TAGA NextGen

Improving Cost Estimating Opportunities Within Cutting Table Technology

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Presentation Overview

- Background and Context
- Research
  - Equipment
  - Testing Process
  - Results
- Summary/So What?
- Conclusions
- Future Directions

Background

- Data, Print, and Education.
- Teach the basics of job costing/estimating.
- Work with industry across the country.

Some Context

"We guess!"

"We are still working on that…"

"It depends on the week!"

"It is loosely based off prior jobs we have completed."

"What do you mean by estimate?"

Prior Work

- Estimate the circumference of the object.
- Total circumference (based on number needed).
- Calculate cutting time.
- Add a complexity factor.
- Account for setup time.
- Estimate cost.

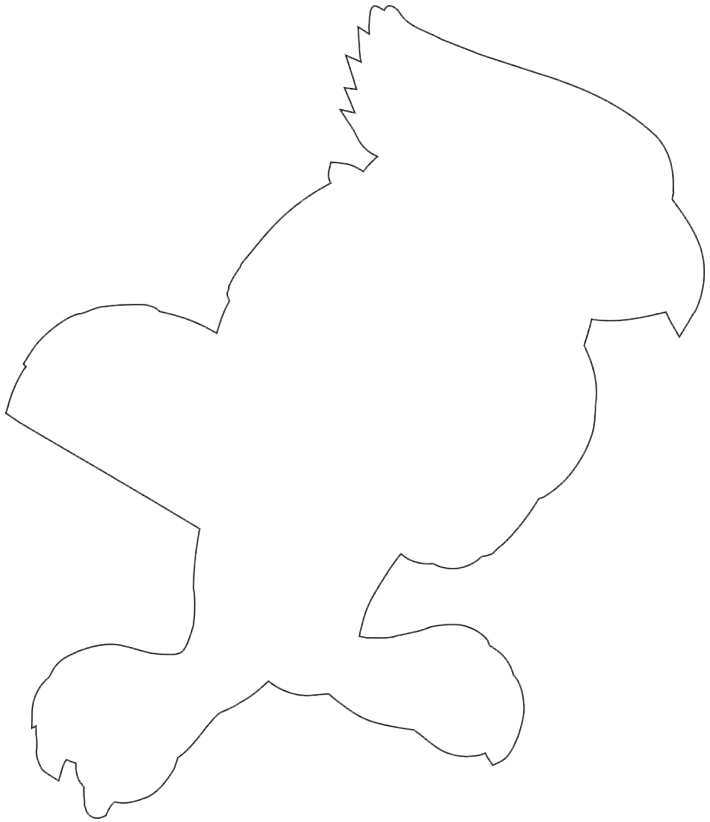
Prior Work

Cutting Table Production Standards (hourly rate: $115.00)					
Setup time		**Cutting tool base rates per linear inch**		**Shape Complexity**	**Time increase**
single sheet	5 min first sheet; 1 minute per additonal	serigraphy knife	1100 in/min (2794 cm/min)	simple	4x
step & repeat per piece	5 min first sheet + .25 minutes per piece	high frequency knife	900 in/min (2286 cm/min)	medium	8x
milling	10 min first piece; 1 minute per additonal	milliing knife	236 in/min (600 cm/min)	high	12x
kiss cut	add 5 minutes			very high	20x

Prior Work

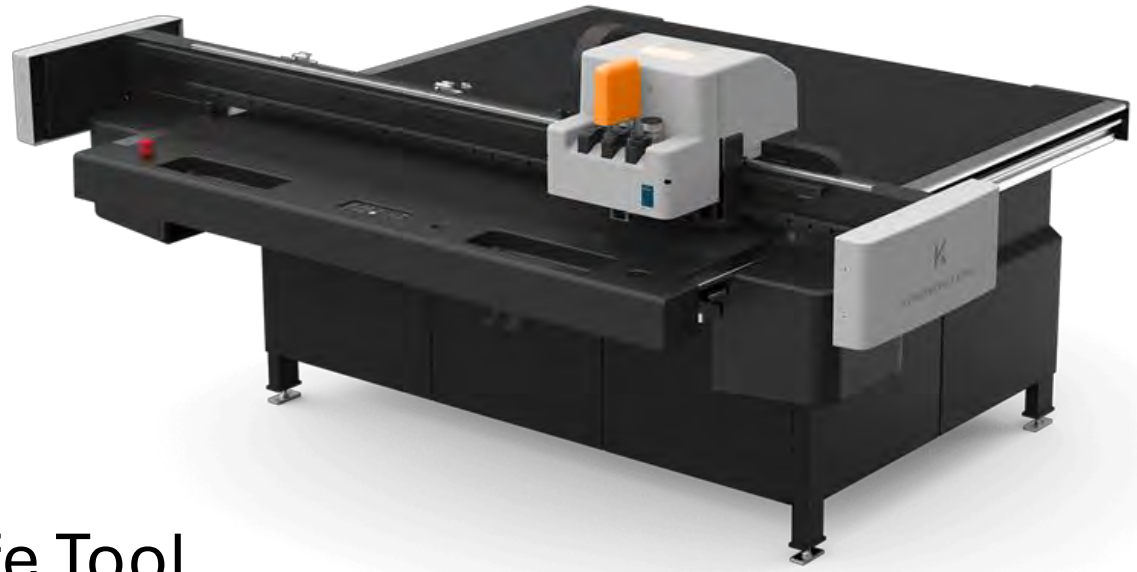
- Estimate the circumference of the object.
  - $C = 2\pi r$ OR $C = \pi d$

