Novakinetics Next Gen 3D Printer

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Novakinetics Aerosystems

Overview

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Introduction

- Client: Novakinetics
  - Aerospace Composite Parts
  - Parts are made with molds
- What can be done to decrease production time, while maintaining product quality?

Novakinetics.com

Novakinetics.com

Needs Statement

- Novakinetics is in need of a more efficient manufacturing process in order to reduce lead time for molds & tooling.

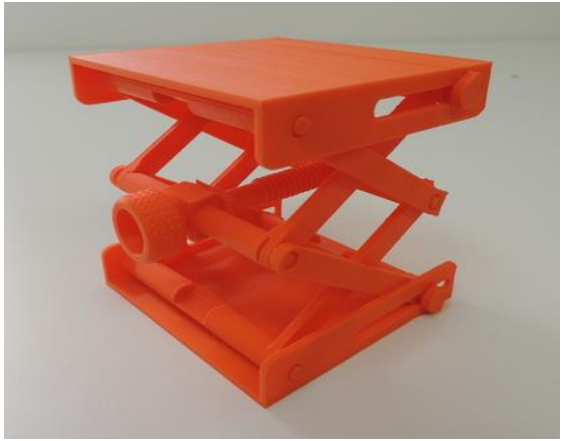
Project Goals

- Create a large-scale 3D printer.
- Optimize printing process.
- Make the 3D printer affordable.

3D Printing

- Uses fused deposition modeling (FDM)
- Objects are built layer by layer
- Common materials used are ABS & PLA

fundable.com



thingiverse.com

Objectives

OBJECTIVE	MEASUREMENT	UNITS
Large Print Volume	Volume	ft^3
Fast Print Speed	Filament / Time	mm/s
Accuracy	Length	mm
Maintenance	Time	Hours/Week
Safe to Operate	OSHA	Unitless
Ease of Use	Time to Proficiency	Hours
Economic	Cost	US Dollars

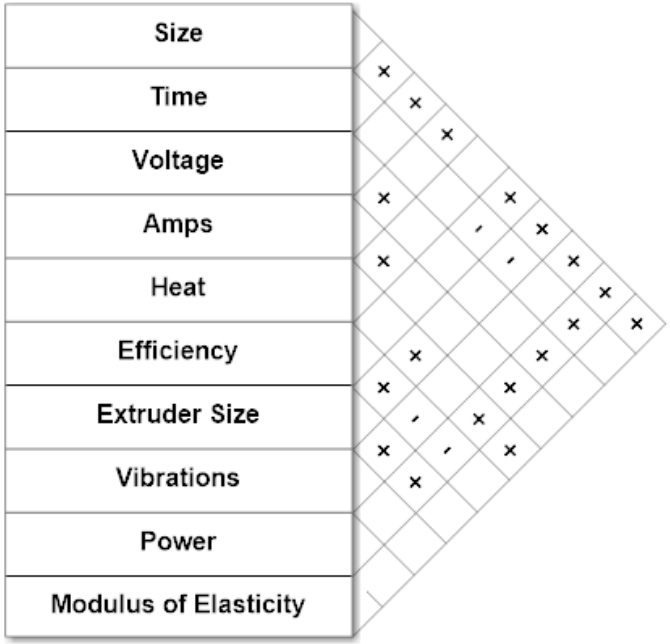
Constraints

- Part thickness $\geq$ 0.05”
- Surface dimension tolerance of ±1/32”
- Resolution < 0.5mm
- Print volume $\geq$ 8ft^3 (24” x 24” x 24”)
- Power use $\leq$ 480V, 200A

