Trevor Crout
Scalpel to Computer Control

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The future of Modelmaking, I believe, will make the best use of new materials and technologies to speed up and enhance the traditional hand crafted model. It is unlikely that computer technology will completely replace handmade work which can convey the unique element of human art and craft.

Parts are best made by a experienced Modelmaker who has decided to branch out and learn the computer skills required to make parts for others. He or she must want to learn these extra skills and be dedicated enough to spend a considerable amount of their own time honing their skills. Programmes are getting easier to use. Straight-forward cutting can now be accomplished by defining a tool path that has been assigned a colour, however, programming to machine accurately in the 3rd dimension is rewarding but still requires a great deal of careful application .

I have been a Modelmaker for 30 years, the last 21 years have been at the London based Architectural Practice of GMW Partnership. Over the years I have scribed countless equally spaced engraved lines, and as a side effect, suffered many aching wrists! Finally about 7 years ago, after spending a day or so scribing lines and applying liniment I decided that there must be a better way.

It was not until I went to the CAD/CAM show 1989 at the National Exhibition Center in Birmingham that I found that Desktop Milling Machine existed. This wonderful device truly changed my life. The machine was a CNC (Computer Numeric Controlled) Roland PNC 3000 CAMM3. It did all the things that I had hoped for and a great deal more besides. This wonderful piece of equipment could cut parts in three dimensions! I just had to have one so therefore I arranged for a demonstration to be given at GMW Partnership to show to the Computer Manager and the Partner responsible for the Modelmaking budget. The setup was brought along a few days later and, as luck would have it, we were making a model for the very Partner who controlled our purse strings. His project needed brick lines and windows and the demonstration team from Denmark, Eh Data Technic, showed how easy it was to programme using their Toolchips software. We persuaded them to make more than enough parts for the model before they left the premises. At the next Partners Meeting it was agreed to purchase the Computer, Toolchips Software and a Roland milling machine.

Trevor Crout Modelmaking

In February 1996 I left the GMW Partnership bought the computers and two Roland milling machines. I now run my own business with GMW as one of my main clients, however I can now supply other Modelmakers and Prototype Designers with parts or models. I also sell and teach TOOLCHIPS software and specify complete machining solutions.

Roland Cutting and Engraving Machines

Roland Digital are probable best known for making computerized musical instruments and especially their electronic keyboards. The story goes that a small milling machine was needed to make a part for a musical instrument. As Roland already made plotting machines the basic parts were already available to make one in their own factory, therefore the first CAMM 3 machine was created. This machine used standard Hewlett Packard plotter language as of course did the plotters and was therefore easy to setup for straightforward cutting cycles . The "lift pen" command was used for the "Z" axis command. This machine was manufactured later as the PNC 3000. I do not know for certain if this story is true but it does sound feasible. The range of Roland machines is changing at the moment and prices range from around £12000 to as low as £1500 when the new CAMBOY machine is ready for release. These machines will have software for producing 2D and basic 3D forms included.

Eh Data Technic

A group of graduates in Arrhus Denmark who had specialized in writing software for CNC machines heard of the new Roland machine and produced a programme for it to enable 2D and 3D cutting paths to be made. They formed a company and called Eh Data Technic Aps and registered the software as TOOLCHIPS. It is a fully featured 2D / 3D computer aided drawing and manufacturing programme. The latest version will be available in September 1996 on CD ROM and run with Windows 3.1 and Windows 95 operating systems. Post processors are available for all Roland cutting machines and for most other CNC Machines including lathes. If a special processor is required these can also be written to order.
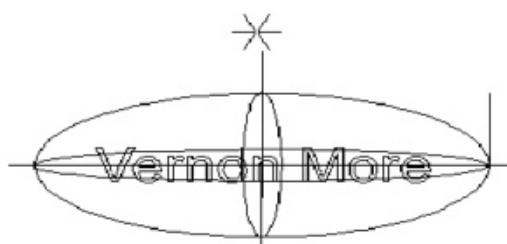
Toolchips Software

