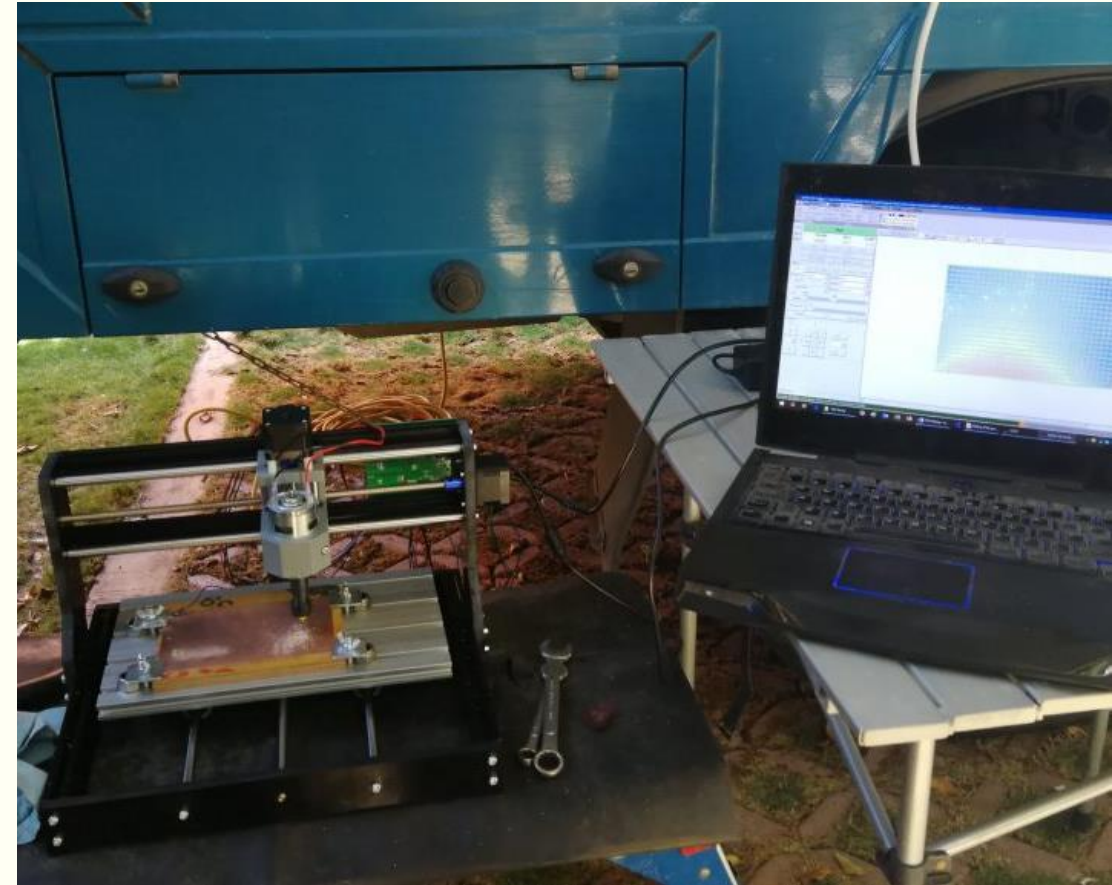


TECHNOLOGY IN HOME/HOBBY SYSTEMS

A somewhat deeper look at one form of applied
technology in fabrication of home/hobby components



Component Fabrication Utilizing CNC Systems

Warning!

- This presentation tends towards the technical side of machining via automated methods
- It still remains a high level introduction
- Please ask questions
- Perhaps it will inspire you to go further
- Do proceed with caution if you do

Component Fabrication Utilizing CNC Systems

- Methods of modern machining applicable to modeling
 - 3D Printing
 - Laser Machining
 - CNC Routing
- 3D Printing
 - Fabricating near impossible components of out special resin
 - Reference The Nautical Research Journal, Summer 2014
 - Commercial developer **Shapeways**
- Laser Machining
 - Common in todays kits by most all manufacturers
 - High level **Shop Notes** topic introduced to the group by Bill E
 - Local fabricators; **Smidgen, Don Onley Shop (Rochester)**
 - Home/hobby systems
- CNC Machining
 - Not commonly used by any known kit manufacturer
 - High level **Shop Notes** topic introduced to the group by **Roger Gaborski**
 - **Local fabricator; Smidgen**
 - Home/hobby systems