- In the case of this shape that was used for cutting, the width or diameter was measured at 12.36”
  - 12.36 x 3.1415 = 38.83”
  - Actual circumference = 60.25”
  - 55% difference in size!



Equipment Used

- Kongsberg X20 CAD Table

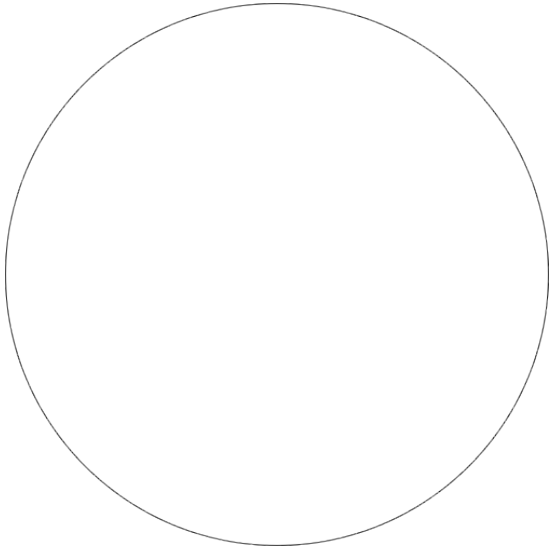


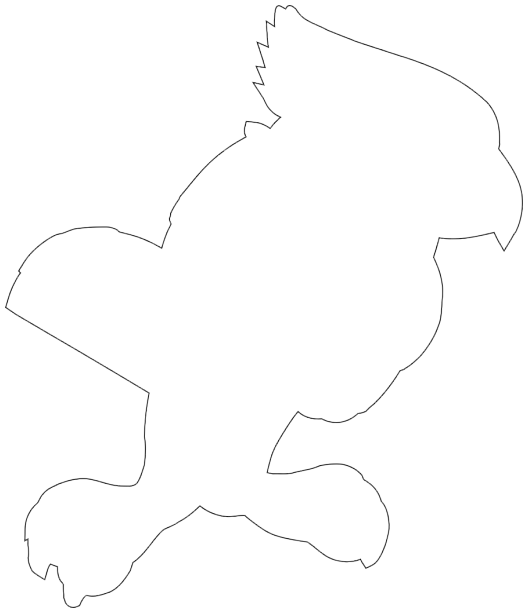
High-Frequency Vibracut Knife Tool
SR6224 Blade

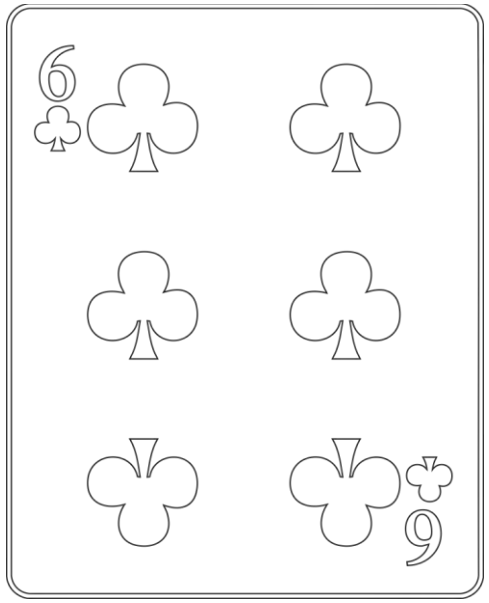
Psaligraphy Knife Tool
SR6150 Blade

Testing Process

- 10 Designs
  - Simple (x3)
  - Moderate (x3)
  - Complex (x2)
  - Very Complex (x2)

