

# CNC Routing – From a hobby perspective

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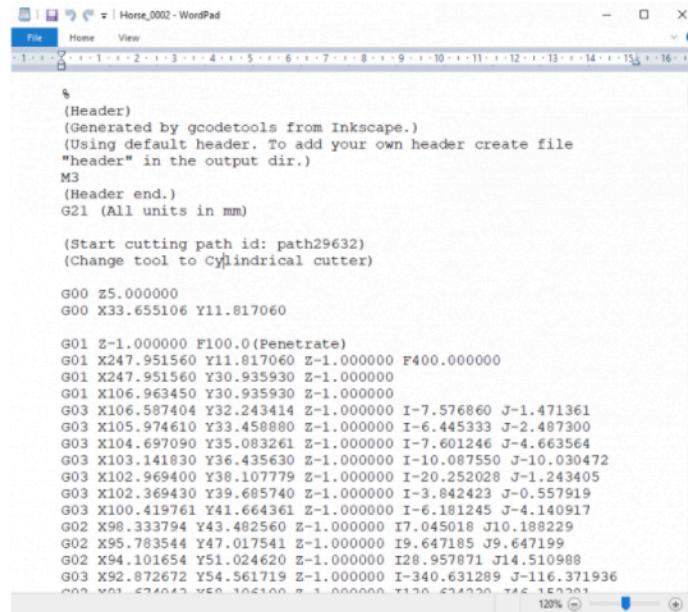
# CNC – WHAT IS IT?

- CNC -Computer numerical control is a method for automating control of machine tools through the use of software embedded in a microcomputer attached to the tool. It is commonly used in manufacturing for machining metal and plastic parts.
- Types of CNC:
  - CNC Milling Machine
  - CNC Lathe
  - CNC Router
  - CNC Laser Cutter
  - CNC Plasma Cutter
  - 3d Printer

# G-CODE – The machine code

A simple text file, with movement commands (G0X) and machine control commands

While its common for machinist to write G-Code directly, most users use CAM tools to generate G-Code directly from drawings.



The screenshot shows a Windows WordPad application window titled "Horse\_0002 - WordPad". The file menu is open, showing options like File, Home, View, and Insert. The main text area contains G-code commands. The code starts with a header section, followed by machine control commands (M3), and then movement commands (G01, G02, G03) defining a cutting path. The text is in a monospaced font, typical for machine code.

```
$  
(Header)  
(Generated by gcodetools from Inkscape.)  
(Using default header. To add your own header create file  
"header" in the output dir.)  
M3  
(Header end.)  
G21 (All units in mm)  
  
(Start cutting path id: path29632)  
(Change tool to cylindrical cutter)  
  
G00 Z5.00000  
G00 X33.655106 Y11.817060  
  
G01 Z-1.000000 F100.0(Penetrate)  
G01 X247.951560 Y11.817060 Z-1.000000 F400.000000  
G01 X247.951560 Y30.935930 Z-1.000000  
G01 X106.963450 Y30.935930 Z-1.000000  
G03 X106.507404 Y32.243414 Z-1.000000 I-7.576860 J-1.471361  
G03 X105.974610 Y33.458880 Z-1.000000 I-6.445333 J-2.487300  
G03 X104.697090 Y35.083261 Z-1.000000 I-7.601246 J-4.663564  
G03 X103.141830 Y36.435630 Z-1.000000 I-10.087550 J-10.030472  
G03 X102.969400 Y38.107779 Z-1.000000 I-20.252028 J-1.243405  
G03 X102.369430 Y39.685740 Z-1.000000 I-3.842423 J-0.557919  
G03 X100.419761 Y41.664361 Z-1.000000 I-6.181245 J-4.140917  
G02 X98.333794 Y43.402560 Z-1.000000 I7.045018 J10.188229  
G02 X95.783544 Y47.017541 Z-1.000000 I9.647185 J9.647199  
G02 X94.101654 Y51.024620 Z-1.000000 I28.957871 J14.510988  
G03 X92.872672 Y54.561719 Z-1.000000 I-340.631289 J-116.371936  
G02 X91.574042 Y50.106100 Z-1.000000 I120.524220 J15.152201
```

# CNC Router In Action

CNC Consists of 3 axis:

X Axis

Y Axis

Z Axis

For a router, a spindle drives a cutting tool



# So what can you do with it?

3d Wood Carving

Wood Joinery for Furniture

Parts for CNC

Arts and Crafts



# Examples of my carvins



# Edge Lit Acrylic Signs

First Attempt

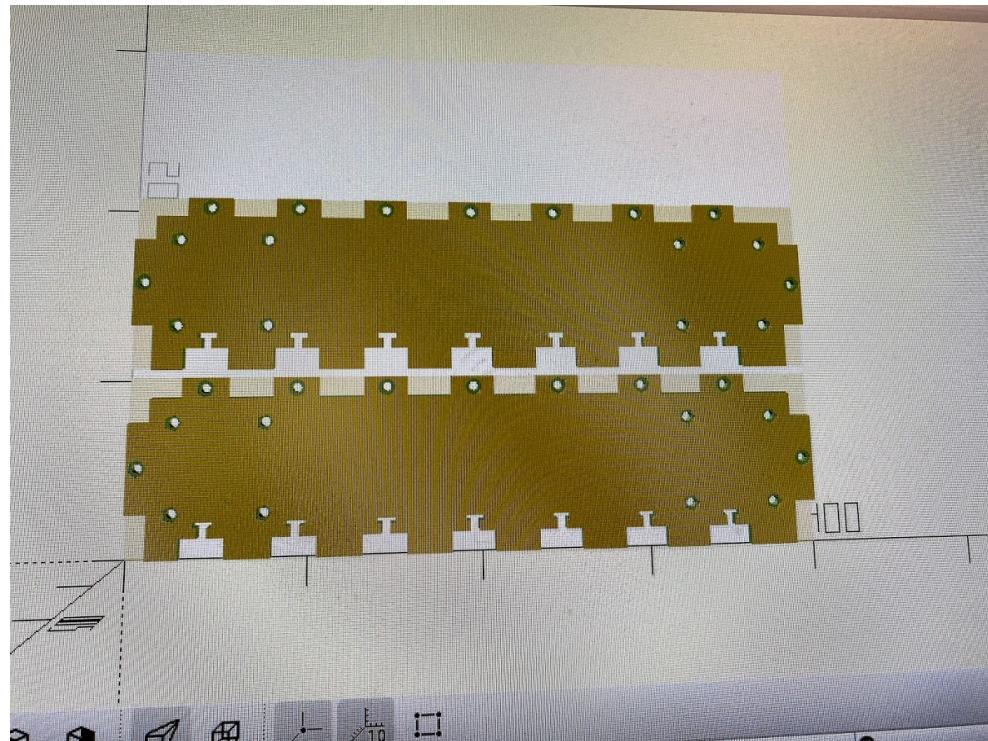
SVG Based Vectored ART

Using either a V-Bit or a  
Diamond Drag Bit



# Furniture Components

Designed to be interlocking components for furniture or workbenches.

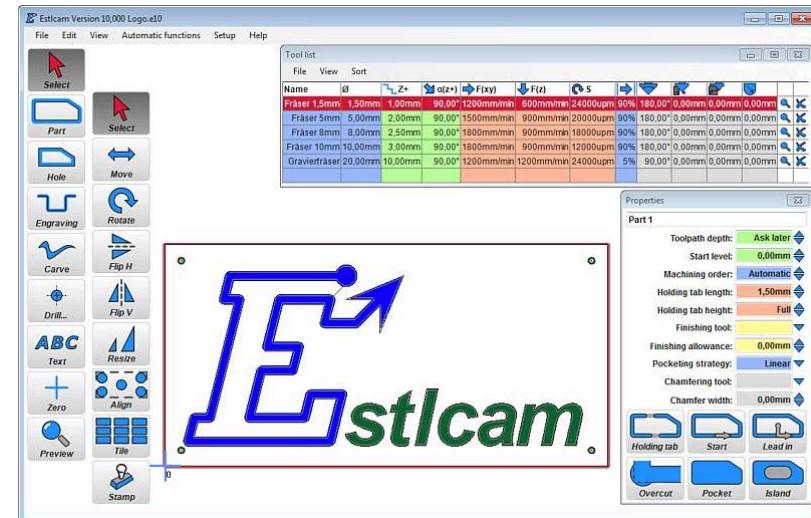


# Tools in my kit bag

- ESTLCAM – Takes 2d or 3d and Generates G-CODE
- OPENSCAD – Language for design of 3d/2.5d artwork
- CANDLE – Software that sends the gcode to the cnc
- GRBL – The firmware on the CNC that takes G-CODE and drives the motors