Component Fabrication Utilizing CNC Systems

- Today's focus is **CNC routing/carving** for model ship component fabrication
- Not a “be all end all solution” BUT.....
 - Useful for elements such as bulkheads, transoms, keel components etc.
 - Your imagination may be the only limiting factor to its application
 - Basic CNC systems have 3 axis capability X, Y, Z
 - More complex systems can incorporate a rotational axis and more (5, 6, 7 axis)
 - Wide array of tooling to fabricate parts
 - Mini router bits
 - Mini drill bits
 - Carving bits
 - Miniature chucks

Component Fabrication Utilizing CNC Fabrication

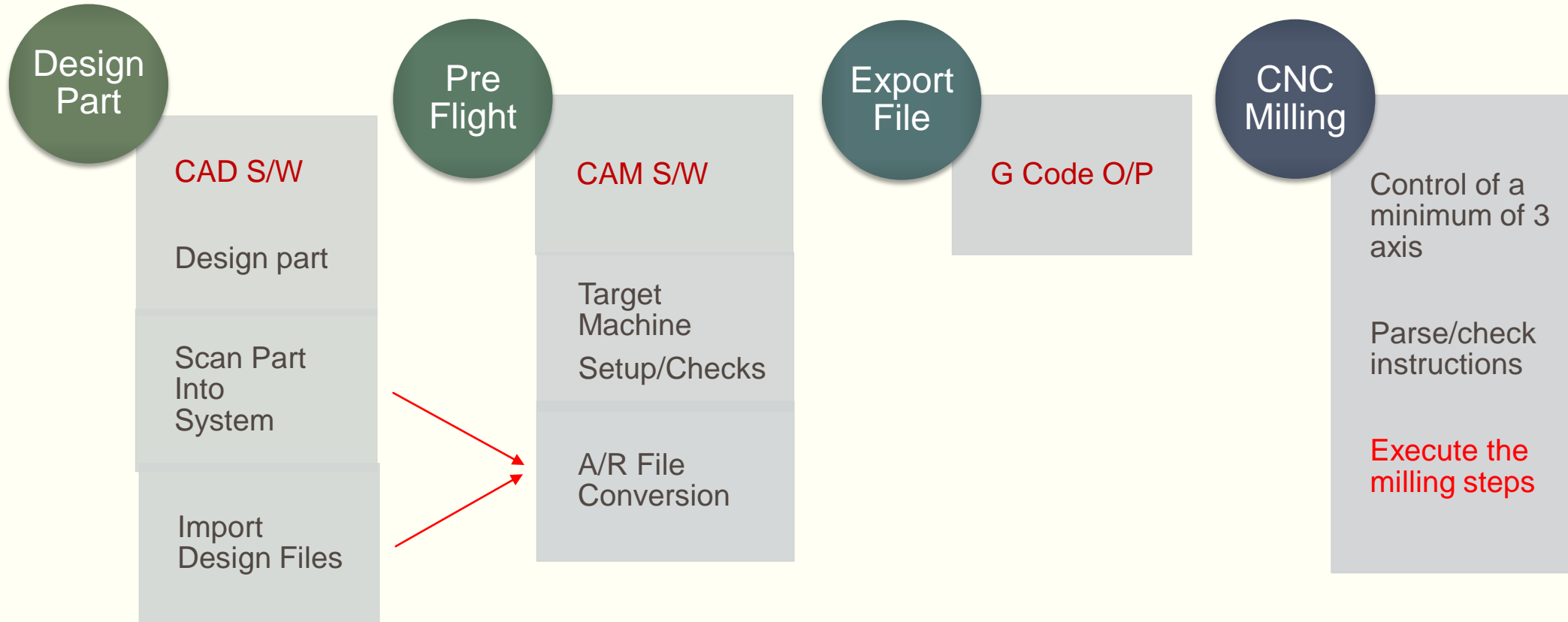
- Advantages

- Broad range of material types can be used; wood, plastic, soft metals
- Material thickness can be greater than most home/hobby laser systems
- Capable of 3D carving
- Fast reproduction given adherence to design rules
- No char as with laser machining
- Claim: As accurate as laser technology

- Disadvantages

- Inside corners are rounded to the radius of the tool
- Witness or identity marks not easily applied
- Tool breakage can be a problem (one must pay attention to *feeds and speeds*)
- Hold downs and tabs must be more robust
- File **continuity** appears to be much more critical (more later)

