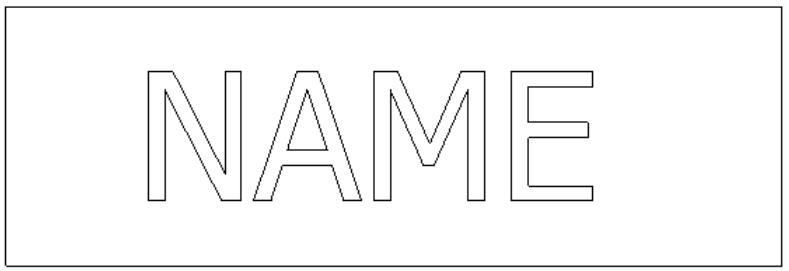
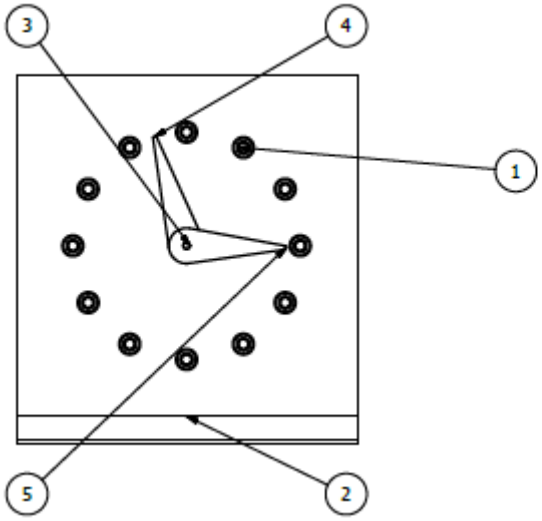
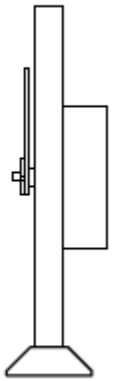
CAM (Surf Cam)

- Instructor - Robert Tosch Ext. 7421
- Course Objectives
  - Bolt circle on clock
    - work on parts for clock
  - Use CAM software to create a CNC program for a name plate
  - CNC name plate
- Lunch
  - Finish mill & drill clock
    - CNC mill/engrave face
  - Assemble clock

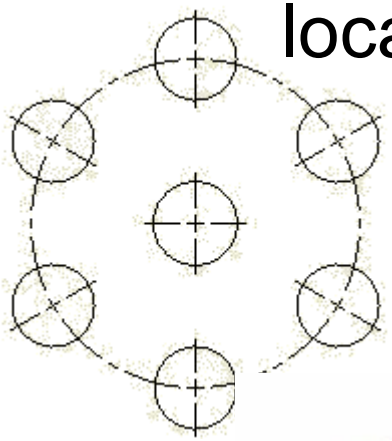


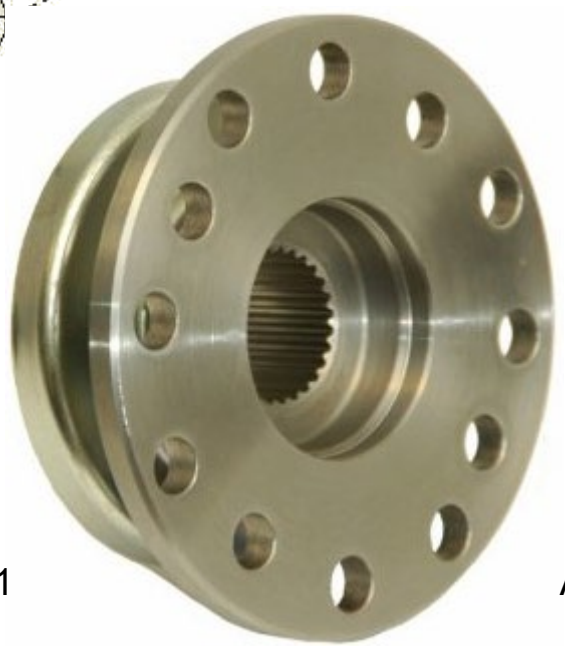




Bolt circles

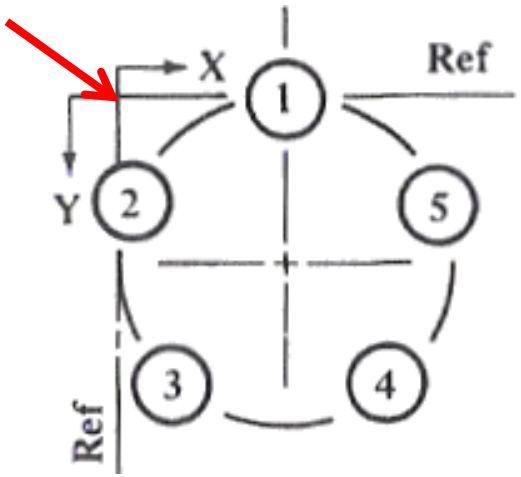
- Bolt circle are common on flanged parts
  - **Trig** can be very useful in finding the hole locations





Type “A” bolt circles

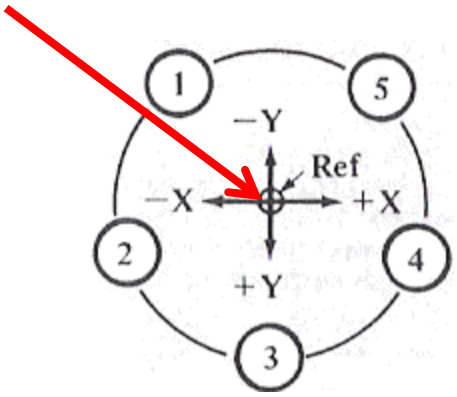
- Note origin for dimensions
- Determine the X, Y value for hole #5 for a 9 hole pattern on a 5” bolt circle
  - X =
  - Y =



7 Holes		8 Holes		9 Holes	
x1	0.50000	x1	0.50000	x1	0.50000
y1	0.00000	y1	0.00000	y1	0.00000
x2	0.10908	x2	0.14645	x2	0.17861
y2	0.18826	y2	0.14645	y2	0.11698
x3	0.01254	x3	0.00000	x3	0.00760
y3	0.61126	y3	0.50000	y3	0.41318
x4	0.28306	x4	0.14645	x4	0.06699
y4	0.95048	y4	0.85355	y4	0.75000
x5	0.71694	x5	0.50000	x5	0.32899
y5	0.95048	y5	1.00000	y5	0.96985
x6	0.98746	x6	0.85355	x6	0.67101
y6	0.61126	y6	0.85355	y6	0.96985
x7	0.89092	x7	1.00000	x7	0.93301
y7	0.18826	y7	0.50000	y7	0.75000
		x8	0.85355	x8	0.99240
		y8	0.14645	y8	0.41318
				x9	0.82139
				y9	0.11698

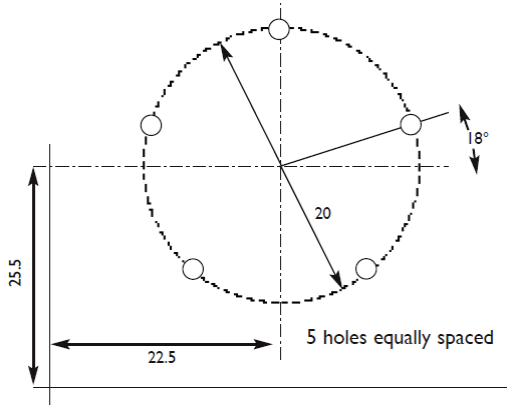
Type “B” bolt circles

- Note origin for dimensions – central coordinates
  - Determine the X, Y value for hole #7 for a 18 hole pattern on a 6” bolt circle
  - X =
  - Y =

