
4. Brush paint in one direction. If your paint is the right consistency, the brush strokes will disappear as it dries. If not, thin it with mineral spirits or paint thinner. Use a brush size that matches the area being painted. For special treatments,

- create a brush shape by cutting the bristles to a point or other shape. For stippling paint, use a square-tipped brush or a sponge.
5. Paint light colors first and work towards the darkest colors, leaving enough time for the paint to dry or cure- usually 24 hours for most enamels and at least a few hours for acrylic.
  6. Mask with tape or frisket. Using "magic" type tape that is low tack (or stickiness) or specially made masking film called frisket is best. Paint away from the tape rather than into it.
  7. Spray paints in a suitable location **following the manufacturers instructions**. For best results, avoid spraying when both excessive heat and humidity are present. It is important to spray light coats, holding the can at a distance of approximately two feet. Let dry two to three minutes and spray another light coat. To clear valve after using, invert can and spray several seconds. If nozzle clogs, clean with thinner.

## Lesson 6 - Finishing Techniques

**Decals:** Decals usually come with model kits but you can purchase additional decals to make your model more realistic. Some decals are stick-on but most of them are water-slide decals. Attached with the following method:

1. To apply a decal the surface must have a smooth, glossy finished or painted surface. Spray or paint a gloss finish (a fast and easy method is to use acrylic floor wax) over the entire model to avoid uneven patches when a final gloss or flat finish is added later. Allow paint to dry thoroughly.
2. For best results, decals should be applied so that they can dry horizontally. Use a jig will allow the model to lie on its side.
3. Cut each decal from the sheet as needed. Cut clear film away from design. Decals should be trimmed out as close to the printed area as possible or a section of clear border will be visible around the edge. (Some modelers using modern setting solutions prefer to leave a margin around the decal area in order for the edge of the decal to blend cleanly.) Use decal setting agent, which allows the decal to flow evenly over the model's surface to insure good results. Using tweezers, dip decal completely into water for about 10 seconds then remove and allow the decal adhesive to soften. About one minute should be sufficient.
4. While the adhesive is softening, use a soft, medium size brush, and wet the area where the decal is to be applied with a few drops of setting agent which helps eliminate tiny air bubbles.
5. Holding the decal paper with tweezers and use the brush to slide the loosened decal onto the model.
6. A decal setting solution can be applied to the decal and set the model aside for drying. After the decals have dried for several hours, carefully wipe the decal adhesive residue from the entire model using a damp, soft cloth.
7. After the decals have dried for at least 24 hours, complete the model by spraying with either a flat or gloss paint depending upon the desired sheen of the finished project.

## Lesson 7 - Detailing

**Stretched Sprue:** "Sprue" (aka parts tree) is the tubular plastic branch that your parts came attached to. There are many materials and pre-molded parts available for adding your own small details to models, but one of the most basic is the left-over plastic in your kit. If held over a candle until it is soft, it can be stretched to make threads of different thickness. These are useful for making aerials, flying wires, spark plug cables, etc. Take both ends of the plastic in either hand and place it about one inch above a candle flame but not close enough to catch fire. Be careful. When the plastic has started to distort, it can be pulled apart with an even motion. Hold apart until the plastic cools. With practice you will get the thickness and length desired.