Basic Path of Creation to Parts Production



Breaking Down The Process Steps

Design
Part

CAD S/W

Typical Commercial Packages \$\$\$

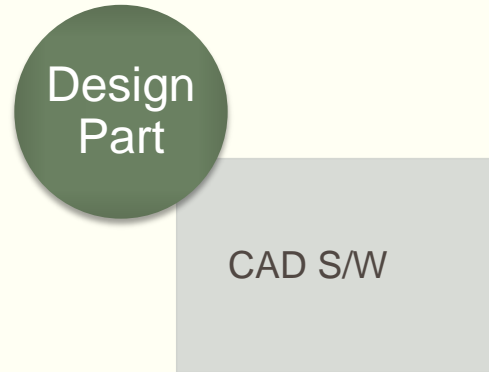
- Aspire
- Auto Desk/Fusion 360
- SolidWorks
- Many, many more

Freeware

- Easel (CAD/CAM sort of)
- Carbide Create
- <https://all3dp.com/1/best-free-cad-software-2d-3d-cad-programs-design/>*

- For the most part one would use these software applications if you were starting from a blank sheet
- Corel Draw and MS Visio are not included as true CAD software applications but can be utilized
- Sketch Up may justifiably be placed under freeware?
- Run on Windows and some run on MAC OS
- * Just too many to list here and that may be part of the problem

Breaking Down The Process Steps



- Recall; one can import files for processing from other sources
- *(The more I delve into this subject I am tending to conclude this is more aptly a CAM function as some software are inseparable packages)*
- Types of imported files
 - Scanned image
 - DXF (file) – Design Exchange File
 - SVG (file) – Vector Graphic File
 - JPEG (picture)
 - PDF (requires conversion to JPEG via freeware)
 - Others?

Breaking Down The Process Steps

Pre
Flight

CAM S/W

Typical Commercial Packages \$

- BOB CAM
- Meshcam
- Cambam
- <https://all3dp.com/1/best-cam-software-solidworks-autocad/>