Figure 1

The drawing (fig.1) is made up of an elliptical shape drawn in the Toolchips programme and uses text from Corel Draw. The text was converted to curves, the fill removed and exported as an .ai file. Adobe .ai files imported from graphics programmes in this way are easily converted to create tool cutting paths within Toolchips (fig.2).
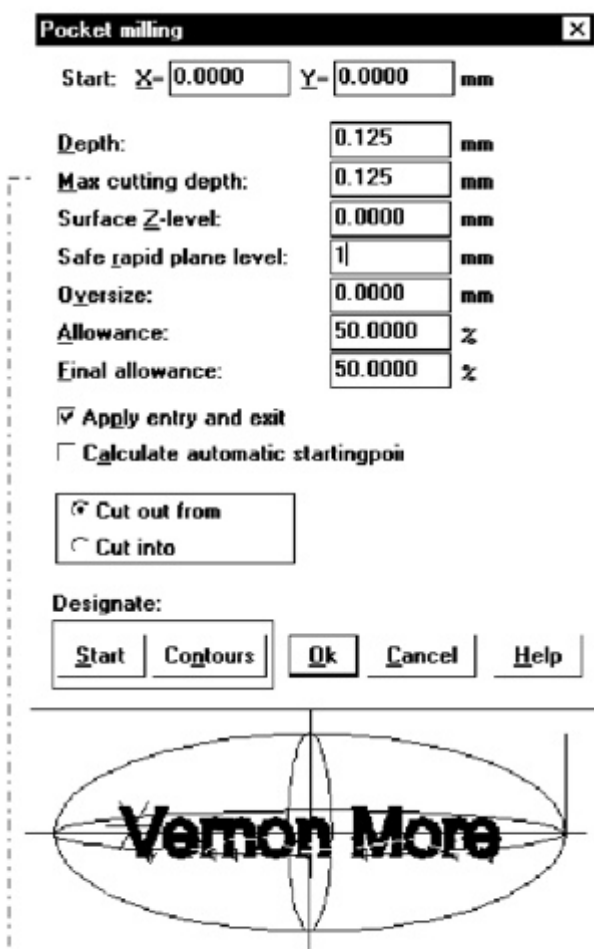

Figure 2
The elliptical shapes where drawn in Toolchips and provide profiles for the 3D model. The text cutting information was then projected onto the 3D surface (fig.3).
Toolchips 2D
This form is one of many options available. In this case it is used to create a spiral cutting path for a previously specified 0.1 mm diameter tool. The dark fill in the text would be shown as red in the programme, and if magnified, the size of the tool and any potential cutting problems would be obvious.
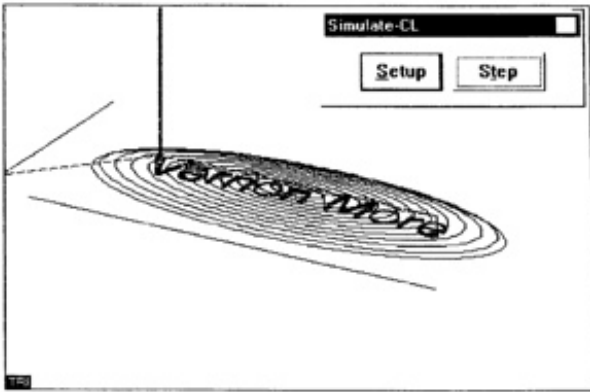
Figure 3: Toolchips 3D simulation
Spiral cutting creates a much faster machining operation because, unlike Pocketing, the tool does not have to traverse the work piece in straight lines and is therefore much quicker. The cutter remains in contact until each letter is finished
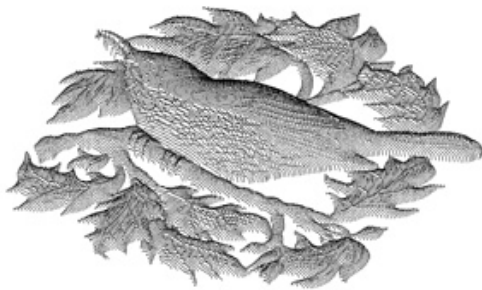A Brief Description of ArtCam by Delcam International

Figure 4
ArtCam enables the creation of 3D cutting paths to be made from scanned or drawn computer bitmap graphics. It is more an artistic programme than engineering. Having said that it can be very precise, the tolerances are defined by the accuracy of the original artwork. The bird (fig.4) was created from a bitmap drawing that has had coloured areas added to define the shape and height of areas to be modeled. As this is printed in monotone it is not easy to illustrate. because the use of colour is an essential part of the process (fig.5).