**Detailing:** Generally it is the small details that add the most realism to models. Some standard examples:

1. Some models look more realistic when they show signs of wear and constant maintenance. Edges should be nicked with silver spots where the paint has been knocked off. Worn areas should also be indicated around access panels. Engine and exhaust stains can be simulated by applying a mixture of flat black and mineral spirits or paint thinner. Oil stains can be made in the same way but remember that oil stains should be swept across the model horizontally, as it is much lighter and moved by the slipstream. Mud stains are made by mixing brown and flat black perhaps with bit of talcum powder mixed in. Paint some panels in a lighter shade to bring out details. Rust can be simulated with a red and black, or brown mixture. For vehicles in heavy use, and abuse, parts can be bent or banged. Cut off or file down sections of the model (thin the parts by grinding or filing the part down first from behind before altering the part).
2. To show panel and part lines, a thin line of paint or ink can be applied using a brush or "Rapido-Graph" type pen. (Black may be too stark - a little gray or brown can be mixed into it for a more realistic look.)
3. Many parts that are not in scale can be replaced by more authentic looking pieces. A thin plastic sheet or wire part usually looks much more realistic than the kit part it replaces.
4. Figures have improved greatly in past years with faces in particular being highly detailed. By painting a flat color that is mixed with tan or brown, a realistic look can be achieved.
5. Transparent plastic parts can be easily modified. Windows and openings can be sawed (not cut) in two; a hobby or razor saw is good for this. Put masking tape over the rest of the piece while working to prevent damage. If your original clear piece needs replacement, you can mold another with a vacuum forming machine, using clear plastic sheets. If you don't have access to one, the following procedure can be tried: coat the outside surface of the old piece with a very thin layer of Vaseline. Next, apply a coat of clear fingernail polish and allow it to dry.

- Over a period of a few days, add more and more layers of polish until you have built up a thickness of 1/32" or more. When the final coat is dry, separate the old piece from the film of nail polish. Trim as needed and glue the molded polish part to the model with white glue.
6. Parts that are difficult to paint can be masked with adhesive tape cut into thin strips with a hobby knife and applied carefully to the surface. Thin strips of colored tape can also be used for areas.
  7. Painting has to be realistic and a thin, slightly "whitened" color that is sprayed provides the best appearance for a scale model. A blending in of colors or a subtle shading can be achieved by using artist's pastels. Grind up pastels to make a dust then apply with a soft brush.

## Lesson 8 - Presentation & Display

**Display Base:** Constant handling is a problem for a model that is not protected in some way. Little details such as aircraft landing gear, AFV machine guns, and ship masts will soon snap off if people pick up the models. Mounting your model on some type of base so the base, rather than the model itself, can be handled and moved about is a solution. Hardware, craft and hobby shops sell wooden plaques with fancy beveled edges that come suitable sizes for most models. Plaques can be finished with a simple paint job or with the same kind of sanding and varnishing you'd give a piece of furniture. A thick piece of clear plastic also can serve as a base if the edges are beveled and sanded to give it a finished look. Larger models can be mounted on plywood or plastic bases cut to fit a model's dimensions. An inexpensive picture frame with the glass taken out can also serve as a nice display base. The model can sit on its own weight or be held in place with pins or fine wires. Placing a group of models or figures onto a base that has texture can also create a diorama setting. Whatever base you choose, it will enhance the appearance of your model and enable you to handle the model without touching any of its delicate details.

**Display Case:** Once you have finished your model, how is it going to be displayed? If you have seen models in a museum, they would probably be in a glass case. You could buy a glass case, or a cabinet or bookshelf with a glass front, but it is not necessary. A box can serve as a display case if you have at least one side as a see-through panel- use a picture frame and glass for a quick display case. A clear plastic box can also serve as a good place to store models

but these kinds of cases tend to obscure details. Once you have decided how you will display your models, you will need to decide where you wish to display them. A few models could even sit outside a case on a windowsill or mantelpiece, as long as the models will not be in the sun or on a heated surface as heat will warp plastic and sunlight will cause paint to fade. Ideally, models should be displayed where the most people will see and appreciate them, however, due to the possibility of accidental damage, it may be wise to keep your models in a room or workshop when they are not being viewed by visitors.