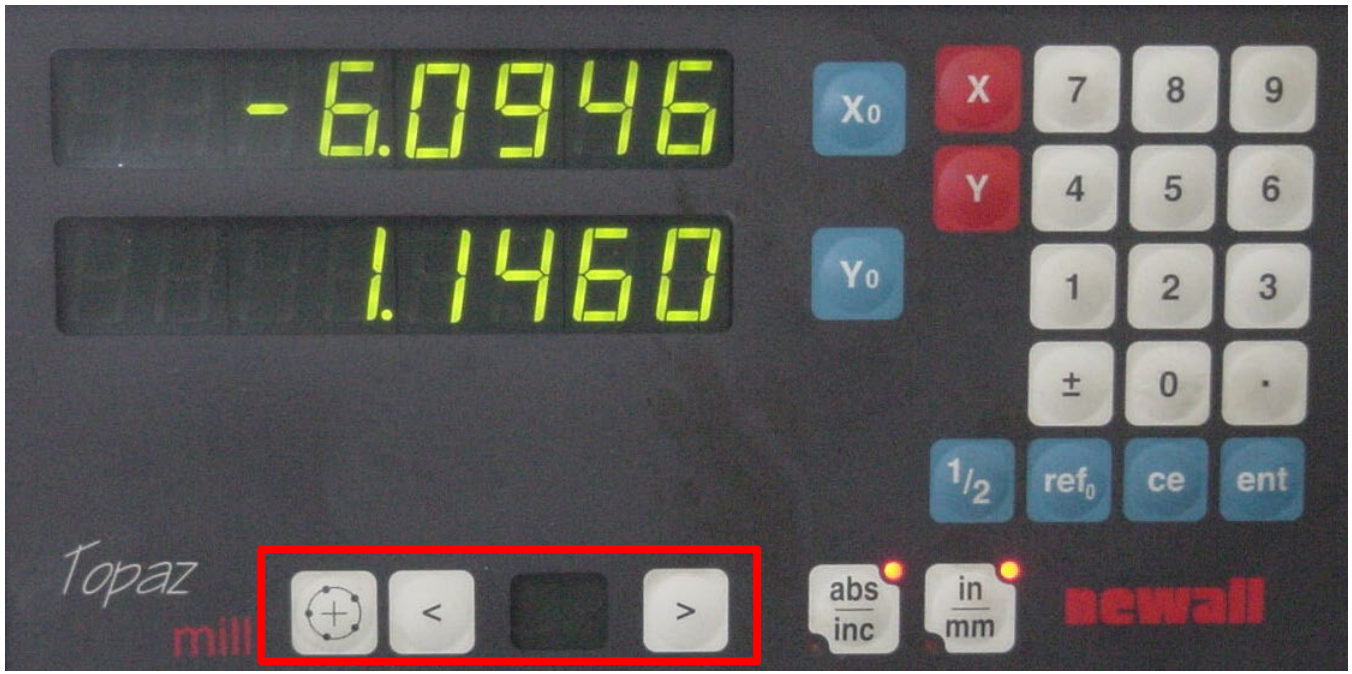


17 Holes		18 Holes		19 Holes	
x1	−0.09187	x1	−0.08682	x1	−0.08230
y1	−0.49149	y1	−0.49240	y1	−0.49318
x2	−0.26322	x2	−0.25000	x2	−0.23797
y2	−0.42511	y2	−0.43301	y2	−0.43974
x3	−0.39901	x3	−0.38302	x3	−0.36786
y3	−0.30132	y3	−0.32139	y3	−0.33864
x4	−0.48091	x4	−0.46985	x4	−0.45789
y4	−0.13683	y4	−0.17101	y4	−0.20085
x5	−0.49787	x5	−0.50000	x5	−0.49829
y5	+0.04613	y5	0.00000	y5	−0.04129
x6	−0.44758	x6	−0.46985	x6	−0.48470
y6	+0.22287	y6	+0.17101	y6	+0.12274
x7	−0.33685	x7	−0.38302	x7	−0.41858
y7	+0.36950	y7	+0.32139	y7	+0.27347
x8	−0.18062	x8	−0.25000	x8	−0.30711
y8	+0.46624	y8	+0.43301	y8	+0.39457
x9	0.00000	x9	−0.08682	x9	−0.16235
y9	+0.50000	y9	+0.49240	y9	+0.47291
x10	+0.18062	x10	+0.08682	x10	0.00000
y10	+0.46624	y10	+0.49240	y10	+0.50000
x11	+0.33685	x11	+0.25000	x11	+0.16235
y11	+0.36950	y11	+0.43301	y11	+0.47291

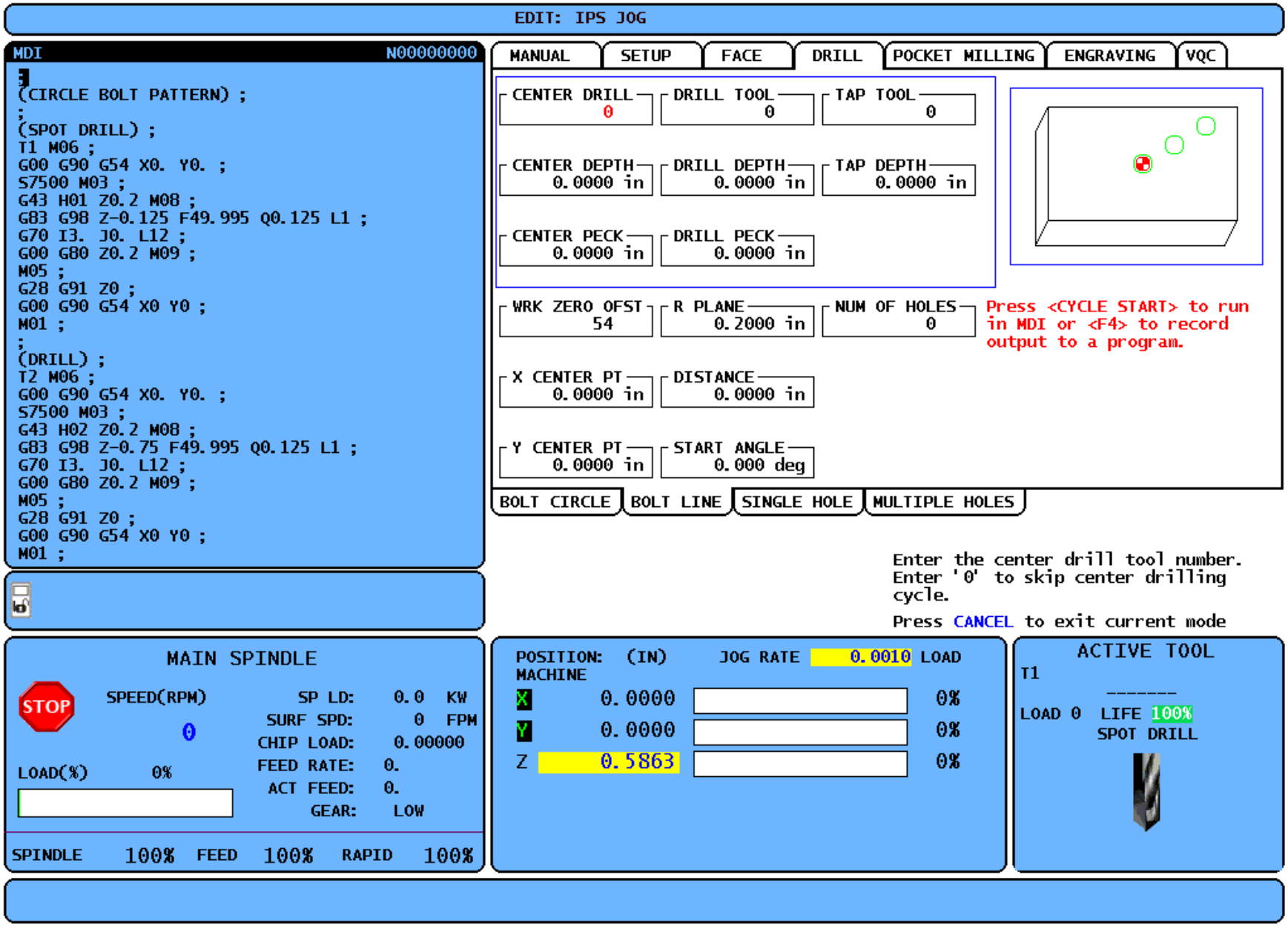
Topaz bolt circle



- Read the manual
  - Bolt Hole Circle" mode
  - LED shows the letter "**C" for center.**
  - Press **[>] to move to the next input.**
    - **Follow the LED directions**