Figure 5
The gray scales would be colours in the programme and the rectangles at the bottom of the screen are all related to the graphic. Three of the rectangles have special properties assigned to them. (see enlarged detail fig.6).
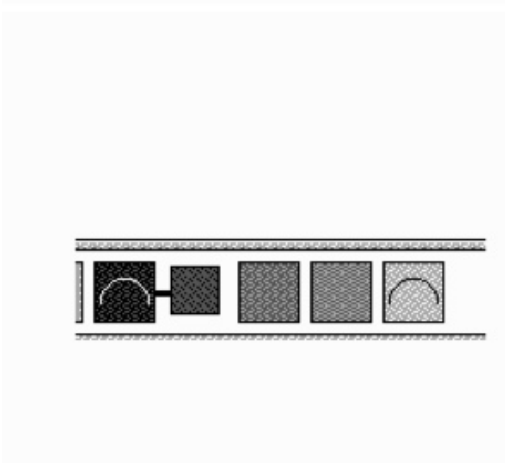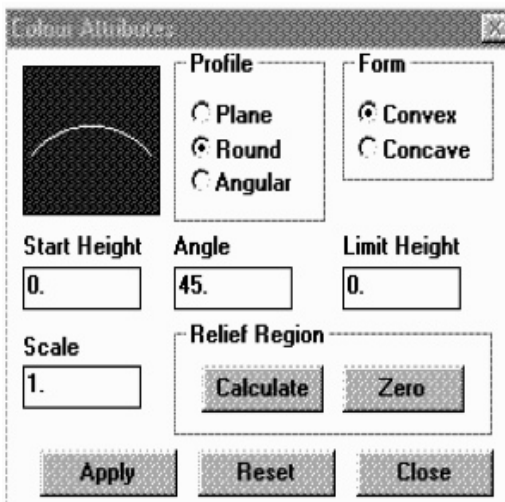

Figure 6
Figs 5 and 6 show the way in which ArtCam uses colour to define a three dimensional area. The two grey scale rectangles which are linked are used to create the eye of the

bird. In fact two shades of blue were used and these were linked. As can be seen in the Colour Attributes box, the shape has been defined as a convex round profile; then the linked rectangle was given a plain attribute to form the outline of the eye. The light grey was used to define the claws of the bird and this to was given a convex round attribute.

Electronic Mail: The Internet and E-mail Providers

Easy access via telephone cable networks to other computers can now be used by Modelmakers to good advantage. I subscribe to CompuServe and have found it indispensable. I can use the service to communicate with Eh Data Technic in Denmark. If I have problems when testing the software I can click on a phone support icon within the programme which will write a compressed file containing not only the part that I can see but all the hidden programme steps that I have used. This can then be sent to Denmark via CompuServe and used by the Support Group. Often I send my e-mail in the morning before 7 am and receive the answer later the same day. E-mail is also very useful for keeping in touch with potential customers and for down loading updated software from companies such as Microsoft.

Many Architects are now "on line". GMW Partnership registered on the Internet recently and this has helped me to obtain information much more efficiently. Drawings created using CAD are best because they can be downloaded directly and used without having to do any drawing construction. The other advantage of using the computer link, in this way, is that if the information does prove to be wrong the Architect is at fault and not the Modelmaker!

There are many service providers offering connection to e-mail services. I chose to use CompuServe because it has its own independent network from which the full Internet can be accessed. I have found that it is easy to operate.

When choosing a service provider ensure that AutoCad .DXF file format can be sent and received without resorting to extra software to make it work with the UNIX system used by the Internet. The ability to send and receive DXF files is very important for Modelmakers because drawings can be received at the correct scale. It must be remembered that Fax transmissions are scaled to fit A4 paper.

Useful Names and Addresses

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