



MAKING LIFE EASIER

Delcam plc has long been known as a producer of software programs for 3D modelling and the manufacture of complex surface shapes for industry in general and, in the case of the footwear industry, for sole unit engineering and moulding in particular. CRISPIN was a well established specialist footwear industry provider of similar programs for last and upper design, pattern grading and engineering, and cutting and costing functions.

An obvious synergy existed between the two so, in 2007, Delcam acquired the CRISPIN business to create Delcam CRISPIN with the aim of providing a range of products that would offer software programs covering all aspects of the design and tooling process for footwear. The fact that Delcam also had an extensive sales and support network with over 300 reseller offices worldwide, would hopefully also give potential customers further confidence to buy in the knowledge that they could find product support locally in every country where footwear manufacture took place.

A COMPLEX SITUATION

Any company wishing to digitally design and manufacture footwear will typically need to use a wide variety of different software products that might well include

any or all of the following:

- 2D sketching painting such as Adobe Illustrator
- Last design including 3D scanning of lasts and prototypes
- A database to search for lasts of the correct size and shape
- Last machining
- 3D upper design
- 2D pattern engineering and cutting
- 3D sole unit engineering
- 3D modelling software for accessories
- Triangle fixing for rapid prototyping of uppers and soles
- Material editing to mix textures and colours
- Ray-tracing for rendered images
- Leather cutting projections and overall costing

Needless to say, these software programs will generally have to be sourced as separate products and from a number of different suppliers. This is complex, time consuming and can also lead to problems caused by the incompatibility of some systems with others. There are simply too many different file formats with every product needing to be able to export and import formats to and from each other. Such data

translation always results in some loss of information, the resolving of which can often be extremely frustrating.

For instance, currently available upper design systems are generally faceted (triangulated) models, which makes them difficult to transfer to other modelling systems for advanced editing. Furthermore, the data for each of the products used in the shoemaking process may overlap and duplicate some of that used by others. For example, 3D upper design, costing, cutting, ray tracing and material editing all need to know about materials. No manufacturer would want to have to define a particular textile repeatedly in different formats if it could possibly be avoided.

Uppers and soles have traditionally been modelled and graded using different pieces of software. This often means that uppers are graded in 2D and soles in 3D, each with a different set of rules. So, how does one ensure that a design line on the upper matches up with its opposite number on the sole for all graded sizes or ensure there are no bonding problems caused by poor fit in the extremities of a size range?

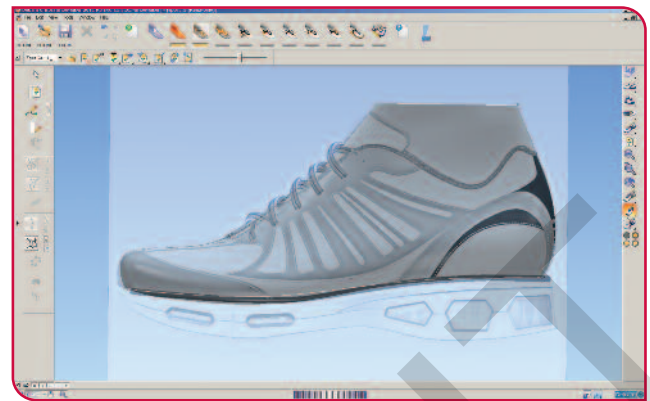
The ideal solution would be for the designer to be able to use software with a very easy and intuitive user interface to create the initial concept and, then, take it through to a high quality rendered image and rapid prototyped model that included both the upper and sole for final approval. It ought then to be possible to create basic graded patterns sufficient for samples to be made directly from the designer's model. It should also be possible to pass this same model to the engineering department for more detail to be added to the sole unit ready for moulding and, at the same time, create the detailed upper patterns (including group grading to reduce tooling costs) needed for manufacture. Each phase of the process should be able to use the previous stage as its starting point and should not need to rework or re-enter any previous data.

SHOEMAKER

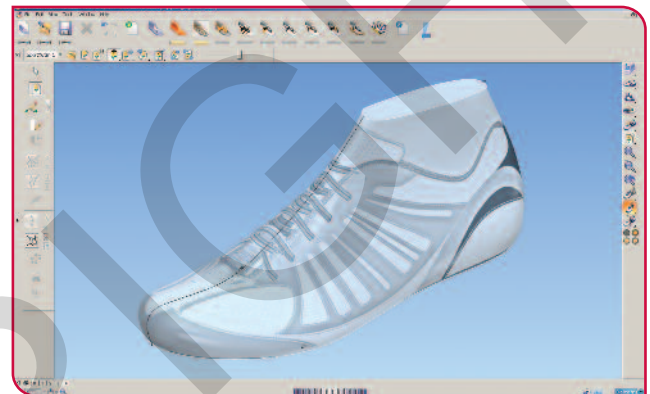
With these aims in mind, the existing separate products from the two original ranges have been reworked in order to integrate them and simplify the way they all work together. The result is a new product range with ShoeMaker at its heart. So, what does it have to offer?