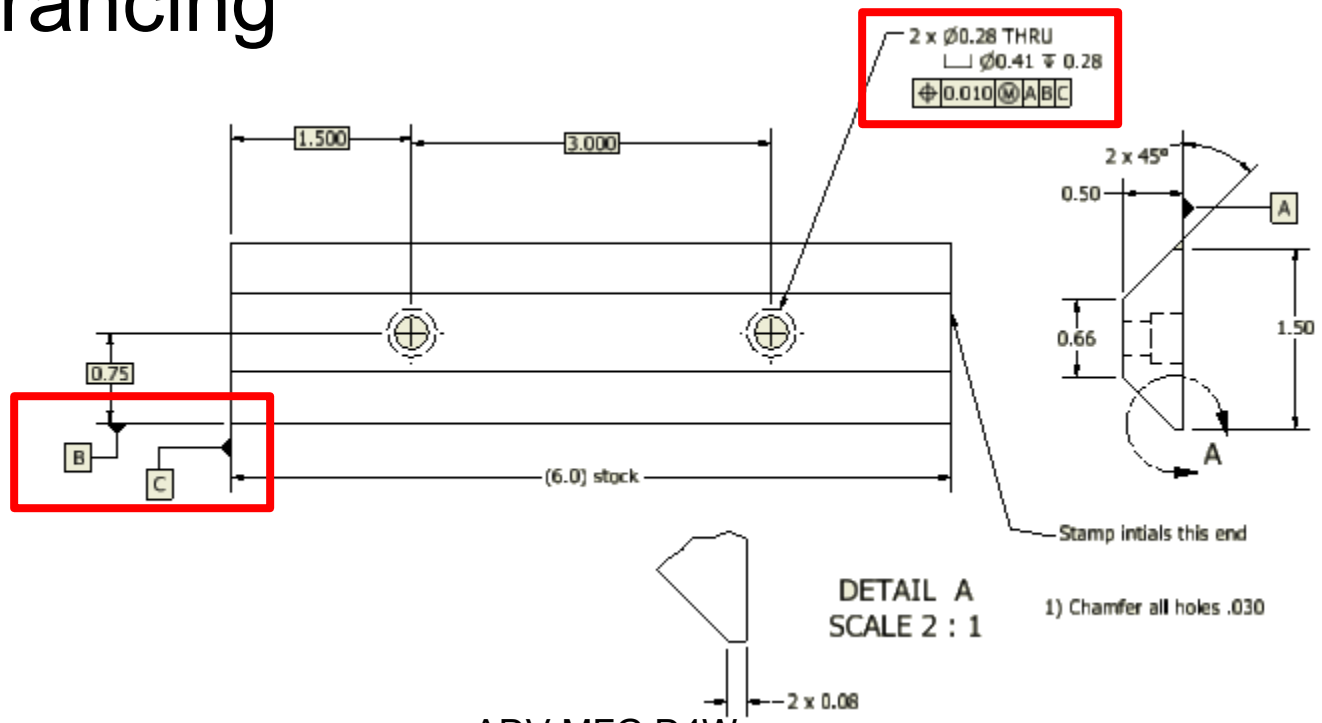


HASS Bolt Circle

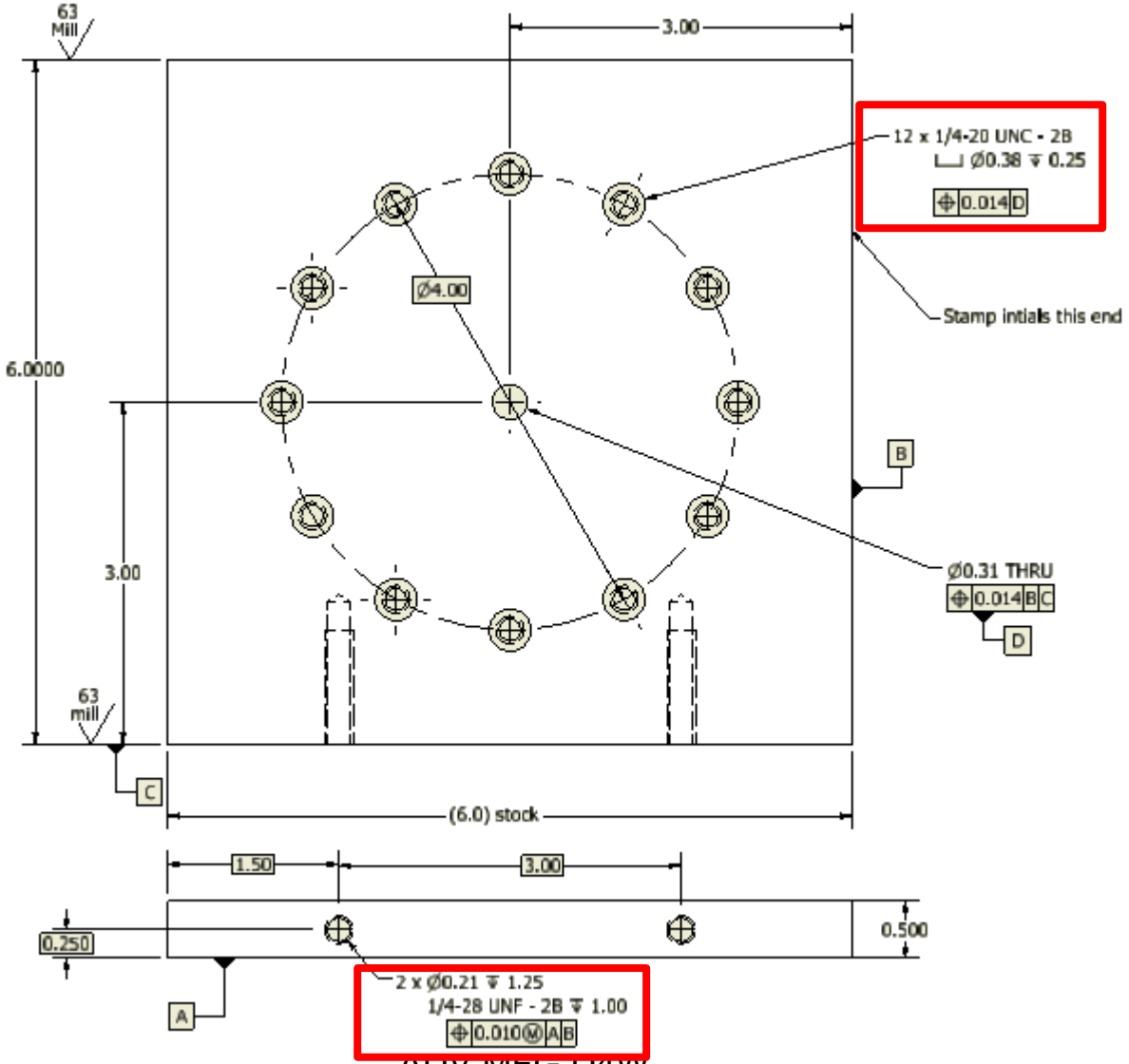


Base Plate

- Datum callouts
- Hole callouts
- GD&T – Geometric Dimensioning & Tolerancing



Clock Face


63
Mill
3.00
12 x 1/4-20 UNC - 2B
Ø0.38 ↧ 0.25
0.014 D
Ø4.00
Stamp initials this end
6.0000
3.00
B
Ø0.31 THRU
0.014 B C
D
63
mill
C
(6.0) stock
1.50
3.00
0.250
0.500
A
2 x Ø0.21 ↧ 1.25
1/4-28 UNF - 2B ↧ 1.00
0.010 M A B

CAM - SURFCAM

- Why is CAM valuable
  - As compared to manual programming
- CAD/CAM Boosts productivity
  - Speeds up CNC programming – by allowing the programmer to automatically generate the NC program from the engineering CAD data
  - Reduces machine set up time – reduces the program prove out time
  - Especially critical where lot sizes are small and/or parts are complex

Learning any CAM Software

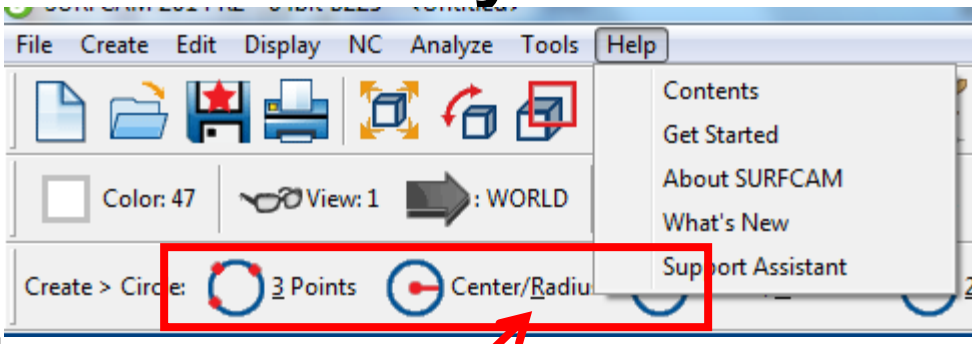
- (6) processes for all CAM Systems
- Job Setup
  - Axis selection, Retract (safety) Plane, Stock, Work holding, Machine Specific equipment
- Geometry selection
  - Geometry to machine, offsets Geometry, containment boundaries
- Tool selection
  - Tool definition, flutes, material, chip load & cutting speed