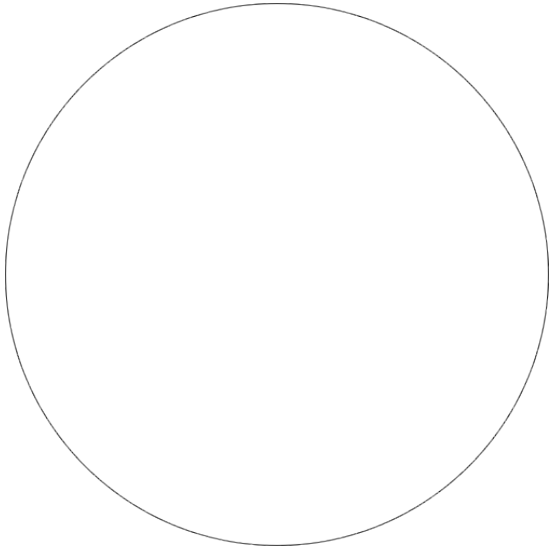


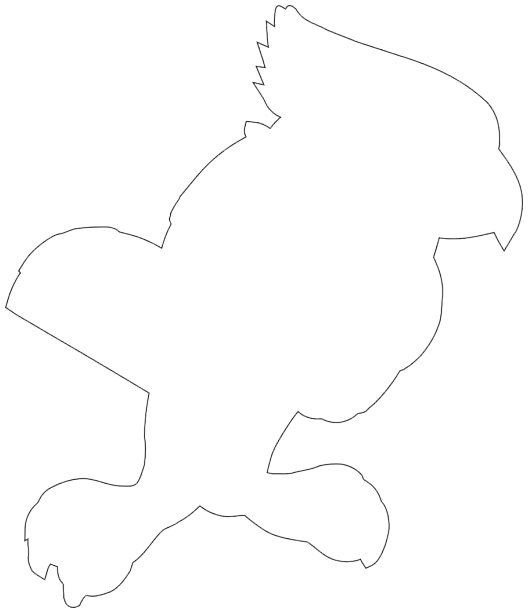


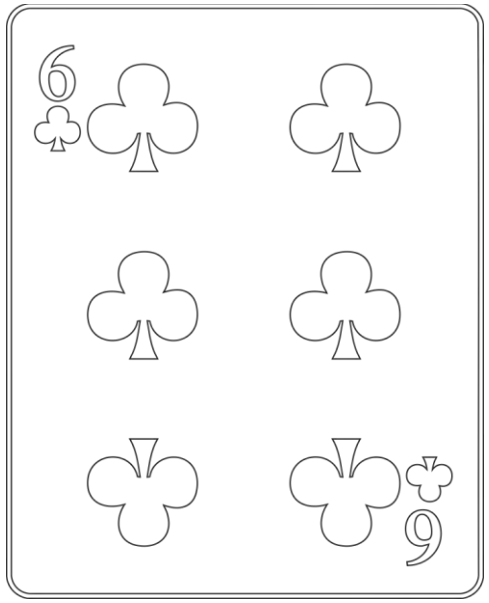


Testing Process

- Two Substrates
  - Paperboard (.024”)
  - Corrugate (.063”)
- Minimum of three cuts
- Three sizes
  - Baseline fit within a 14” square







Dimensions of Cuts

Shape	Complexity	50%	100%	150%
1	Simple	21.91”	43.84”	65.73”
2	Simple	22.67”	45.34”	68.01”
3	Simple	36.75”	73.5”	110.25”
4	Moderate	40.725”	81.45”	122.175”
5	Moderate	30.125”	60.25”	90.375”
6	Moderate	24.98”	45.34”	74.94”
7	Complex	83.715”	167.43”	251.145”
8	Complex	56.225”	112.45”	168.675”
9	Very Complex	240.145”	480.29”	720.435”
10	Very Complex	181.685”	363.37”	545.055”

