VACFORM MODELLING - a new approach.

by John W. Adams.

Models featuring the vacuum formed method of construction have been around for a long time. However, many people, who consider themselves to be competent modellers, will still not attempt this form of construction. Also, I speak with an equal number of modellers who have had a go at vacuum forms and made, what appear to them, irredeemable mistakes and given up in disgust. Why? Do they lack confidence, patience or skill? Perhaps the answer lies in the traditional techniques.

These vary slightly on the theme of cut out and sand down parts using an abrasive covered board either wet or dry . Some advise modellers to leave a rim of waste plastic around the part. The theory here being that when this rim wears down to a thin membrane and breaks off, the correct thickness has been achieved. In fact, if the average wall thickness is 1mm and a rim of 2mm has to be sanded away, that to me spells three times the effort.

Let us look at the problems:

1) Vacforms are difficult to cut out.
2) I can't see how far to sand down.
3) My fuselages end up like bananas.
4) Parts are difficult to hold whilst sanding down.

And some common mistakes:

5) My trailing edges end up too thick and the wing appears flat.
6) I make a mess of cutting out cockpits and wheel wells.
7) I have taken too much plastic off.

Now let us look at some answers

1) Before scoring out the parts you must have a marker to show how much plastic will require sanding (abrading) so the parts will fit together. You will need a fine (0.1) pointed marker pen, preferably permanent ink. A soft sharp pencil will suffice. I find a Rotring .35 (or similar make) drawing pen ideal (I use both red and black ink). Simply draw around each part where the part meets the backing sheet. This ink line shows us where we score and where we need to remove plastic. Be accurate. The ink line is King.

2) The first myth to dispel is that vacforms are not cut out by brute force, but merely scored around with a sharp blade. Start off with the right tool for the job: a good knife with a replacable blade is essential.

I always use a straight edged blade such as a Swann Morton 10A pointed blade with a No3 handle. (The No 11 blade is too fragile.) This type of blade is good for most jobs, but knives such as Edding and Stanley are best for heavy work. Olfa and Scribe 'N' Cut make tools whose primary purpose is scribing panel lines but which can be used to score through very thick material. I only use blades with a curved edge, for scraping.

Hold the scalpel comfortably like a pen and angled away (about 45 deg) from the piece to be removed. Score all around the part using reasonable pressure. Once the surface of most sheet material has been broken by a cut or score that sheet is then stressed by bending so as to open the cut. The sheet will invariably break along the cut, no matter how wiggly the score line. Always take some cuts out to the edge of the sheet and start the break-out there. Practice on a piece of waste plastic. The part when broken out is sanded down to the pen line.

3) Fuselages end up like bananas because when using the traditional techniques, any pressure on the centre of the fuselage will cause the part to bow and as this is usually at the widest/deepest part, the plastic will be thinner. Consequently the centre of the part abrades away quicker. Also 'moulded in' stresses can cause a part to bow when released from the constraints of the backing sheet. Obey the ink line and the parts will fit.

Note! the waste plastic at the ends of a tapered fuselage, drop tank, nacelle or wing tip (where a mould cavity narrows) will usually be thicker! Paragraph 4 should provide a solution.

4) When using the traditional abrasive paper-covered board the following formula applies. Finger ends tend to disappear at the same rate as the plastic, or, when the water turns red , that's far enough. Also parts are slippery and tend not to want to move against the drag of the abrasive. There is nothing to grip on to with parts such as tailplane halves or wheel halves.

We need some form of adhesive tape which is resistant to shear (drag) loads and tacky enough to grip on a curved surface and yet peel off easily when required - and something to hold the part in comfort.

A method often employed to hold parts whilst sanding is to use some kind of sticky tape, either made into a loop or of the double sided variety, often using a piece of wood as a handle. These tapes are not made for the job and are either too strong or too weak. The part keeps falling off or will not come off easily.

The answer is Sticky-pads and Tee-Al. (If this just sounds like a blatant advertisement, the simple truth is they work.) Sticky-pads measure 12mm x 25mm and have a fabric base coated with a high-tack but highly peelable adhesive which is very resistant to side loads. Tee-Al is simply handy lengths of Tee-section aluminium extrusion used as handles.

When these two items are combined, handling of vacform parts becomes very easy. A suitable piece of Tee-Al has one or more Sticky-pads removed from the backing strip and positioned on the top face of the Tee and then the protective wax paper is removed from the pad. The vacform part to be worked on is simply pressed into place and abrading or scraping can begin.