Learning any CAM Software - Continued

- (6) processes for all CAM Systems
- Machining Strategy
  - Cut direction, tolerances, radial cut, axial cut, High Speed Machining options
- Speeds & Feeds
  - Approach feed, Machining Feed, Retract feed, slow down feed, Spindle Speeds
- Approach & Retract into & out of Cuts
- $$$ Cycle time reduction

SURFCAM Screen layout

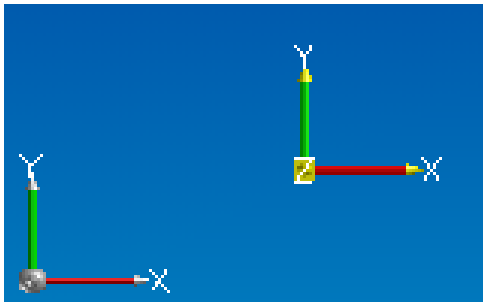
- Help screen
  - Contents
  - Store to T drive – Backup to Thumb drive
- Save early & often
- Hot keys increase your productivity
  - Underline = hot key
  - Display the Tap / Drill Chart. Press CTRL+T



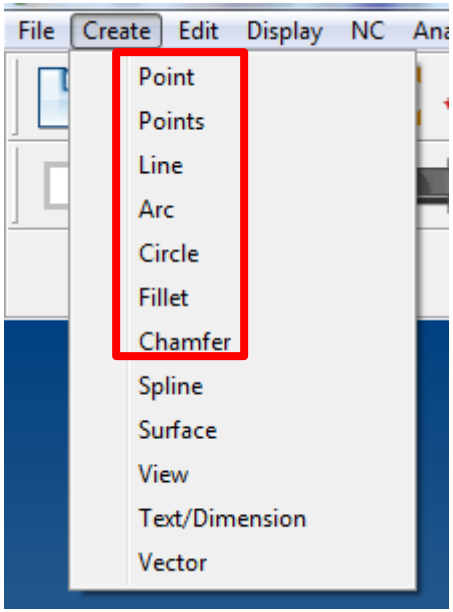
Layers & Colors

- Layers
  - Create geometry on different layers
- Color
  - Select color when creating geometry

Getting started

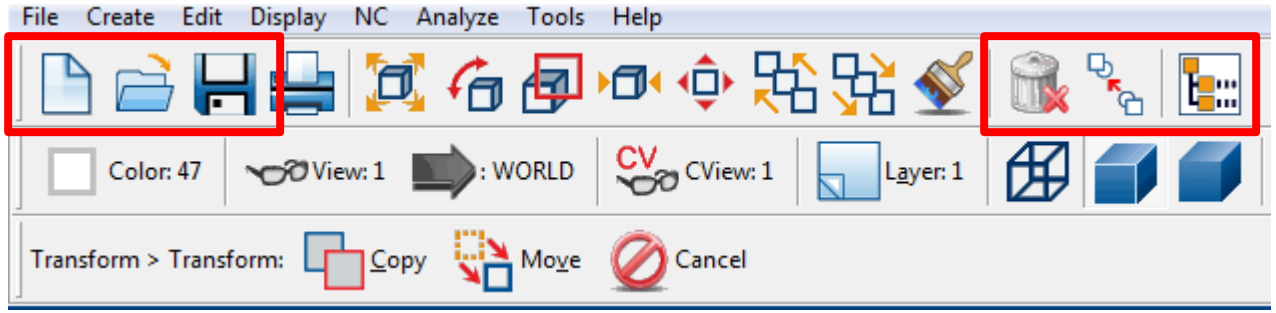


- Cartesian coordinate system
- Origin Point – X0Y0
- Create Geometry
  - Points
  - Lines
  - Circles
- Fillet & Chamfer
- Right & Left mouse buttons
  - Center roller



Screen icons

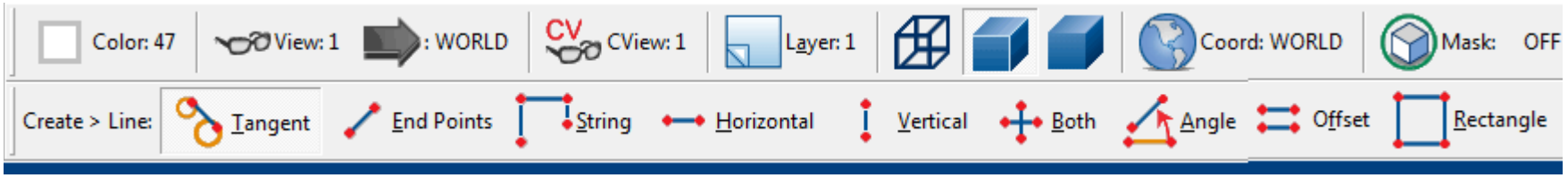
- New, Open & save
- Delete
- Transform
  - Copy
  - Move
- Operations manager



Point Geometry

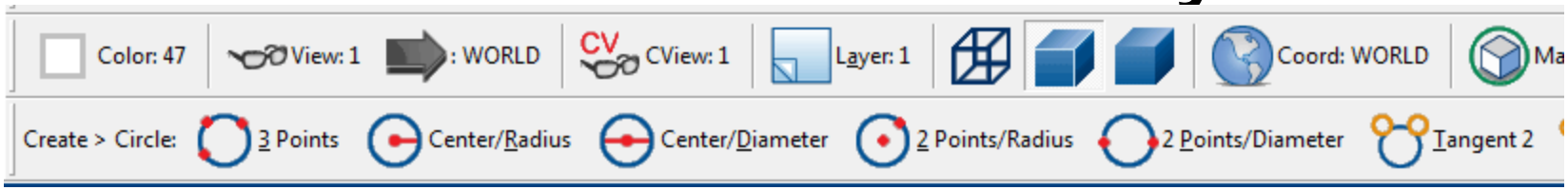
- Selection options – determines how geometry is located
  - Sketch = danger not accurate
  - End point = end point of existing geometry
  - Center = select arc geometry to find center
  - Keyboard = Enter X, Y, and Z coordinates
  - Quadrant = select quadrant of circle

Line Geometry

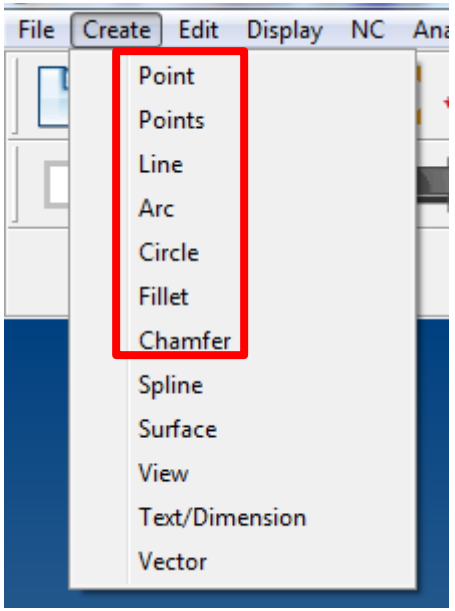


- Selection options
  - Tangent = tangent to an arc
  - Horizontal = horizontal line
  - Vertical = vertical line
  - Angle = create line at an angle
  - Offset = offset for a line (awesome feature)
  - Rectangle = create a box