Delcam claims it is the next generation of 3D footwear design. While it is based on the original CRISPIN ShoeDesign software, it has been completely re-engineered to create full solid models based upon the Parasolid kernel as used by Delcam PowerSHAPE, Siemens NX, SolidEdge and Dassault SolidWorks.

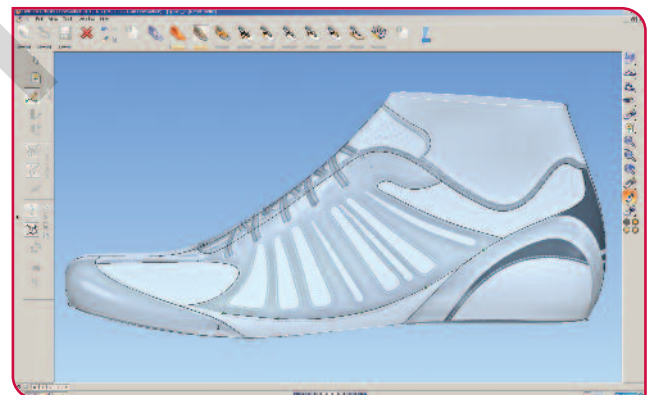
It has a simplified user interface that is particularly suitable for conceptual designers. Most concepts follow the same creative path so, once the user has learnt how to draw a line on a last, he or she will almost be capable of modelling anything. There is also a new designer-oriented method of sketching where multiple 'pencil' strokes made close to each other on a tablet or touch-sensitive screen are merged together in much the same way that a conventional drawing board is used.



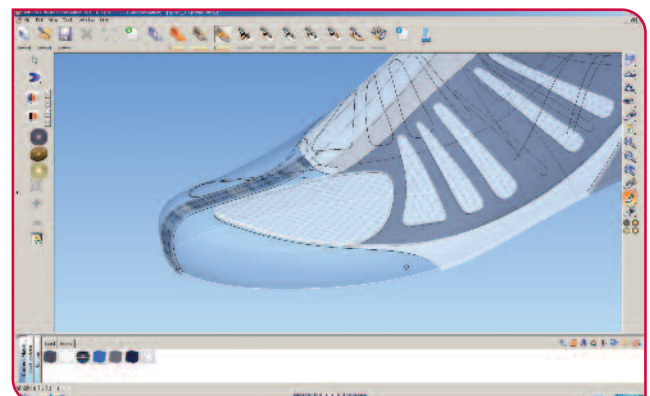
Stage 1 – Sketch stencil. This displays the common way of creating style lines in ShoeMaker whereby a drawing, sketch or photo can be imported and positioned against the 3D last.



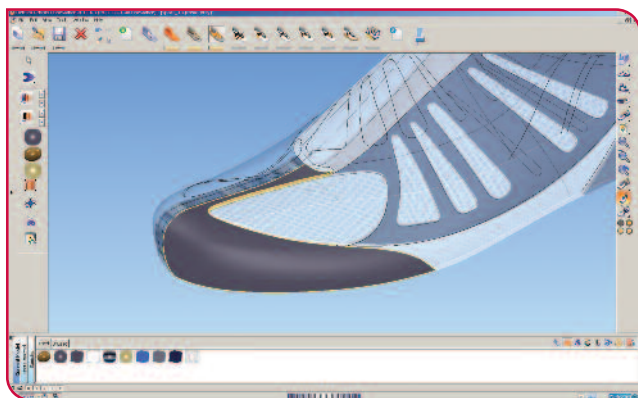
Stage 2 – 3D wrapped stencil. The stencil is then wrapped around the 3D last ready for drawing in the style lines.



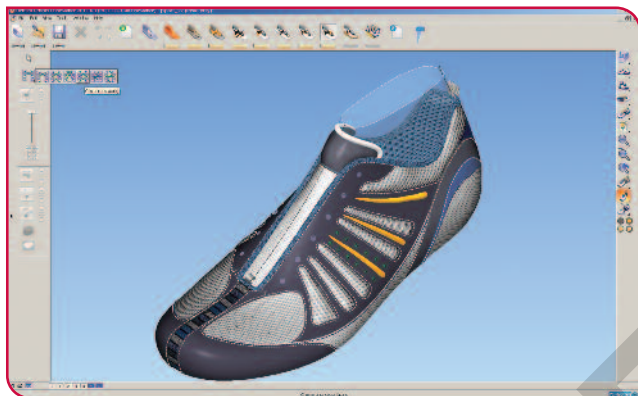
Stage 3 – Creating style lines. These are produced using either the point-to-point line drawing tool or the sketch function linked to a Graphics Tablet and pen.



