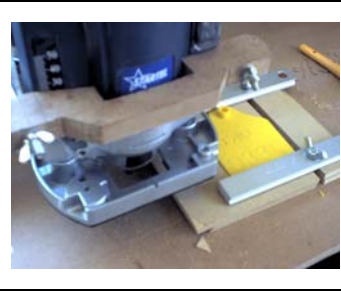# Building your own PCB Router

Part 3 (Implementation)
Eddie Leighton ZS6BNE
www.qsl.net/zs6bne
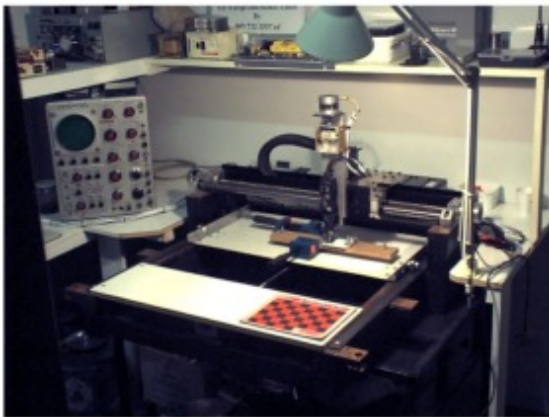zs6bne@webmail.co.za

This is the final part in this series. I trust that these articles have sparked some interest in home contruction of anything from mechanics to electronics to programming and that you will enjoy the results of your attempts at building your own machine to accomplish difficult tasks.
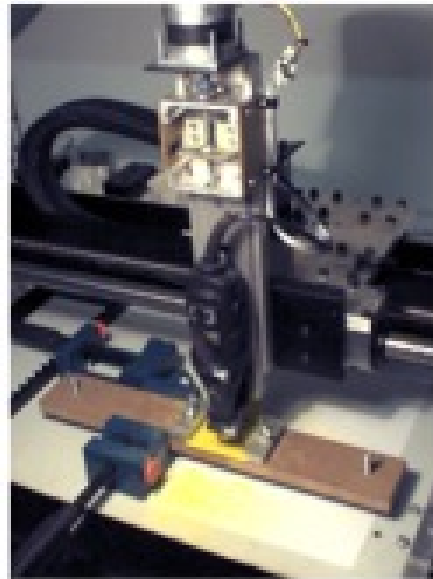
For stages of construction for this homebrew CNC machine , have a look at the following web address.

http://www.qsl.net/zs6bne/mycncmachine.htm

**The "AGEA3's" original Z-Axis**

The "AGEA3" in it's early stages

It must be noted here , that TurboCNC's parameters must be set correctly so that the calibration of your machine is done properly. Simply said, if TurboCNC asks the machine's axis to move in a particular direction and for a particular distance , then the machine must do exactly that. See TurboCNC's setup section for more detail.

The PC Board below was designed using Protel Technology's "EasyTrax" (DOS Program) which can be downloaded from my website at
http://www.qsl.net/zs6bne/files/hobbycnc/

The G-Code was generated from EasyEdit's PCB result file (Preview.pcb) by the third party software "gcplot.exe" (Include in the EasyTrax zip file) and processed by TurboCNC driving the homebrew CNC machine. What can be seen here is the **excessive "Play"** in the Dremel's spindle bearing (See the picture above) which of course is not acceptable. I have since modified the machine and replaced the Dremel drill arrangement with a cheap variable speed wood router discussed later on in this document.
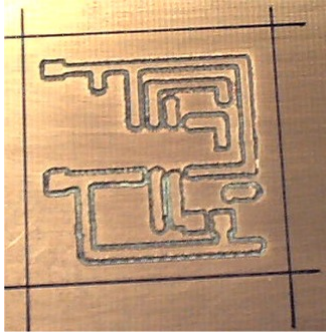
**Early stages - My first attempt at engraving a Printed Circuit Board**

I recieved a nice little circuit of a QRP CW (Yes morse) rig that uses a FET as a P.A. The circuit was sent to me by OM Evert ZS6AQW who is active in the mornings on the QRP Net on 80 meters on a frequency of 3579 Khz (06:30 - 07:00)

Building this rig proved to be a **good exercise** to demonstrate the capabilities of the CNC machine and available software.
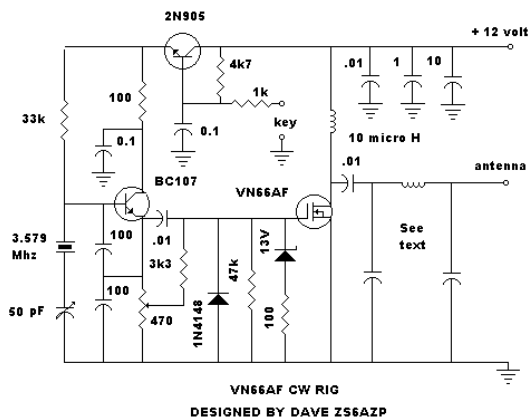