Circle Geometry

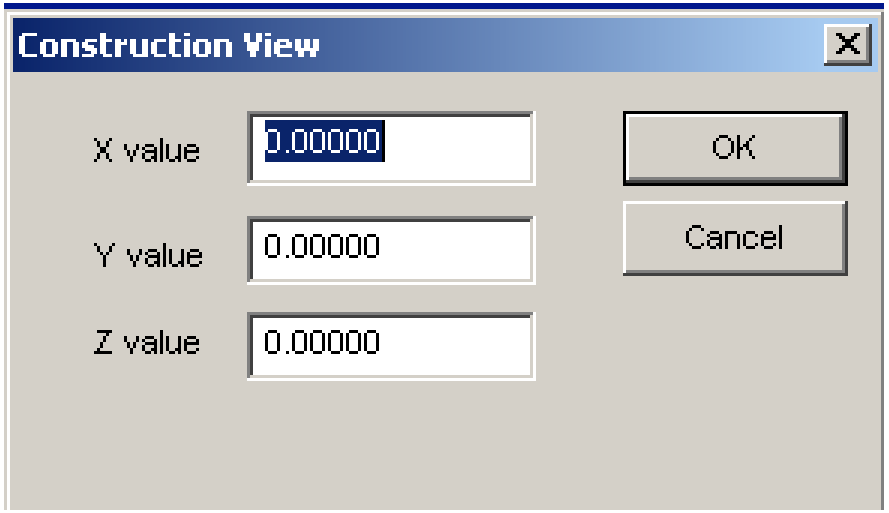


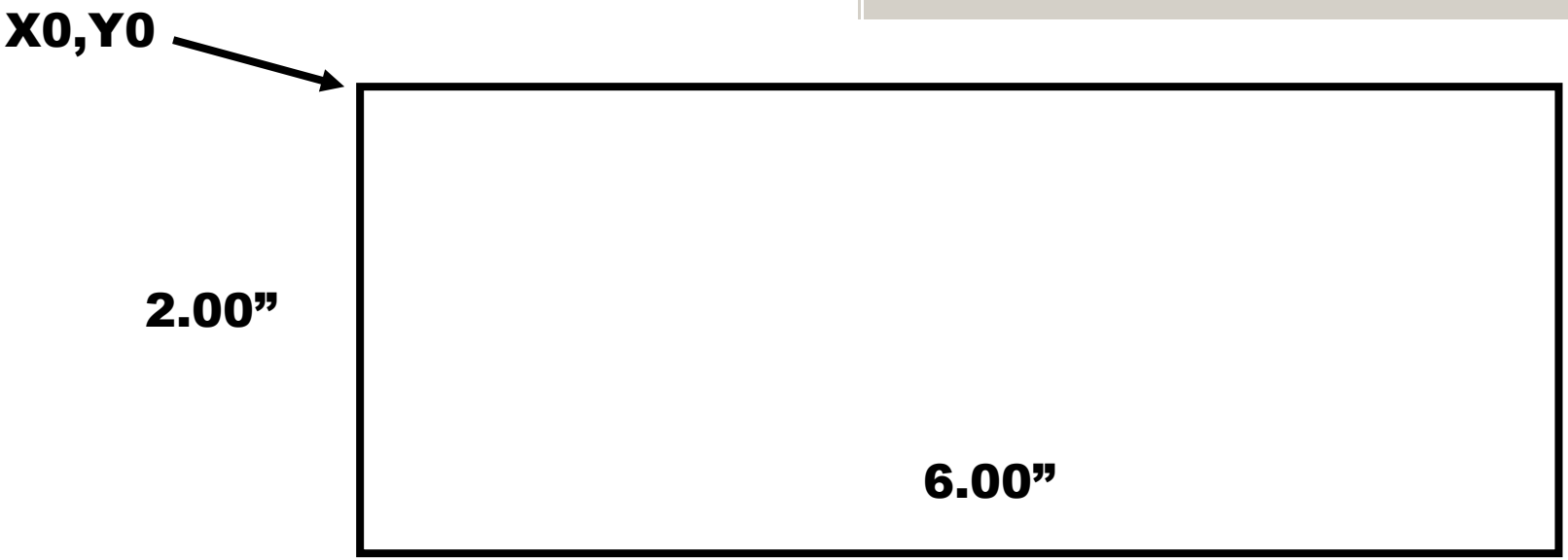
- Selection options
  - Center/Radius
  - Center/Diameter
  - Create > fillet = create fillet between geometry
- Create geometry using keyboard entry & existing geometry



Keyboard Input

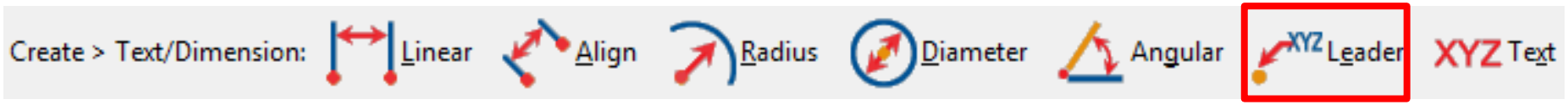
- Create line
  - End points > keyboard
- 6.00 x -2.00 dimensions
  - create a box

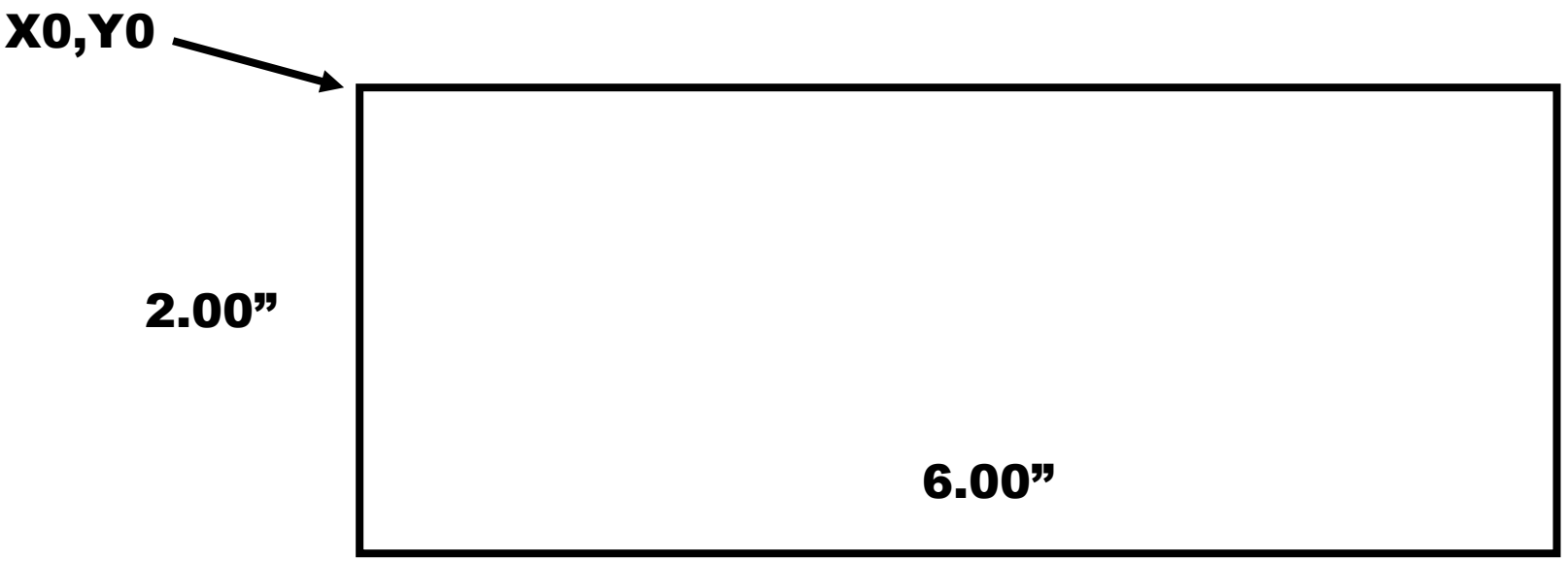




Edit color & Change layers

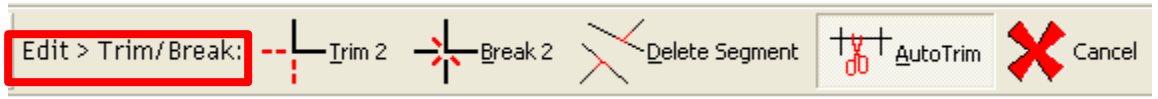
- Create Dimensions
  - Leader dimensions





Edit > Trim/Break

- Trimming One Entity
  - digitize entity to keep (area to keep)
  - digitize the trim too entity