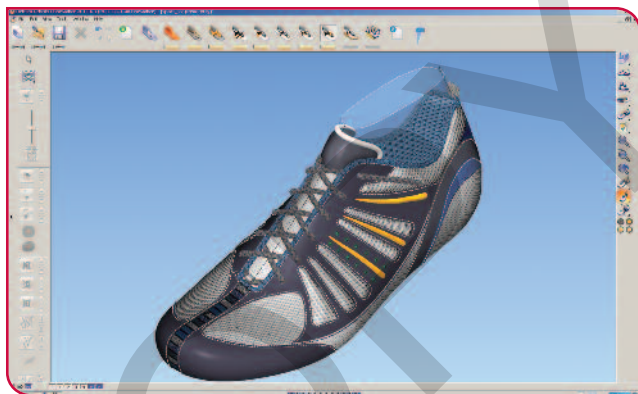
Stage 4 – Creating pieces. A single upper component piece is clicked in the middle ready to fill with the chosen texture or colour.



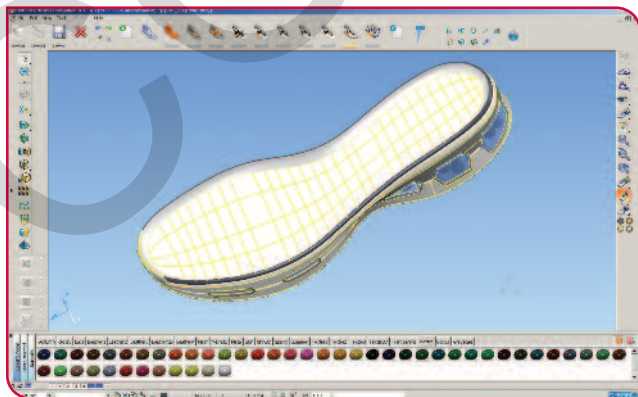
Stage 4a – Adding colour and texture. A further click causes the component piece to be created automatically including the chosen texture or colour. The process is simply repeated until the upper is complete.



Stage 5 – Adding laces. The type of lace design is chosen and the appropriate eyelets or punch holes selected.



Stage 5a – Creating the actual lace. Single click automatically positions the lace and threads it through the eyelets or punch holes.



Stage 6 – Engineering the sole. A sole unit based on the last bottom shape is created and engineered in the same 3D environment and using a similar sequence of clicks.

There are almost no forms with the new system, with most things achieved by intuitive drag and drop. Stencils such as a photograph of a shoe or a designer's sketch can be positioned in front of the last during sketching or actually 'wrapped' on to it in 3D. User-defined toolbars and shortcuts do however remain for the expert should they wish to use them.

ShoeMaker is built on top of a full feature-based solid modelling kernel, so functionality is associative, whereby changing one object automatically updates all associated objects. It also automates difficult operations. For example, it takes just a single mouse click to search for an outline of style-lines and create a pattern piece. It likewise also takes just one click to thread a lace through a series of eyelets in any given lace pattern. Graphical realism is maximised by the use of programs that are loaded on to the graphics card's GPU to provide such enhancements as bump-mapping and colour mixing of textures.

There is the same capability for full sole or sole unit, and accessory and mould design as with PowerSHAPE. The surface modelling features are claimed to almost certainly be the most powerful currently available in any product on the market. ShoeMaker has a comprehensive suite of triangle modelling features as well as its surface and solid modelling capabilities, allowing triangle models to be wrapped on or merged via Boolean operations with any part of the model. Closed STL/VRML models for rapid prototyping are easily created to assist the design process with these types of component.

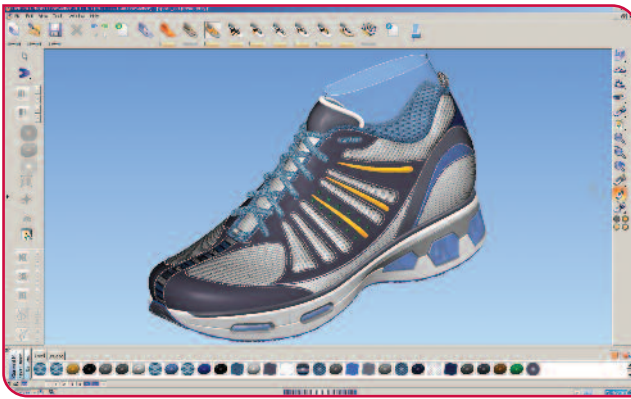
ShoeMaker's upper and sole systems have the same model format (.shoe) and can be created and viewed together in the same program. Patterns are, in turn, generated automatically from the 3D model to include all underlays, folding allowances, marker lines and notches. Furthermore and, most significantly, it allows the whole shoe including last, upper and sole, to be graded together.