Results: HF Knife – Corrugate

Shape	Complexity	Speed	50%	100%	150%
1	Simple	16.4 in/sec	19 seconds	23 seconds	26 seconds
2	Simple	16.4 in/sec	21 seconds	24.4 seconds	28 seconds
3	Simple	16.4 in/sec	39.4 seconds	46.3 seconds	54.2 seconds
4	Moderate	16.4 in/sec	1min 09sec	1min 19sec	1min 22sec
5	Moderate	16.4 in/sec	1min 11sec	1min 27sec	1min 40sec
6	Moderate	16.4 in/sec	48.2sec	52.4sec	52.2sec
7	Complex	16.4 in/sec	47.4sec	2min 7sec	57.2sec
8	Complex	16.4 in/sec	38sec	46sec	42.2sec
9	Very Complex	16.4 in/sec	9min 20sec	9min 51.3sec	11min 30sec
10	Very Complex	16.4 in/sec	7min 13sec	7min 17.3sec	8min 4.5sec

Results: Psaligraphy Knife – Paperboard

Shape	Complexity	Speed	50%	100%	150%
1	Simple	19.7 in/sec	21.7 seconds	24 seconds	26 seconds
2	Simple	19.7 in/sec	21.3 seconds	25.3 seconds	28 seconds
3	Simple	19.7 in/sec	39.4 seconds	48.3 seconds	54.5 seconds
4	Moderate	19.7 in/sec	1min 02sec	1min 17sec	1min 22sec
5	Moderate	19.7 in/sec	1min 10sec	1min 27sec	1min 33sec
6	Moderate	19.7 in/sec	44.3sec	54sec	52.2sec
7	Complex	19.7 in/sec	1min 37sec	2min 11sec	2min 57sec
8	Complex	19.7 in/sec	38sec	49sec	42.4sec
9	Very Complex	19.7 in/sec	7min 38sec	9min 58sec	13min 34sec
10	Very Complex	19.7 in/sec	6min 41.5sec	7min 27.3sec	8min 42sec

Problem Cut

Shape 10 - Very Complex

Results: Side-by-Side

Shape	Complexity	HF - 100%	Psaligraphy -100%
1	Simple	24 seconds	23 seconds
2	Simple	25.3 seconds	24.4 seconds
3	Simple	48.3 seconds	46.3 seconds
4	Moderate	1min 17sec	1min 19sec
5	Moderate	1min 27sec	1min 27sec
6	Moderate	54sec	52.4sec
7	Complex	2min 11sec	2min 7sec
8	Complex	49sec	46sec
9	Very Complex	9min 58sec	9min 51.3sec
10	Very Complex	7min 27.3sec	7min 17.3sec

Results: Side-by-Side

Shape	Complexity	HF - 50%	Psaligraphy -50%
1	Simple	19 seconds	21.7 seconds
2	Simple	21 seconds	21.3 seconds
3	Simple	39.4 seconds	39.4 seconds
4	Moderate	1min 09sec	1min 02sec
5	Moderate	1min 11sec	1min 10sec
6	Moderate	48.2sec	44.3sec
7	Complex	47.4sec	1min 37sec
8	Complex	38sec	38sec
9	Very Complex	9min 20sec	7min 38sec
10	Very Complex	7min 13sec	6min 41.5sec

Results: Side-by-Side

Shape	Complexity	HF - 150%	Psaligraphy -150%
1	Simple	26 seconds	26 seconds
2	Simple	28 seconds	28 seconds
3	Simple	54.2 seconds	54.5 seconds
4	Moderate	1min 22sec	1min 22sec
5	Moderate	1min 40sec	1min 33sec
6	Moderate	52.2sec	52.2sec
7	Complex	57.2sec	2min 57sec
8	Complex	42.2sec	42.4sec
9	Very Complex	11min 30sec	13min 34sec
10	Very Complex	8min 4.5sec	8min 42sec

Summary

- Substrate does not make a significant difference.
  - Yet!
- Size or distance of cuts is not the most important factor in determining cut times.
- More work is needed.

So What?

- Prior work
  - Simple – 4x
  - Moderate – 8x
  - Complex – 12x
  - Very Complex – 20x

- Estimate this job given existing methods…
  - 13.79” x 3.1415 = 43.32”
  - 43.32/900 = .048 minutes or 2.88 seconds
  - 2.88x20=57.6 seconds
  - Actual cut time – 9 minutes, 51.3 seconds

Conclusions

- There has to be a better way!

- Consider better ways to estimate cuts.
  - Sizing factor
  - Cut distances
  - More detailed complexity factor

Future Directions

- Continue time and substrate research.
- Expand tool selection.
- Can we identify better math for complexity?

Thank you!

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