**Cleaning:** Cleaning a model is important as dust is a perpetual problem. A dusting and, later, a thorough cleanup may be needed. A large soft brush or a photographer's puff brush (available at photo supply stores) makes good tools for large areas. Use a small, fine-pointed damp paintbrush to work around the tight and delicate areas that you can't reach with the puff brush. Vacuum clean around, but never directly on the model while you are blowing the dust away so that it doesn't settle back down. If the model has collected sticky dust, you may be able to remove the dust with a cotton swab sprayed with household Endust or Windex on a cotton swab to scrub away the sticky residue that can accumulate on a model, particularly one in a home heated by a forced-air gas-fueled furnace. Monthly dusting should keep your model clean enough to last for years. Residue that has set over a period of time may have to be scrubbed away with a brush or cotton swab dipped in lighter fluid which is a solvent for nearly every type of paint, however, so you will have to be careful to dissolve only dust and not paint. A bath in a saucer of detergent will be enough to wash away most residue and dust. All of your models need such a cleaning periodically. Don't forget to wash the detergent off or it will dry to a tacky, dust-catching finish. Repair any broken parts using quick-setting cyanoacrylate to reattach any parts which may have broken off the model, A coat of paste wax will help to protect the finish on car models or you can add a protective coat of flat clear spray to your military models.

## Lesson 9 - Airbrushing

**Airbrushing:** The airbrush can be described as a "mechanical paintbrush". By placing paint in an attachment to the airbrush and then applying some kind of air pressure, the modeler can achieve anything from pencil-thin lines of color, to uniform coverage of broad areas. Subtle tonal gradations are easy to achieve, and the modeler or artist can mix their own particular paint shade to produce any color scheme.

The most basic type of airbrush is an external mix spray gun. These are usually siphon fed with air blown through the brush and over the paint outside of the brush. The spray is less fine than most airbrushes. Internal atomization type of airbrushes (where paint and air are mixed inside the airbrush) is more common. In a simple single-action airbrush, the trigger can be pressed for air and the amount of paint (i.e. width of spray) must be preset by adjusting a knob on the end of the airbrush body. In the more complex double-action type, both air and paint flow through the airbrush. The trigger can be pushed down for air and pulled back for paint, controlling the ratio of paint to air and allowing the artist to control the width of the spray while painting.

The air pressure can be supplied through a variety of means. Cans of compressed air are silent, easily portable, simple to use, inexpensive for occasional use but for regular use are expensive, and the air pressure goes down as the can gets empty or cold. Compressors are more commonly used and can include the following types:

1. Diaphragm compressor, which uses a diaphragm to pump the air into the compressor and out the airbrush and is the least expensive type of the compressors but the diaphragm, produces a pulsing of airflow that can sometimes be seen in the artwork.
2. Piston compressor uses a piston to compress the air. It does not have the pulsating quality that the diaphragm type has but the oil that is used to lubricate the pistons can get into the airbrush occasionally and it can overheat if used for a long period of time.
3. Storage compressor contains a reservoir tank for the compressed air, so that pulsing does not occur through the airbrush but the simple types run continuously and can overheat.
4. Automatic compressor types use a reservoir. When the reservoir is filled to a certain preset pressure, it shuts itself off automatically. When pressure drops

below the preset level during use, resumes filling the reservoir. The pluses include silent operation, even pressure and that the motor does not run constantly so reduces chance of overheating but the machine tends to be very expensive.

Other air sources include CO<sub>2</sub> tanks (with pressure regulator) which are silent, refills are inexpensive and can go for quite sometime before needing refill but you need to buy a pressure regulator to use with tank since pressure straight from the tank is too high for an airbrush and the tank is heavy- definitely not portable. Car tires are cheap; you can pick up a used one just about anywhere. They can be refilled and reused often and are silent but pressure to airbrush will drop as tire deflates and constant refilling is needed; the tires are often dirty and hard to clean.

After selecting an airbrush and source of air pressure, the first thing for a beginner to do is to practice mixing a diluted paint/thinner mixture that will flow evenly from the airbrush. Generally, a thinner mixture is needed compared to that of brush painting. The combination of thinned paint, air pressure and nozzle setting of the airbrush has to be determined for each application. As more skills are learned, the modeler will be able to use the airbrush to create very accurate looking paint finishes on any type of model.

A periodic airbrush cleaning is necessary (some modelers prefer to clean after each use). Often spraying a solvent through the airbrush is all that is needed but a breakdown of the airbrush can help eliminate problems of paint buildup. Useful solvents to clean an airbrush (after taking it apart) are methyl hydrate (commonly used solvent) or lacquer thinner (great for stubborn cases but be careful as some airbrushes have internal seals that would be affected).