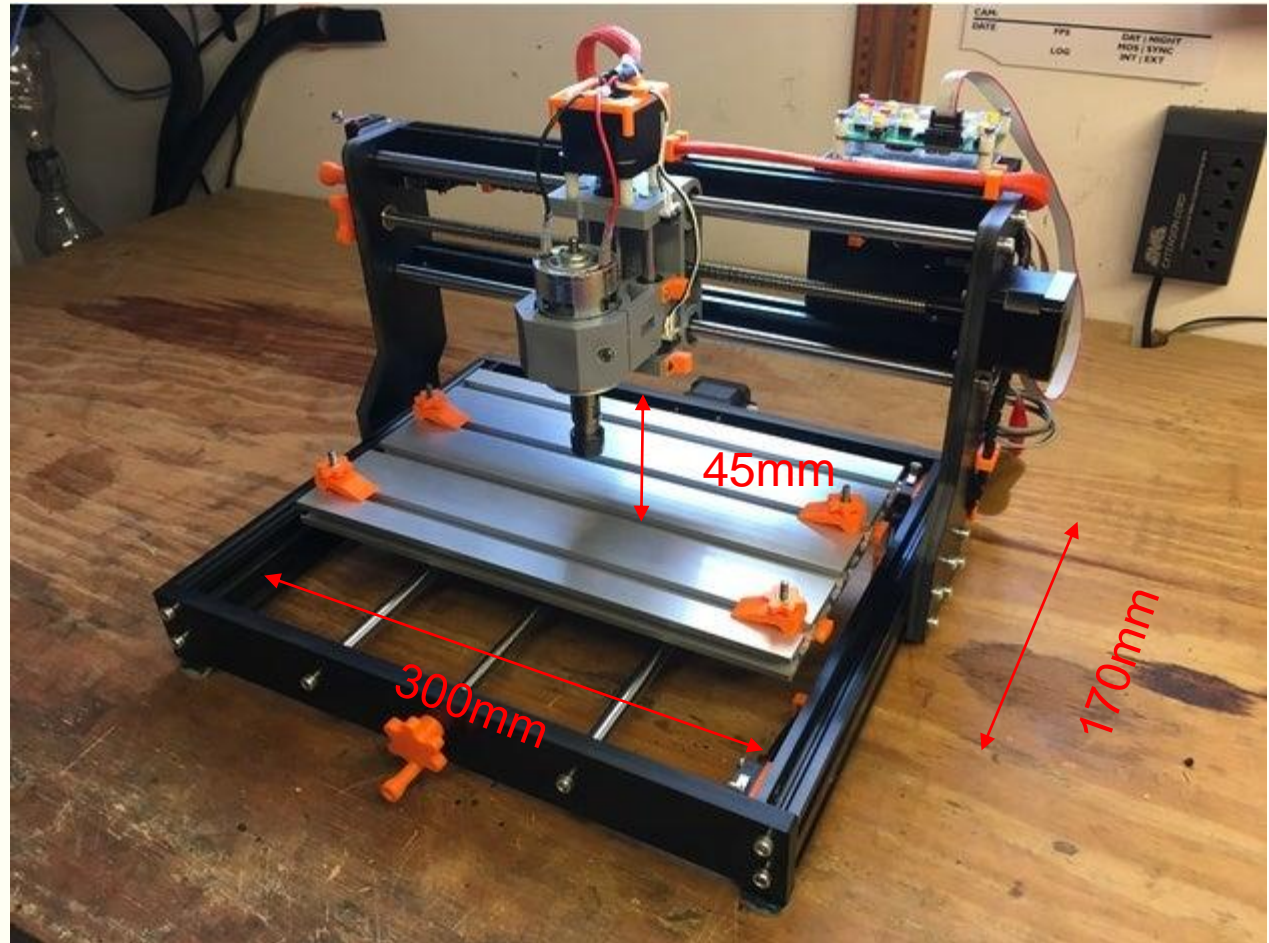
Freeware

- Easel (*CAD/CAM like*) – Xcarve creation
- Carbide Create – Shapeoko creation
- <https://all3dp.com/1/best-free-cad-software-2d-3d-cad-programs-design/>

- The CAM software supports *target machine* particulars prior to generating an output command file for the CNC Controller
- The output command file is a '*G Code file*', which defines positional (x/y/z) and router/spindle motor speed commands for the tool head. The file has no logic or arithmetic instructions for the CNC Controller.
- Some CAM packages have target device parameter setup. Easel is one such program. It supports parameter definition for my SainSmart 3018 Pro.
- Easel even adds tabs to your part design for through cutting