Even small curved or rounded parts can be secured by this method. In trials I have easily held and sanded down the mating surfaces of small difficult-to-hold parts such as drop tanks and wheel halves. Highly curved parts like propeller spinners can be held by drilling a hole and covering it with a Sticky-Pad, cutting radial slits in the pad and pushing in the spinner. A pair of wheel halves took a mere three minutes including cutting out.

Sanding down the parts

For sanding (abrading) the parts, I prefer to make my own handy sanders by affixing abrasive paper of the required grit (80!) to a piece of Tee-Al (or wood, even tube) with ordinary double sided tape (I recommend the new Selotape range). Thus a whole range of sanding tools can be created for little cost. Alternatively you can use a Sandvik Handy Sander fitted with a medium Sandplate. Sandplates are rectangular metal self-adesive plates (110 x 60mm) with a pin-point textured surface, fitted to a comfortable orange plastic handle. It is an excellent tool and widely available. Sandvik also produce a smaller tapered Hobby sander which has its uses. Sandvik also make a larger type but beware, as I have found the moulded plastic handles may have a slight curve, and so the plate is not truly flat, however the self-adehsive plate (220 x 60mm) suitably mounted can be very useful (I have one on the bench top). I sometimes use a 10 inch single cut file (Farmers Friend) of the type sold for sharpening lawn mowers (the handle is forged on the blade).

Leading and trailing edges can be reduced most effectively by scraping, using a heavy duty craft knife blade (Stanley knife). This is held almost at right angles to the surface and scraped to and fro along the wing s inner surface. Use the curved type for single surface biplane wings. If you want to use two hands, then Tee-Al can be easily held in a small vice. Scraping is a very fast way of removing material. You can scratch build wings this way.

There are other advantages to using this system. Work can be carried out at a convenient eye level thus enabling closer monitoring of the plastic removal. You can work over a sink wet or dry so the dust can be washed away. Dust is the enemy of the tacky surface. Once adhered to a dry surface, Sticky-pads will remain in place even under water. If water gets between the pad and the part, adhesion will cease but can be reactivated by drying.

Parts such as wings are kept flat and the trailing edges must be treated separately to the leading edges, which is the answer to problem 5 (flat wings). If you draw a chord line through a section of vacform wing it should be noticed that the leading edge meets this line at a much steeper angle than the trailing edge. This means that more plastic will have to be removed from the latter. So, if the old abrasive board method of sanding is employed, it's all too easy to take off too much of the leading edge whilst concentrating on the trailing edge, if both edges are in contact with the board at the same time. When a polyhedral wing (cranked or gull) is encountered, just treat the wing in separate stages. It's easier with Tee-Al.

Cutting Out

Let us now take a look at cutting out waste areas such as wheel bays, cockpits or windows. As a general rule I do not remove waste areas until I have most of the mating surfaces sanded down, unless they project in some manner so as to be a nuisance to progress. Whilst still in place, waste areas help with maintaining rigidity.

With a cockpit, nosewheel, gun position or cut-outs such as on the conventional fuselage split line, it is best to line up the two halves and secure with a little tape. When you are satisfied that all is correct, score around the waste areas. Now separate the taped halves and where the score lines reach the edge of the part, make a positive nick with the knife. Support the fuselage at the nick with the finger and thumb or a small pair of pliers, and start to shear the waste with the other thumb nail or a second pair of pliers. When the waste part is beginning to move, change to the other side of waste bit and start off the shear there. Within seconds the tear should follow round the score line and the waste part should break cleanly out. When pressure is first applied some distortion may be apparent but you will notice it springs out. For rectangular areas in thicker material, make two cuts with a fine razor saw, the ends of which are joined with a score line, and then crack out.

When an aperture needs to be made in in a fuselage side or a wing surface we apply a slightly different technique. Score around the area accurately and carefully. It does not matter if the shape is rounded or square, but if the shape of the required cut-out is complex (for instance a Spitfire wheel bay) divide it into separate areas, ie a circle and a rectangle. Now score diagonal lines across the waste area within the scored outline and at the intersection of these lines make a hole by forcing in the scalpel tip or, if the plastic is too thick, make a hole with a small drill. Using the scalpel tip, start to apply a cutting pressure along each diagonal in turn. It will be noticed that the little triangular pieces will start to curl inwards shearing along the scored lines. Now, take a blunt instrument like a small screwdriver and simply push in the triangles one by one. They should drop out like petals with moderate force. A pair of needle-nosed pliers may be helpful in removing the waste and it actually takes less time than reading this paragraph. For very thick plastic, use a fretsaw or piercing saw.