## **Lesson 10- Scratch Building**

**Scratchbuilding:** Why get into the area of scratchbuilding or making your own models? Basically, even though plastic kits are available for most modeler's interests, there are still examples of subjects that are not offered by manufacturers, a need to improve upon current models and the chance to create special bases for a completed model. In all of these areas, scratchbuilding techniques are needed.

The simplest scratchbuilding involves "kit-bashing" or the mix of parts from various kits to create a new version of the original kit. Some plastic kits offer the

modeler a choice of versions with "3-in- one" or other types of kits. The optional parts that are provided allow you to change the basic model. Keep all the extra parts even if they aren't used right away, as they can be the start of a parts box. It is amazing how many parts can be used in other model projects.

Accessory parts are also sold by many manufacturers, most of them small, independent companies that are called "cottage" or "garage" companies. These accessory kits are often matched to a particular model kit already in production and can include additional detail parts, decals or a combination of these materials. Although sometimes costly, accessory parts can help you create a more impressive model. Entire kits are also sold as either vacuform plastic or resin (sometimes other materials are also used such as paper or even fiberglass) that are often low production runs and can require an experienced or advanced modeler.

However, if you are making a unique model or wish to convert an existing model using available materials, scratchbuilding techniques are then employed.

**Materials:** The availability of plastic building sections from a company called Plastruct® that were designed for architectural use can give a modeler a variety of useful shapes and forms. Plastruct® structural shapes include tubes, angles, I-beams, stairs and even figures. Some plastic railroad modeling accessories for diorama building are also useful.

Other types of plastic include Styrene that is sold in sheets in both translucent and clear by plastic suppliers and can also be found in many hobby shops. The sheets are inexpensive and easy to cut and shape. Thin, clear sheets can also be used in vacuforming new parts for replacing kit windows or canopies. Acrylic plastic is much more brittle and is harder to form but has applications in bases or specialized purposes. This material is very expensive and is more difficult to find. Resin is now the choice of most cottage manufacturers when they turn out accessory parts or models. The casting of a master part in materials such as latex or RTV (room temperature curing vulcanizing) products is also possible for an individual modeler to create a new part or duplicate an existing part. Resin or

even metal can be used as material for the cast. The cost and time involved in the procedure makes this method more suited for the experienced or advanced modeler. The use of fiberglass, which is a cloth, soaked in resin to form a sheet or shell is another advanced technique. The durability and strength of fiberglass is offset by its expense and the need for a well-ventilated, clean workspace (as the process is extremely messy and the fumes from fiberglass are dangerous). Wood and paper are also extremely useful materials in scratchbuilding. Balsa wood is a soft and easily shaped wood that has been used for a long time in creating shapes for flying models. Sealing the balsa wood before painting is important. Harder woods are also useful as they have a finer grain and are easier to paint. Many modelers still use wood as their master for resin casting or vacuforming. Paper can be easily shaped and in thicker sheets can also be useful as a structural material. Whole models made out of paper can be very effective in making a miniature, especially buildings. Other materials that can be used in scratchbuilding include foam board which is an inexpensive sheet of plastic and foam material sandwiched together which is useful for bases and other applications, plaster of paris or papier-mâché for creating shapes on a diorama base. Metal sheets or tubes are also another good source of material for modeling projects.

**Techniques:** The first step in scratchbuilding is in designating which parts can be built with sheet, rod or other available parts. Then drawing out plans of the parts to be made or modified helps to make a list of small projects. Some of the most common methods of scratchbuilding include vacuforming or casting in resin new parts. Unless a modeler builds a vacuform machine or creates a casting box, there are commercially available units but these are very expensive. Using ingenuity, the scratch builder can proceed but as indicated, this is an area of modeling that requires some experience and patience, as it is a lifetime learning process!

**... and don't forget, have fun!**