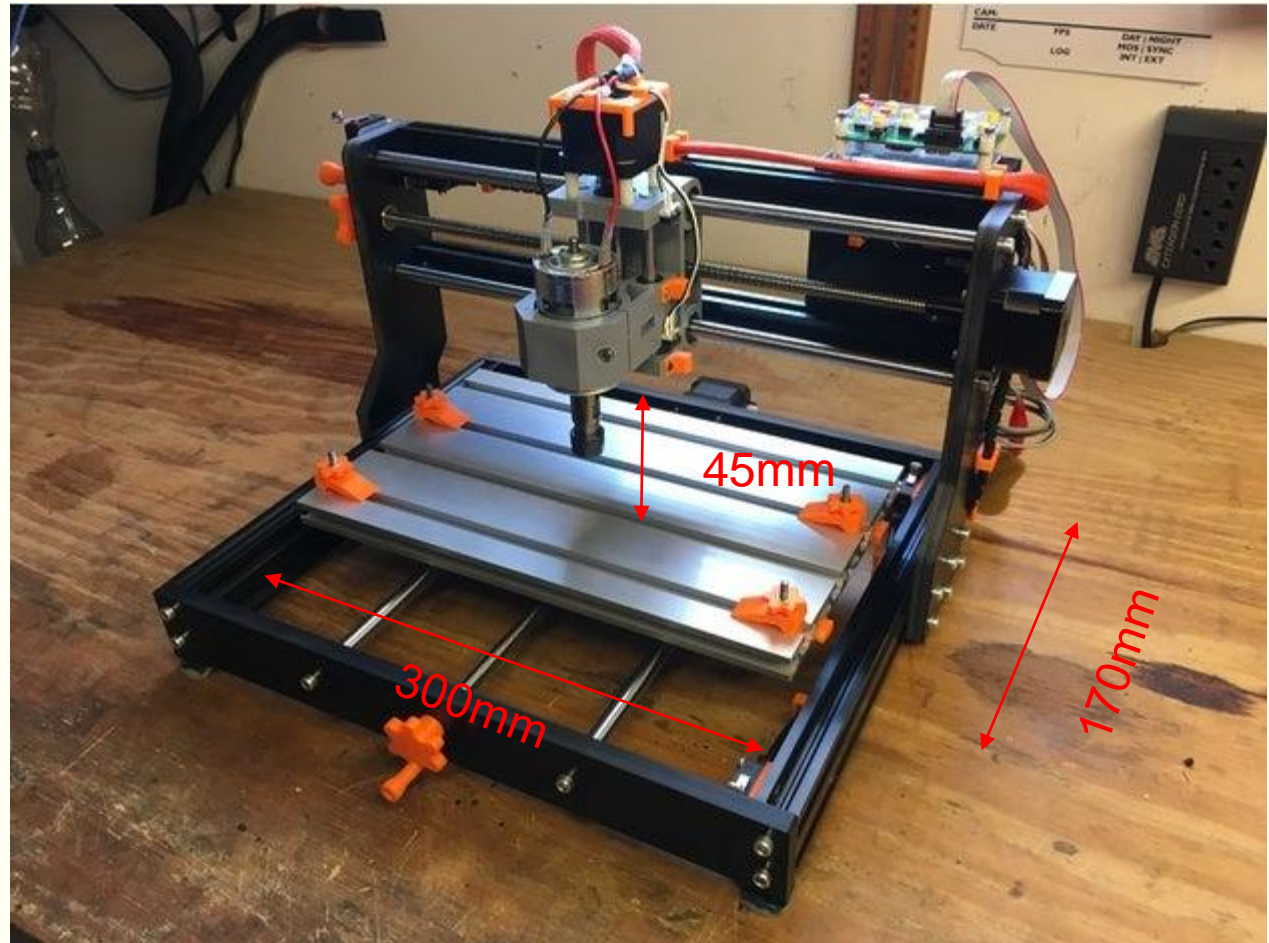
Entry into CNC Systems

- Bought the Sainsmart 3018 Pro thinking it might be a good learning tool
- Learn CNC Routing/Teach my grandson
- Configurable as a CNC router or laser system
- Equipped with a CAM like application called Candle
- Quite inexpensive; \$250
- Well made
- Customer support OK



Original Plan Via the Sainsmart CNC System

- Machine Elements for a new project
- Share the work experience
- Import known workable files and execute fabrication of elements to prove the concept.
- After many attempts at file work *unable* to execute importing files elements into executable g code.
- Haven't given up just have to put it aside momentarily



Project Via a Much More Robust CNC System

- Machining 28 Elements
- ¼ inch Lite Plywood
- Started with the DXF files
- Required considerable node continuity fixes via Aspire CAD/CAM application (\$\$\$)
- Added more robust tabs
- **CNC Mill is Shopsaber, a commercial robust system**
- Each element required about 2 minutes to complete



Lessons Learned

- Imported DXF and SVG files as well as reworked scanned in images require accurate line/arc segment work to define the shape. The ultimate shape must be a continuous pattern. **No node discontinuities!**
- This requirement appears to be more critical than laser machining requirements
- Sharp and proper tool bits yield good results
- **Speeds and feeds** via the CAM application are important for successful execution
- **Limit switches**, if not part of the original CNC system, **should be added**
- If one ventures into this arena the purchase of a fully integrated hardware **and** software system is the path to follow.
 - The Sainsmart 3018 Pro was \$249
 - It came with a rudimentary CAM like application
 - The test software didn't work in most cases (2 out of the 5 test files worked)
 - The 3018 Pro controller software is poorly supported as there are many alterable parameters to tweak
- One would have to spend in the range of \$1300 or more to obtain a “turn key” system such as Shapeoko.

Supporting Material: Bob Warfield a CNC Guru

21 Kinds of CNC Software?

Who knew there were so many?

I like to refer to CNC Software as Digital Tooling, because that's really just what it is.

When I was learning to be a manual machinist, people used to say, "Budget as much for tooling as you do the machine." Danged if they weren't right. In fact, if you wanted to be well tooled up (and what machinist wouldn't?), you could even leave off your measuring tools from that budget and focus on workholding, fixturing, toolholding, cutters, and the like. Then I went CNC, and I started noticing a lot of that tooling wasn't needed any more. Though I might like to have a 4th axis, I didn't need a rotary table, for example. But suddenly, I had a whole new category of tooling to add. At the very least, I needed a CAD program to make drawings which I would then feed to a CAM program to generate the gcode needed to be really productive with the machine.

G-Code editors and feeds and speeds calculators were not far behind. There are many other kinds of CNC software, which I've taken to calling "Digital Tooling", that are important to CNC work.

This article will walk you through what's available and what each type of package can do for you. Check it out:

[\[https://www.cnccookbook.com/cnc-software/?utm_source=ActiveCampaign&utm_medium=email&utm_content=21+kinds+of+CNC+software%3F++%5B+learn+what+each+one+does+%5D&utm_campaign=21KindsOfCNCSoftware\]](https://www.cnccookbook.com/cnc-software/?utm_source=ActiveCampaign&utm_medium=email&utm_content=21+kinds+of+CNC+software%3F++%5B+learn+what+each+one+does+%5D&utm_campaign=21KindsOfCNCSoftware)