If you do not possess either of these useful saws, or a razor saw, you should!

Glues

For vacuum forms use the thin liquid solvent glues. These are often Methyl Ethyl Ketone based. The correct method of use is to hold the parts together and apply the glue to the joint with a brush or Touch 'N' Flow solvent applicator. Capillary action will take the glue through the joint while light pressure is applied.

Always work in a well ventilated room when using any solvent-based glue and keep the glue covered when not in use.

The wide family of cyanoacrylates, more commonly called 'super-glues', are best used when small or dissimilar materials are to be joined, or reinforcements or instant results are required. If cyanos are used on canopies a white 'blooming' of the transparency may occur. This is caused by the 'gassing' cyanoacrylate reacting on contact with the hygroscopic plastic surfaces, and being clear you can see it.

Do not remove the top of your cyano bottle and dispense glue straight from the bottle - the tingle in your eyes is the same effect as on your canopy! Buy a small glass mirror or culture dish lid and dispense a drop of glue at a time, dip a pin or a cocktail stick into this to apply the glue. For a measured drop try breaking off the tip of the eye of a small needle to produce a fork (be careful of your own eyes when doing this). You will need to clean out the fork with the tip of a blade occasionally.

There are a number of accelerators (often called kickers) on the market which speed up the setting rate of cyanoacrylate glues. These contain 1.1.1. Trichloroethane, so treat with caution. Ordinary bi-carbonate of soda has a similar effect, and can be used for building up areas quickly. I will expand on this later.

P.V.A. base glues such as Kystal Klear are the best for affixing transparencies. Apply with a small brush or cocktail stick. Any excess can be cleaned off with a damp cloth.

Transparencies

These seem to give more than their fair share of problems. I seldom put a knife anywhere near a canopy, instead prefering a small, very sharp pair of scissors. Buy high quality. Next, can you see what you are doing? I find that working against a mono-coloured background a help. You will find the background required varies according to the light. If the frame lines are indistinct, then cut strips of masking tape and use them to define the no-go areas. Work carefully and trim the waste off a little at a time. Flex-i-files are good for sanding the edges, but remember to remove the dust and most importantly, do test the fit of the canopy to the fuselage frequently.

When you are finally satisfied with the fit, hold the canopy into place. Now run a brushfull of liquid glue around the edge and apply slight pressure. Repeat with the glue and hold for a minute. If you allow the glue to dry you will find that the canopy is nicely bedded in. It can be easily removed for painting and may be finally affixed using Krystal Klear.

If there is no moulded rim on which to seat the canopy, then glue strips of thin plastic card to form a rim around the inside of the cabin opening. Should you then find that the fuselage plastic is of thicker gauge material than the canopy, then simply build up or pad out the rim with narrower strips, until the canopy is flush with the fuselage surface. This is fiddly but not difficult.

But remember - if you have over-sanded the fuselage, your canopy will not fit!

Battle damage repairs

Or, "I've taken off too much plastic." It's not the end of the model, you can repair most mistakes. Most initial problems are caused by failing to mark or score out accurately. So, if for instance an inconsistent score line has caused a piece to stay with the backing sheet when breaking out, simply retrieve it and glue into place using super-glue, then sand down as normal. If it's a large tear/spilt then you might want to reinforce with a piece of plastic card. All repairs are best carried out using super-glue (cyanos, cyanacrylates), because you get instant strong joints which sand well.

A more common mistake is over-sanding of parts, especially on fuselage halves. Usually this is caused by not obeying the ink line or by being over-enthusiastic when sanding down and not checking often enough. If one fuselage side has had too much removed from the middle (banana) then the answer is to assemble the parts together with tape and assess how much is missing. Once this is ascertained, glue some suitable strips (taper if required) into the gap, glueing only to the wounded side. Gap-filling cyano can be used but if this is not to hand, use super-glue and bi-carbonate of soda (baking powder) to bridge the gaps. You just apply super glue and then a pinch of bi-carb, this soaks into the glue and instantly sets hard. Repeat the process until the wound is filled, then restore the contours using a tool such as a Flex-i-file or Flex-i-pad. The result will be a strong hard repair much quicker than using two part or tube fillers.

If the case is a trailing edge with a large piece missing, then the best approach is to cut out the area and square it up, then glue a piece of suitable size plastic strip into place. Use super-glue and/or baking powder again and file to shape.

When damage occurs to the corner of a wing tip, prop blade or something like the end of a tip tank or radome, simply apply super-glue and then dip in a small pile of bi-carb. This will harden immediately. Repeat the process until a suitably-sized blob has formed and then file back to shape. If you have to use those vac-form props then this is the solution for filling the blades.

