



## Theory of operation:

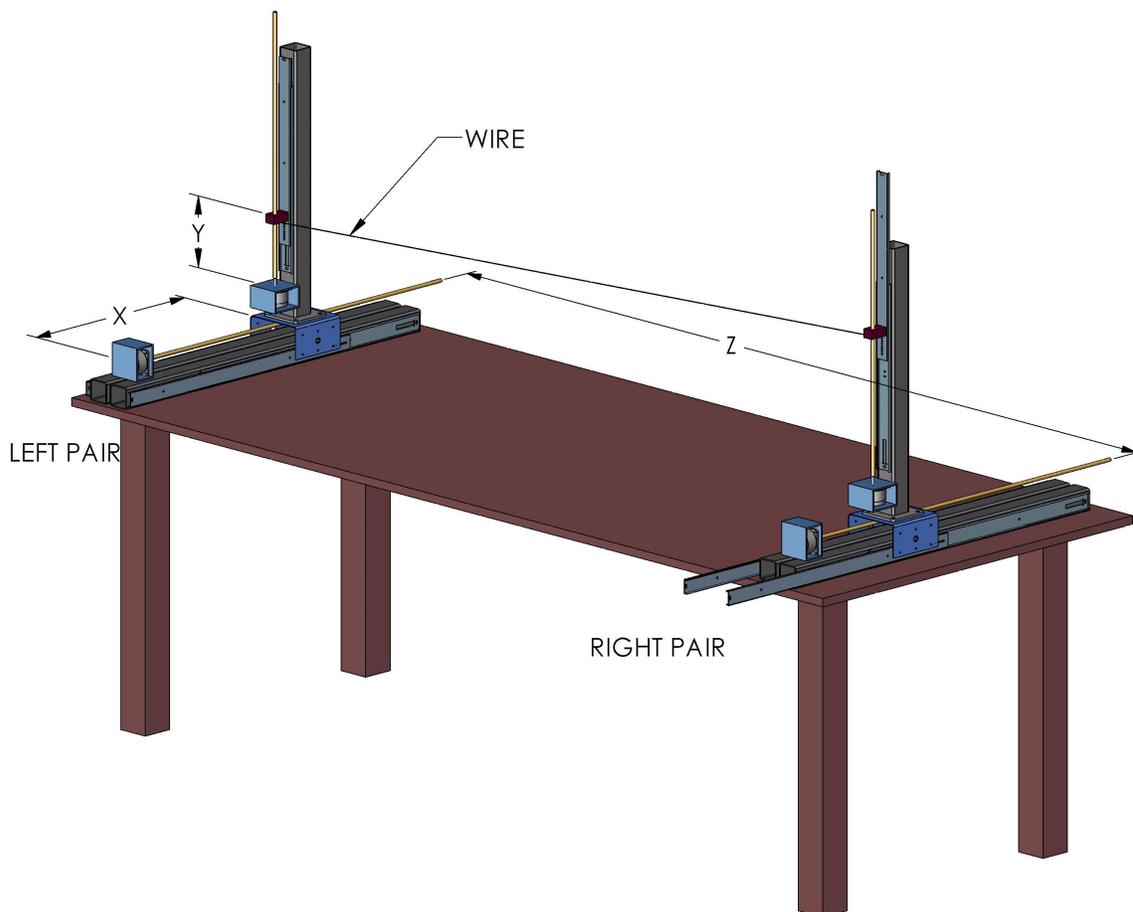
CNC foam cutter is 4-axis machine. It has two pairs of X-Y axis (total of four) that are fully independently controlled. Wire is sprung between left and right axis pair, this wire is heated with electric current, amount of heat is microprocessor-controlled.

Theoretical mechanical accuracy of the machine is 0.025mm (0.001").

In order to cut a shape (airfoil), left (root) and right (tip) section needs to be provided. This section can be identical for left and right pair of axis (for straight, parallel wing), or it can be different for each side (tapered wing). Ability of the machine is not limited to the airfoil shape, virtually any shape can be cut. See sample section for some shapes that we cut.

Since the cutting tool is straight line (wire sprung between two points), it is impossible to cut wing with curved leading or trailing edge (for instance elliptical wing such as Supermarine Spitfire). Good approximation can be achieved by splitting the wing in to several sections with different taper.

Root of the wing can be finished with cut under certain angle, when joined together with opposing half wing this, will create dihedral angle.





## **Formats:**

Software that controls cutter accepts DAT format. This file contains normalized X-Y coordinates for desired shape. Sample of such file is available in download section (CLARK-Y.DAT). First line of the file is ignored by the software and can contain design notes. Following lines contain X and Y coordinates of the shape (normalized). Contour of the shape starts at right-most point (TE) continues towards left through left-most point (LE) and finishes where it started.

Also included is DAT.xls file that helps visualize desired shape, there are several tabs in that file, showing different shapes as well as CLARK Y airfoil. Feel free to modify coordinates and see how the shape changes. You can use it to develop coordinate file for your desired shape.

*If you do not have MS Excel, you can download OpenOffice from [openoffice.org](http://openoffice.org) It is free software that is fully compatible with MS Office formats (\*.doc. \*.xls).*

1. Easiest way is to provide desired **airfoil(s) name**. I have extensive database of different airfoils, also there are numerous web sources for airfoil coordinates:

[University of Illinois airfoil database](#)

[Andrews's airfoil database](#)

[NACA 4 digit series airfoil generator](#)

2. **DAT file** as described above

3. One of the **CAD file** formats (AutCAD, DXF, Solid Works 2006, IGES, ProE, Parasolid, STEP, ACIS)

4. **Bitmap image** (BMP, JPG, TIFF, GIF, PSD, PDF), this will be digitized in order to obtain coordinates.

5. If you have your shape in the format that is not listed above, please send me an email, I am sure that we can make it work.

## **Cutting envelope:**

Please refer to the image of the machine for axis orientation

X: 420mm (16.5") – chord-wise

Y: 280mm (11.0") - thickness

Z: 1400mm (55.0") – span-wise

If your shape exceeds one of the above dimensions, it can be cut in several sections, I have done wings with chord length up to 660mm (26.0"). Please see sample section for details.

## **Foams available:**

Celfort 300 (30 psi pink extruded Styrofoam, up to 2.0" thick)

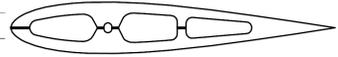
Styrofoam SM (30 psi blue extruded Styrofoam, up to 4.0" thick)

HighLoad 100 (100 psi blue extruded Styrofoam, up to 2.0" thick)

HighLoad 60 (60 psi blue extruded Styrofoam, up to 3.0" thick)

HighLoad 40 (40 psi blue extruded Styrofoam, up to 3.0" thick)

EPP white (expanded polypropylene foam, 1.5" thick)



***What is needed in order to provide you with a quote:***

- Left (root) shape in one of the above listed formats, including its X dimension
- Right (tip) shape in one of the above listed formats, including its X dimension (if different from the left)
- Span/half-span of your wing (Z dimension)
- List all spar cavities that you require and their desired location
- Type of foam
- Quantity of wings that you require
- Washout (if required)
- Taper (if required)
- Dihedral (if required)