Finally, other programs such as LastMaker for last import and modification, Engineer Pro for 2D pattern engineering, TechPac for technical documentation and ShoeCost for synthetic and leather nesting and costing, have all been re-engineered to share the same .shoe file format and to have a consistent user interface featuring the same toolbar structure, viewing and selection procedures.

EASY TO USE

The process starts by using LastMaker where a scan of a physical last can be quickly converted into a last model for modification by using either key measures, section shape and toe swapping with other lasts or interactive 'sculpting' before being saved in a .shoe file.

The same .shoe file can then be opened in ShoeMaker and 2D designer sketches or photographs wrapped on to the last and then used as templates for interactive sketching of new design style lines. Further clicks create 3D parts with photorealistic textures as well as design features such as padding, stitching, lacing and piping. Quick prototypes can then be generated by colour 3D printing or ray-traced videos



Stage 7 – Completing the design. A complete 3D conceptual design with full textures, padding, laces and engineered sole unit has now been created which, in turn, becomes the final rendered design for commercial approval as show in the image at the beginning of this article.

of the shoe rotating for design review.

ShoeMaker Pro contains full 3D 'Tribrid' CAD for surface, solid and triangle modelling, which allows the sole or accessories to be modelled. Opening the same .shoe file in Engineer Pro, allows the patterns to be automatically generated ready for cutting prototypes or more detailed pattern engineering. ShoeCost can open the same .shoe file to display an instant costing of the shoe, calculated by state-of-the-art nesting on synthetic materials or leather hides and skins. Finally, TechPac is able to use all the data contained in the .shoe file to automatically generate, and manually edit as necessary, a complete pack of technical documentation including images and part drawings.

A complete workflow report is generated throughout the product creation process. The single .shoe project file gradually builds up through revision as it passes from person to person and as each adds further information. Models can be stored on a central server for global access under revision control and the project assigned from person to person with full historical tracking and email notification. Everyone involved thus knows who is doing what, when and why.

Corporate libraries of lasts, materials, accessories, etc., are easy to set up in neutral formats in the company's own folder structures on its own network servers. These can be seamlessly integrated within ShoeMaker and other Delcam CRISPIN products while, at the same time, remaining accessible from any other third-party products in use.

All in all, the Shoemaker system certainly appears to be highly effective. At the same time, it is also simple to use which, in turn, will enhance operator confidence and make training that much faster. A single software and hardware system from just one supplier that is able to carry out all the functions described must have attractions for many manufacturers. A worldwide support capability is a further plus as, if a problem does arise, it should be possible to resolve it with a minimum of delay. The fact that the component parts have been designed from the outset to work together would in any case hopefully avoid this. All in all, it appears to be yet another further positive step forward for shoemaking in general. 🍷

“...coming to terms...”

Boolean operation – named after George Boole, a 19th century mathematician who invented the algebraic system of logic that is the basis of all modern digital electronic systems, it permits detail to be added to or removed from 3D computer generated virtual models.

Bump mapping – this is a method of adding a textured surface to a 3D virtual model rather like Texture modelling. It differs in that it uses multiple polygons to respond to light and this also enables it to alter colours.

Cintiq screen – a type of visual display screen that allows the operator to draw directly on to the LCD image it contains using a special 'pen' and so creates a better 'hands on' feel for CAD designing.

GPU – Graphics Processing Unit, a non-mathematical way to create lighting effects and transform objects each time a 3D image is redrawn that reduces the strain this process would otherwise place on the computer's central processing unit (CPU).

.Shoe – a new file format where several data files are stored together in a similar manner to a zip file and, which is capable of containing all the 3D last, 3D design, 2D patterns, cutting file, costing and technical documentation involved. The main aim is both to contain this data and also allow each product to open all other data related to it. Having everything in one place provides a more integrated solution and ensures original data is always used rather than different copies.

STL/VRML models – these are used to transmit data. STL is mainly used to pass design data to a last making program, while for VRML does the same for mould making.

Triangle modelling – refers to the fact that a triangle is the easiest shape for a computer to cope with. A polygon is the next simplest and these two shapes form the basis for all CAD 3D modelling techniques.