When joining fuselage halves it is usual to strengthen the joint with strips or tabs of plastic card glued into one half so as to form a rim on to which the other fuselage half fits. A better fit will be achieved on very curvaceous fuselages if these tabs are placed at intervals and stick outwards: 10 thou card is best. It is a tedious job cutting a number of these tabs, so I use an office paper punch to produce a load of little discs which will contour nicely around the inside of a fuselage half, even if the fuselage does look temporarily like a Viking ship.

Perhaps here a word of caution about choosing your subject. Vacuum formed kits vary in quality. If you have never attempted a vacuum formed kit before please don't be tempted to go out and buy that 15 year old Scruggs four engined Wonderplane kit. Instead try a few simple exercises, get some plastic card and make a new tailplane for that damaged Mustang, or practice making holes in a piece of plastic card. There are lots of cheap vacuum formed kits around, often from Eastern Europe, and they can be picked up at model shows. Examine the kit and if it's crisp and cleanly moulded it will probably fit together well. If it looks blobby and ill defined, don't buy it.
If some items like spinners or wing roots are thin and crushed then re-inforce with Milli-put or bi-carb but never use tube type fillers (most tube type fillers are only good for shallow surface blemishes). Milli-put, if properly mixed and placed on a storage heater or hot domestic radiator, will harden very quickly and not affect the kit plastic. Here s a tip: mix and heat the Milli-put before applying it - it will harden just as fast. It is advisable to wash your hands immediately the putty is mixed and again after the application is completed.

The following useful tip came via one of my customers. To fill well fitting joints such as leading edges and fuselage centre lines, scratches or panel lines, use Tippex Correction fluid. Note it must be the bottle which incorporates a red oval 'Perfect' design in the label and not the one with a green oval. The enviromentally friendly one may do wonders for typists but it's no good for modelling. Tippex bonds very well, dries quickly and sands beautifully.

White metal

Most recent vacuum formed kits contain detail parts cast in white metal, or suitable parts can be purchased to improve older kits. The best adhesive is cyanoacrylate. White metals usually contain a proportion of lead, (those called pewter should not), so don't eat when working with it and do wash your hands.

Blow holes or any deficiency in the castings are best repaired with the super glue and bi-carb combination. Milli-put or plastic padding car body fillers also adhere well to white metal. If a hole in a propeller or engine is too big then bush it with a piece of plastic or metal tube. Household pins make good strong prop shafts.

However the occasion often arises when there are no under carriage legs available for that old large kit. The solution is aluminium or brass tube. This can be bought in a variety of concentric sizes with which you can fabricate oleo legs. If you cannot find it in your local plastic kit store, then make a visit to a model railway shop or one specialising in flying models. You will be amazed what goodies you will find. It does puzzle me still just how parochial many 'plastic kit bashers' are!

Tube can be easily cut with a fine saw or even with a heavy duty craft knife by rolling the tube back and forth with the blade as you apply pressure. Plastic card fillets or fairings can be stuck on to the metal with super glue or five minute epoxy, then filed to shape. Brass has the advantage of being soldered (exit plastic modeller, stage left).

Axles can be glued to the end of the tube, or drilled right though to accept a piece of wire (a section of household pin) which can be sleeved up with metal or plastic tube to scale size. If you are boxing in a wheel bay, make the top from thick plastic card or, if it is a kit vacuum formed item, strengthen it so that it can drilled to take the under-carriage leg. Metal tube can be utilised for wing spars, and when threaded through a fuselage it can be bent either side to set the dihedral angle.

Jigs

The assembly of vacuum formed kits can be facilitated by making jigs. A jig can be as simple as a piece of plasticine, or an elaborate affair constructed from plastic card. With only a little imagination, a few pins, cocktail sticks, plasticine, right-angled triangles cut from card and a square of card with lines drawn on to it for a base, even the most complex biplane can be set up for accurate final assembly.

Vacuum formed models do require some hand and eye skills but remember these can only be discovered or improved if you are prepared to have a go. The hardest part is picking up the scalpel and making that first cut (sorry, score). If this article fires some of you to stretch your horizons or provides a solution to a particular problem then it has achieved its aim. If on the other hand you are going to sit back and wait for the Big Injection Company to produce that Scruggs Wonderplane, I have it on good authority they never will. So you might as well use your time whilst saving up for the resin from Blob-o-Kit (who probably nicked it from the vacuum form anyway), to have a go, and find, as my youngest daughter used to say, the World can be your Lobster!