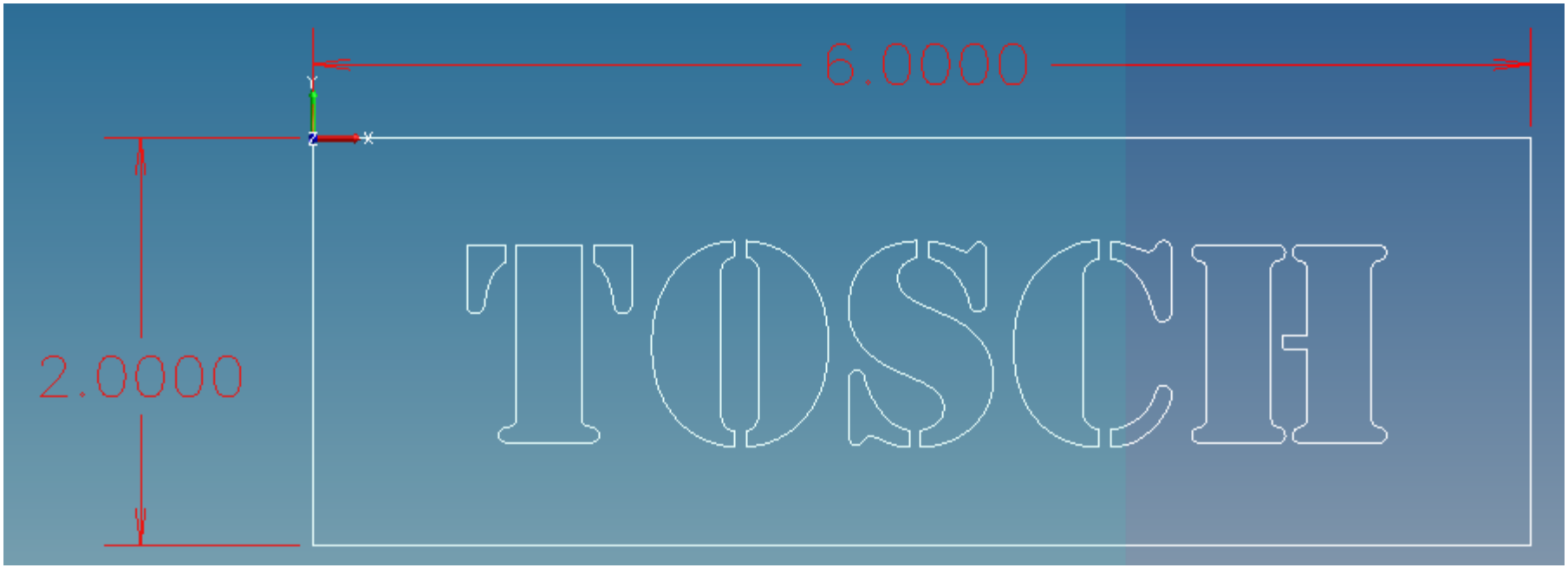


- Trimming Two Entities
- Radius trim

- Breaking an Entity
  - digitize the first entity
  - digitize the entity to break too.
- Be aware of where you select the element