Circuit of the 4 watt QRP CW Transmitter

This trasmitter also uses a minimum of components and puts out a lovely 4 watts! The PSU being a 12 volt gel cell battery or similar. What I did was I coloured in all the termination points on the circuit using Window's **"Paint"** program then I wiped out all the component drawings leaving a crude PCB design behind. (Component side)
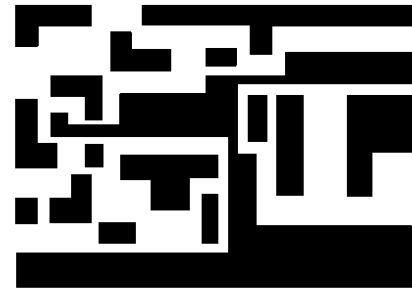
**The bitmap image created in "Paint"**

What is so nice now , I have discovered more software on the Internet that detects edges on a drawing (BMP File) and the result can be saved as a DXF (Autocad generic file). This software goes by the name of "WinTopo" and comes as a demo or a registerable professional version.
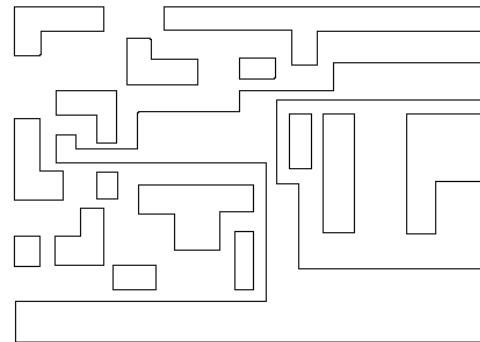
**The bitmap image processed by "WinTopo's" edge detection**

Then I use another freeware program (ACE) and convert the DXF file to a G-Code file which can be read by the homebrew CNC machine running "TurboCNC". I did a dry run earlier on this evening on a piece of Supawood and "engraved" the PCB design onto the wood. It turned out quite well! Even ideal for a breadboard setup for a novice! One can knock in a few panel pins as termination points and the PCB design outline will always be visible. I coloured in the remaining "islands" with

a marker pen to make them stand out more. Cutting a real Printed Circuit Board is done in exactly the same way.
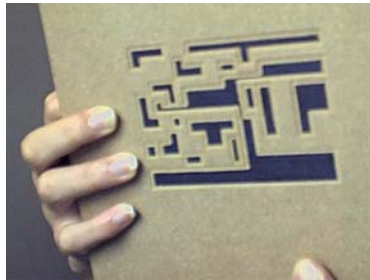

Testing on wood is cheaper than on proper PC Board

Nowadays I have a wood router fixed to the Z-Axis (Imagine machining a PCB with a wood router!!) My only problem now is to get a cutter that cuts a slot of 0.5mm , the smallest router bit is an odd 3 mm! The cutter shanks are either 6.3 or 8mm. Once this problem is sorted out then I will be finally happy with the end result.
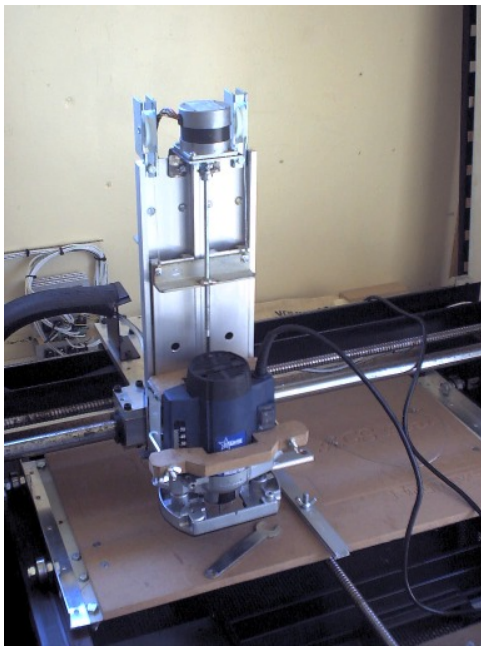
The AGEA3's new Z-Axis
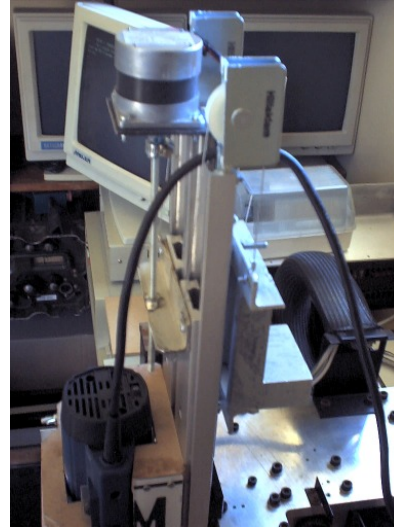
Note the counterbalance weight and "Sliding door" pulleys and picture frame wire cables terminated with lugs.

The success of my Z-Axis came from a lot of experimentation and this design can be used as a guideline. It works better than I expected! The counterweight helps to remove the stress from the stepper motor and also prevents the router from falling to the bottom and possible damage.

Building your own machine or equipment can give you a lot of enjoyment. There will always be room for improvement. Life consists of building blocks and we build on previous experience. My machine , although now fully operational, can always be improved upon but it will continue to give me a challenge to work towards perfection.