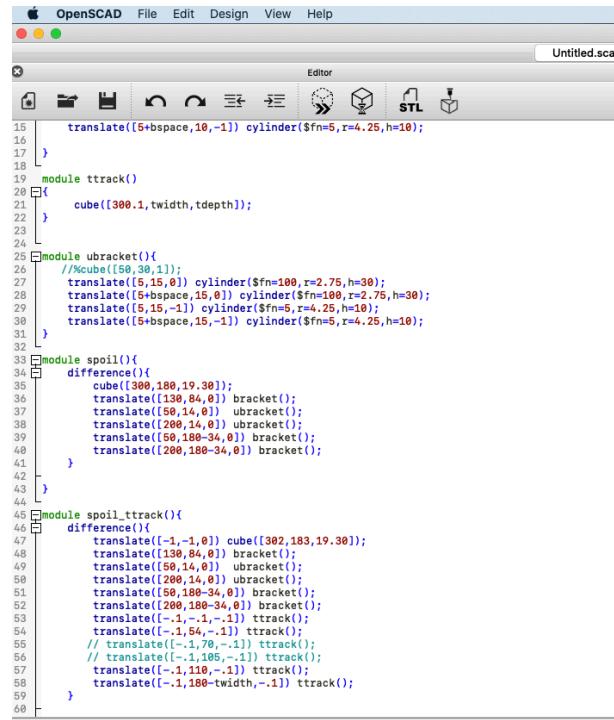
# ESTLCAM

- Takes svg/dwg and stl files and converts to gcode.
- STLs can generate roughing pass gcode, finish pass gcode, and a cutout gcode
- 2.5D using svg or autocad file for very rapid creation of industrial parts
  - By using multiple files, a complex 3d part can be created by combining operations



# OpenScad

- Easy design of 3d objects using a programming/scripting language specifically designed for creation of physical objects.
- Works well with a 2.5D design workflow to do quick mechanical parts
  - Create overall object
  - Create slices and save as svg for each slice
  - Load slice into estlcam and generate operations for that slice
  - Repeate



```
15 translate([5+bspace,10,-1]) cylinder($fn=5,r=4.25,h=10);
16 }
17 }
18 module ttrack()
19 {
20   cube([300.1,twidth,tdepth]);
21 }
22 }
23 }
24 }
25 module ubracket(){
26   //Mcub([50,38,1]);
27   translate([5,15,0]) cylinder($fn=100,r=2.75,h=30);
28   translate([5+bspace,15,0]) cylinder($fn=100,r=2.75,h=30);
29   translate([5,15,-1]) cylinder($fn=5,r=4.25,h=10);
30   translate([5+bspace,15,-1]) cylinder($fn=5,r=4.25,h=10);
31 }
32 }
33 module spoil(){
34   difference(){
35     cube([300,180,19.30]);
36     translate([130,84,0]) bracket();
37     translate([50,14,0]) ubracket();
38     translate([200,14,0]) ubracket();
39     translate([50,180-34,0]) bracket();
40     translate([200,180-34,0]) bracket();
41   }
42 }
43 }
44 module spoil_ttrack(){
45   difference(){
46     translate([-1,-1,0]) cube([302,183,19.30]);
47     translate([130,84,0]) bracket();
48     translate([50,14,0]) ubracket();
49     translate([200,14,0]) ubracket();
50     translate([50,180-34,0]) bracket();
51     translate([200,180-34,0]) bracket();
52     translate([-1,14,0]) ttrack();
53     translate([-1,50,-1]) ttrack();
54     translate([-1,50,-1]) ttrack();
55     // translate([-1,70,-1]) ttrack();
56     // translate([-1,105,-1]) ttrack();
57     translate([-1,110,-1]) ttrack();
58     translate([-1,180-twidth,-1]) ttrack();
59   }
60 }
```