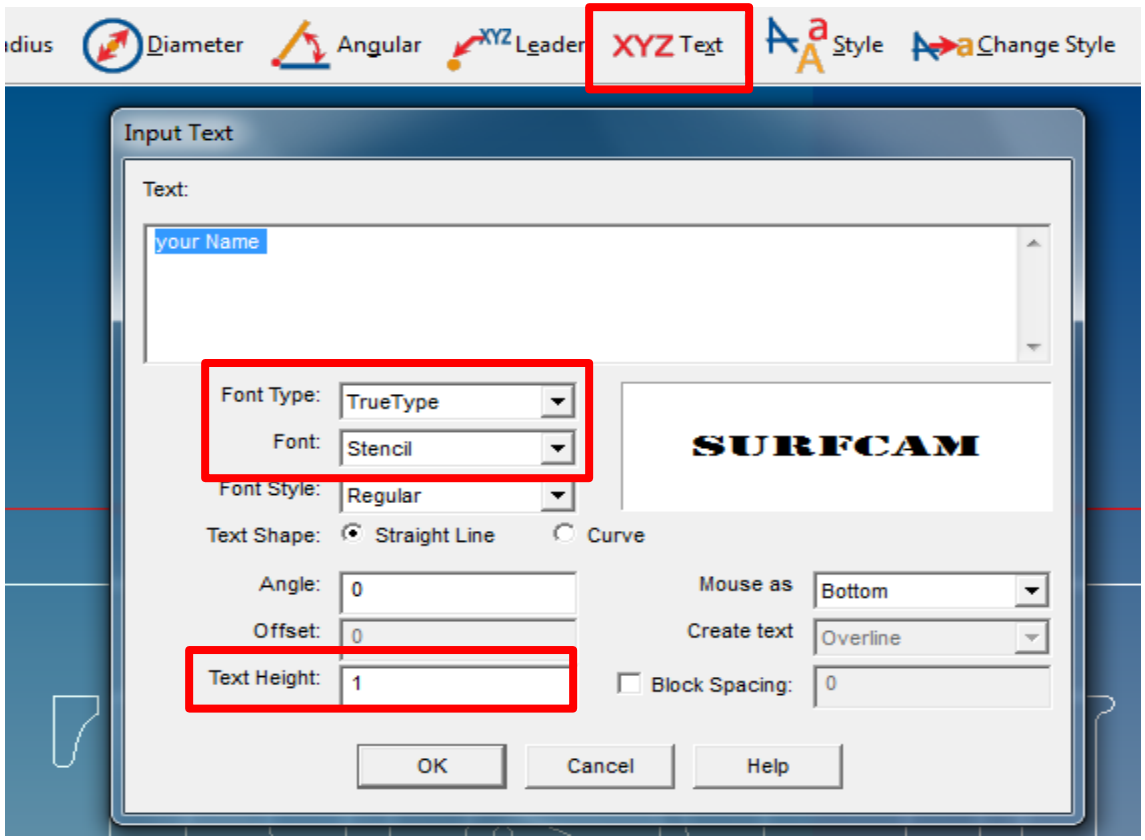
Create box

- Create a 2 x 6 rectangle
- Save file to thumb drive



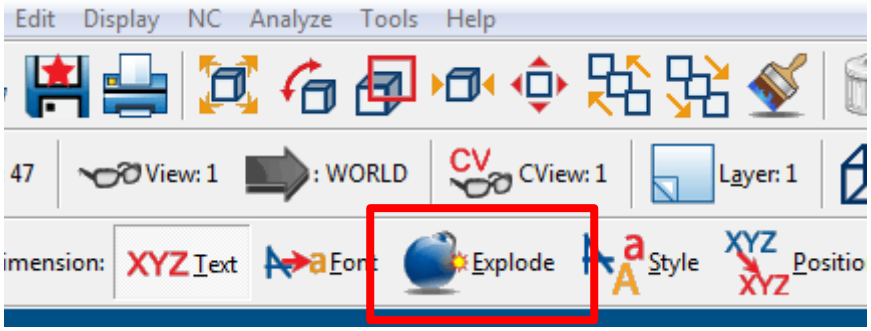
Create text

- Font type: True type
- Font: Stencil
- Text height size to fit 2 x 6 rectangle



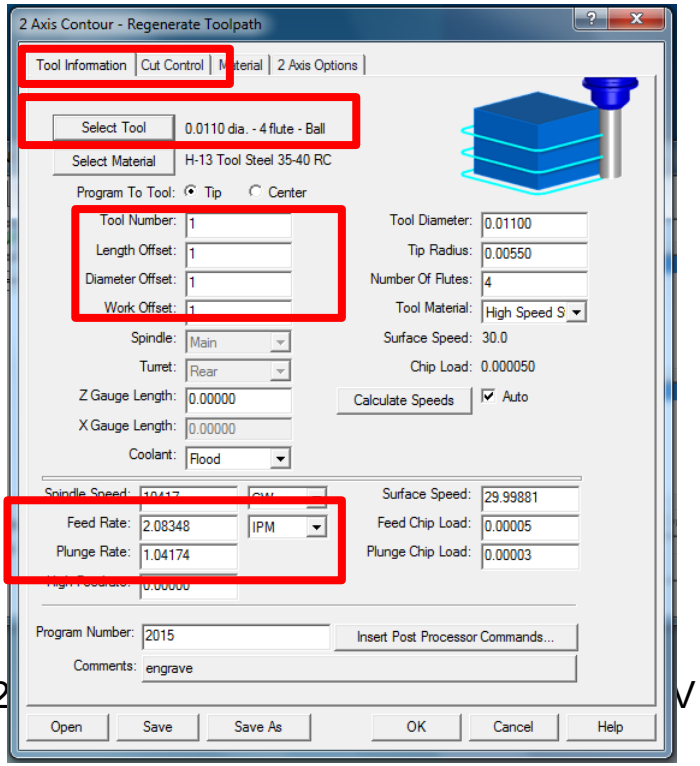
Explode text

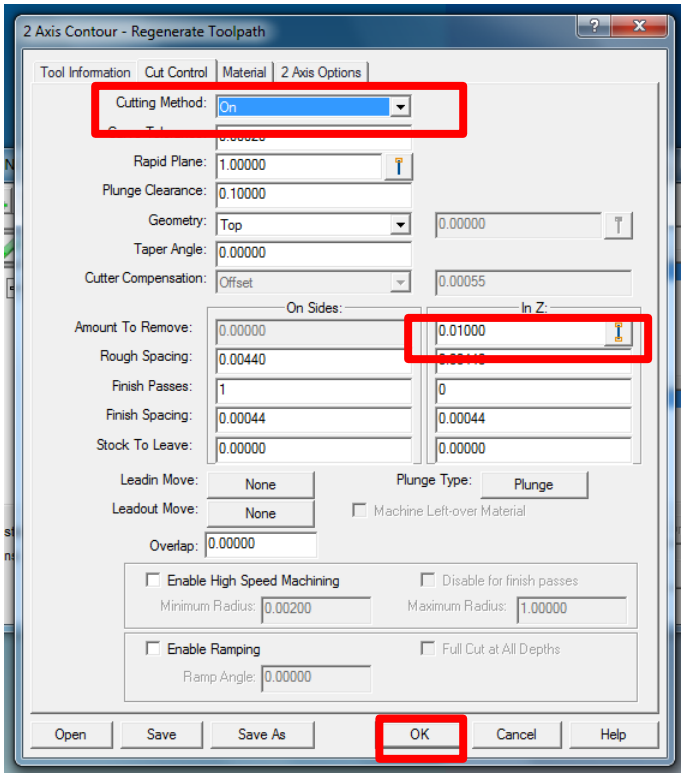
- Edit Text & explode



Add cutter path

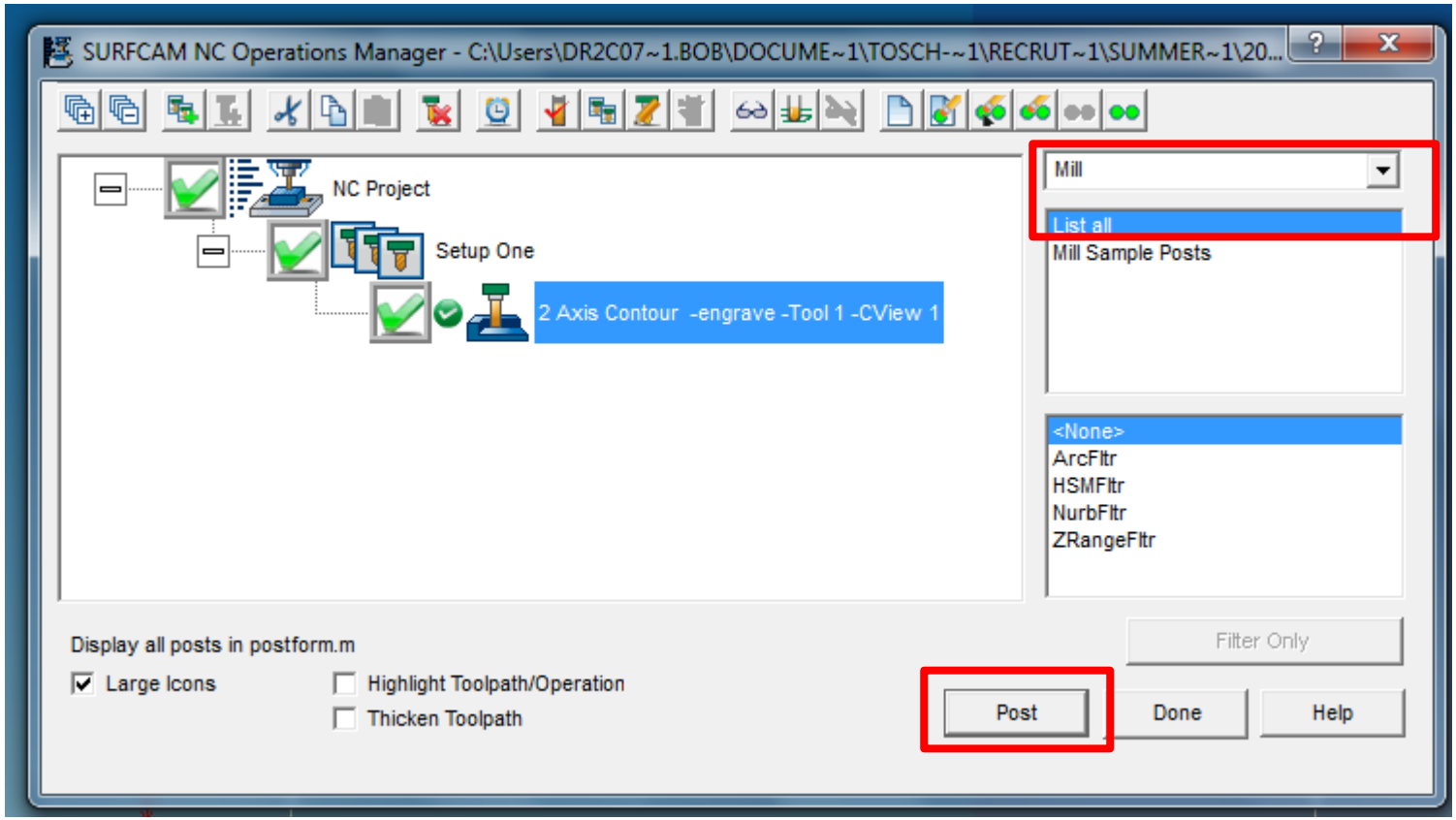
- Load cutter & change to tool #1
- Change feed rates to 10.0
- Change cutting method to on geometry
- Select geometry, depth .010 & press OK





