Zach Swain Available at github.com/zswain/MEEG304

0.020" stepover 8:29 average +- 2% 🡪 **8:19-8:39** , 8min 39sec = 8.65min

1 b. With 8.65-1=7.65 from 2c below🡪(7.65min/60min)\*200pucks = 25.5 hours🡪 **27 hours**

to allow time spent changing out stock etc.

2 a. About **1 hour**, with MasterCAM being finicky.

c. Entirely depends how quickly *you* are able to optimize the pathing, and the time-varying function of time spent to time payoff of optimizing. Instead assume constant 2/1 machine time savings per time spent optimizing. Available machine time savings per optimal puck rounded to 1min. 1 min\*200 pucks = 200 min saved. Optimize at rate of ½ saved time🡪 ½\*200min 🡪 **~100min spent optimizing**

d. With a potential time savings of **200min**, the approximate potential monetary savings from an optimized machining time are (200/60)\*150 = **$500 saved**

e. 1 hr MasterCAM+1.67 hr optimizing+1 hr Quote Calculation = **3.67 hours**

3 f. Each blank takes 3”+1/8” for bit width. 12”/3.125” 🡪 **3 pucks from 1’ stock**

g. If no other sizing is available to minimize the 21.8% waste from 1’ bar stock, then 200/3 = 66.67 🡪 **70 1’ bars**,accounting for any accidental damaging

h. I think the **Acrylic** looks nicer

4 a. In reality, only one; Jeff used only one of each for all the pucks we made.

For the tool lives provided: 1/8” ball 🡪 200/50=4.0 🡪 **5 ball end** \*$12 = $60

1/8” 60° 🡪 200/40=5.0 🡪 **6 60°** \*$18 = $108

1/32” flat🡪 200/25=8.0 🡪 **9 flat end** \*$14 = $126

b. **1 extra of each (3)** as reflected above, because otherwise every bit used would have to extend exactly its entire tool life.

To reduce overall cost required to produce the pucks, the safety buffers and preference can be removed from the estimates i.e. machine time=25.5 hours, material=67 bars of acetal, 4 ball end, 5 60°, 8 flat end. This reduces the total cost down to $7520.00 at a $37.60 unit cost.

The time estimate produced by MasterCAM was 7:57, while the actual machining time seen on the Mazak was 8:29. This is likely due to MasterCAM failing to take into account all intermediary movements that require time to make. Repositioning requires z lift as well as x-y movement, and MasterCAM probably only made time estimates for cut movements.

G-code typically works by using finite, linear positional movement instructions. This is done by each lined instruction specifying what to change the X, Y, Z, and feedrate values to, or to maintain their previous values. There are also i,j,etc. values able to be specified, but the movements are typically still comprised of finite linear motions. This is ultimately due to the fact that most milling machines utilize stepper or servo motors for their motion control. This is what gives the tolerance capability of a machine, the size of each step’s correlated mill movement. Analogous to approximating a curve/surface using finite elements.

Machining:

(27 hours)\*($150/hour)……………………………………………………$4050.00

Per part………………………………………………………………………($20.25)

Engineering:

(3.67 hours)\*($300/hour)………………………………………………….$1100.00

Per part………………………………………………………………………...($5.50)

Material:

(70 1’ bar stock)\*($64/ft)…………………………………………………..$4480.00

Per part……………………………………………………………………….($22.40)

Tools:

(5 ball end)\*($12) + (6 60°)\*($18) + (9 flat end)\*($14)…………………..$294.00

Per part………………………………………………………………………...($1.47)

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Total: $9924.00

Unit Cost: ($49.62)

Delivery:

[(27 hours) + (3.67 hours)] / (8 hours/day) = 3.83 days ……………………..4 days