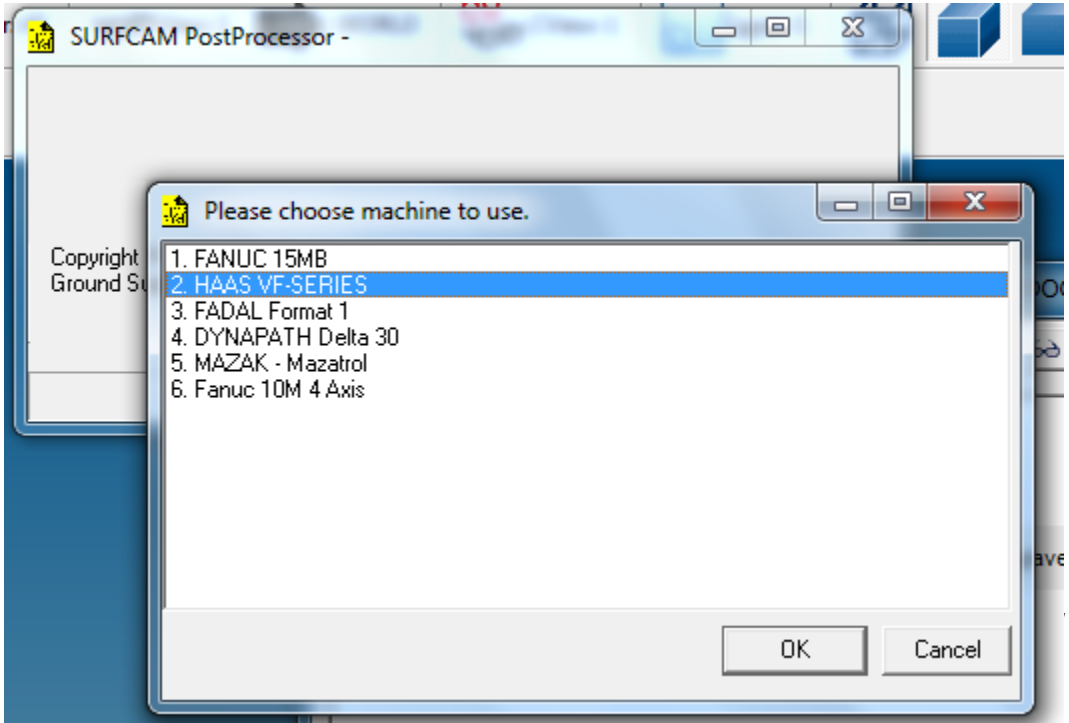
Generate CNC code

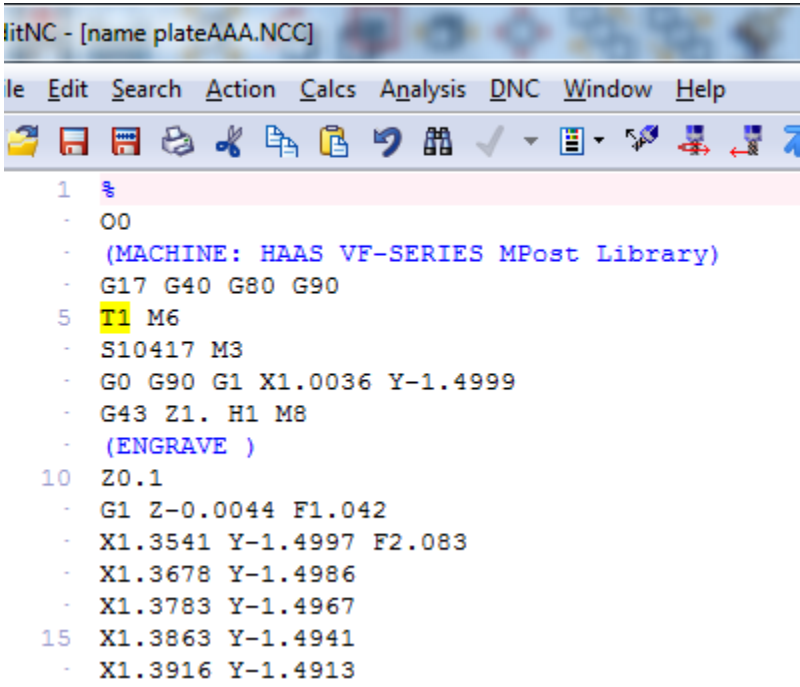
- Open operations manager
- Select post icon



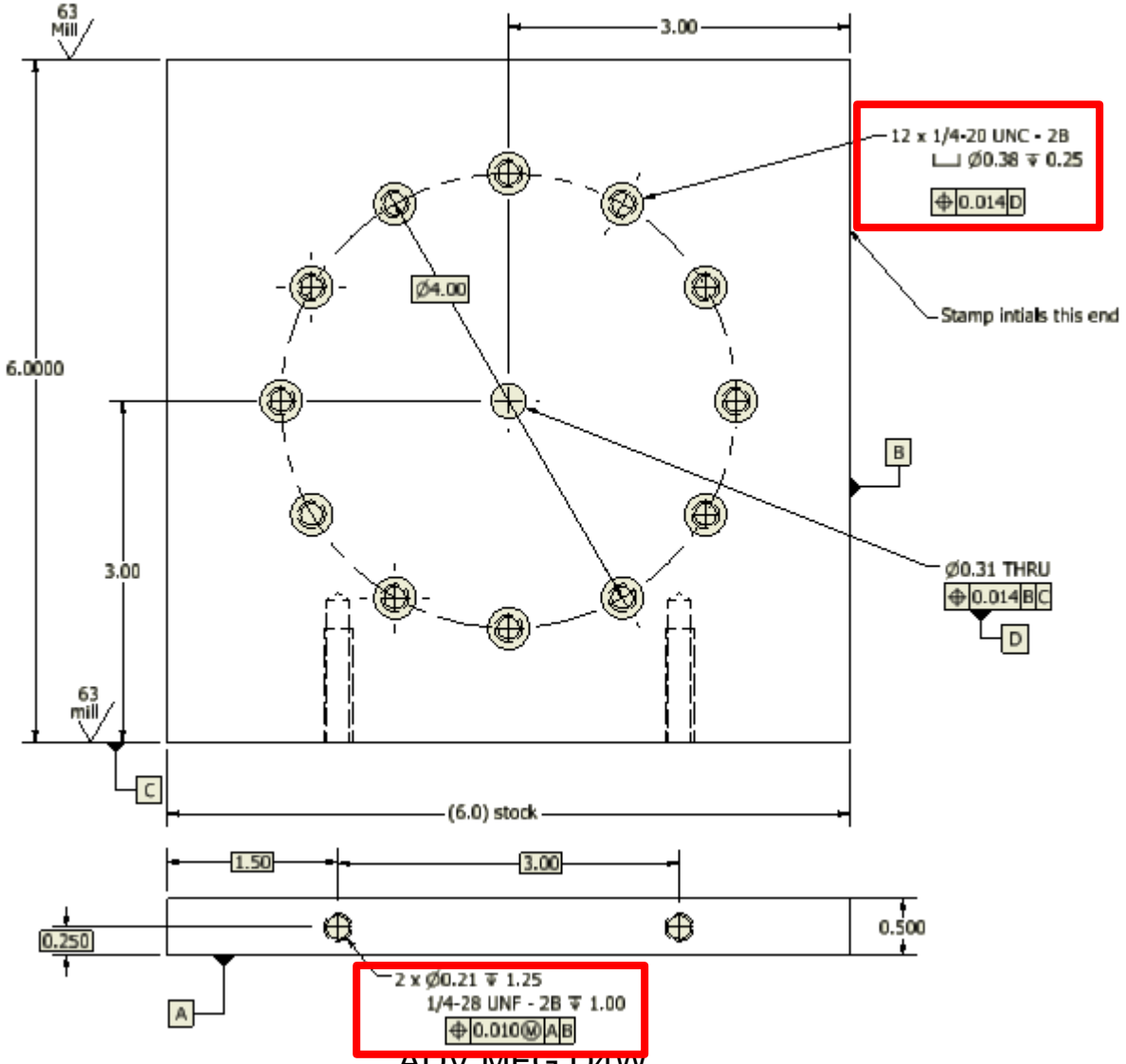
Select Post & generate code

- Select machine: Haas VF series
- Verify F words (feed to 10.)
- Save code to thumb drive





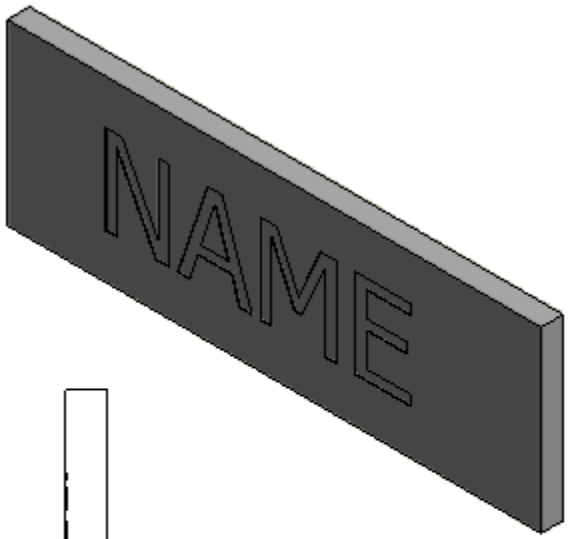
Clock Face bolt circle



Assignment

- Split in 2 groups
  - Continue milling/drilling for clock
    - Assemble clock
  - CNC mill name plate

1) Create part outline & add text
 text will be of suitible size to fit material
2) Explode text & add cutter path
3) Generate CNC code & save to thumb drive
4) Load program in CNC machine, Zero tool
5) CNC Engrave Name plate



ACC Grant Information

ACC is sponsored by a $2.5 million grant from the U.S. Department of Labor, Employment & Training Administration TAACCCT Grant #TC-26458-14-60-A-26. It is the policy of Alpena Community College (ACC) to comply with Section 504 of the Rehabilitation Act of 1973, as amended, and with the Americans with Disabilities Act of 1990 (ADA). These acts provide for equal opportunity for students with disabilities in educational activities, programs, and facilities. ACC is committed to affording equal opportunity to persons with disabilities by providing access to its programs, activities, and services.

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