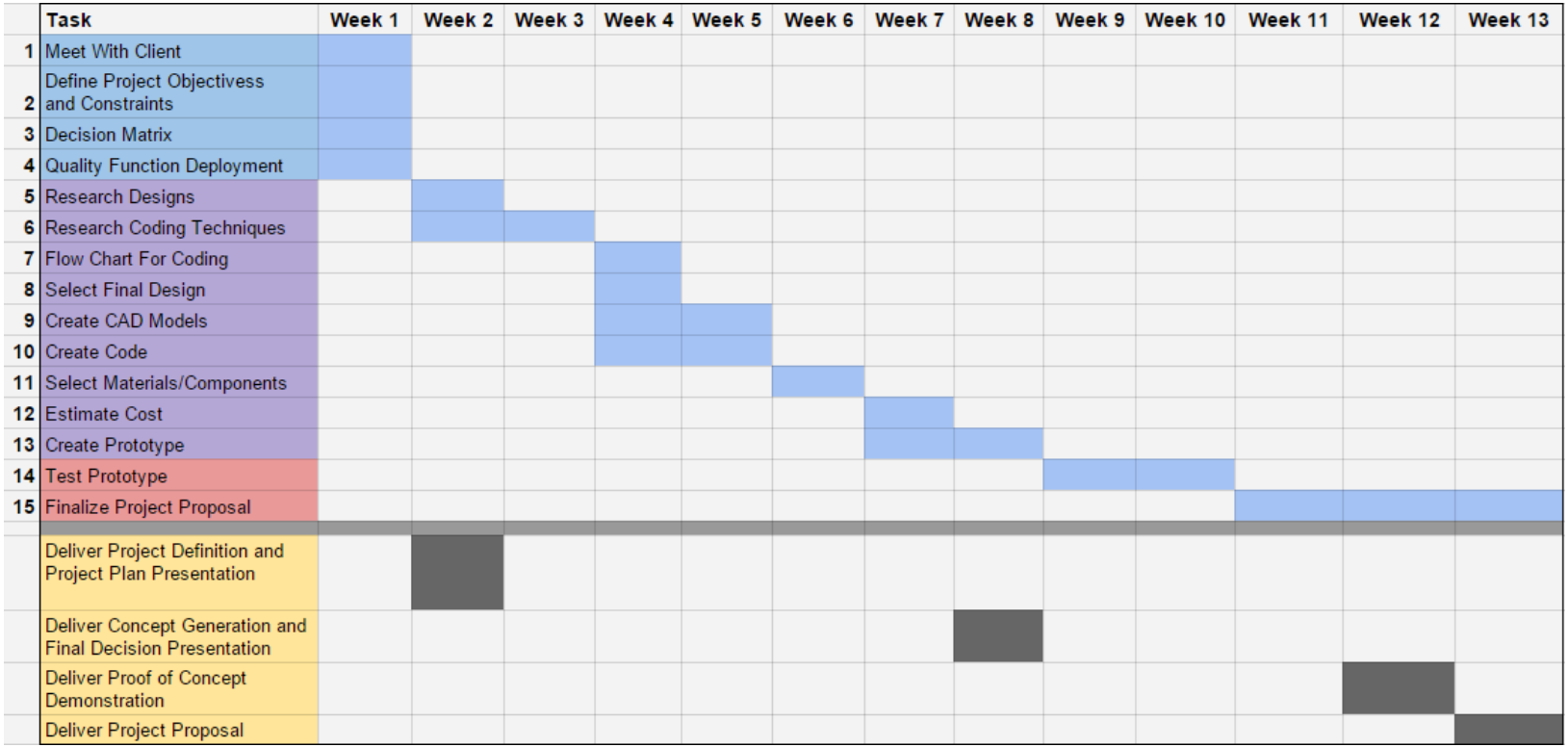
Quality Function Deployment

		Engineering Requirements									
		Size	Time	Voltage	Amps	Heat	Efficiency	Extruder Size	Vibrations	Power	Modulus of Elasticity
Customer Requirements	Machine Footprint	X				X	X	X	X	X	
	Print Material		X	X	X	X	X	X		X	X
	Large Print Volume	X	X	X	X		X	X	X	X	
	Multiple Print Heads	X	X	X	X	X	X	X	X	X	
	Ease of Maintenance	X	X								
	User Friendly		X								
	Print Material Compatability		X			X			X		X
	Rigidity of Print Material					X	X		X		X
	Faster Time to Produce Final Product	X	X				X	X			X
	Ability to Create Complex Parts	X	X			X		X	X		X
	Layer Height		X					X	X		X
	Print Process	X	X			X	X		X		X
	Precision		X			X	X	X	X		
	Print Surface Finish		X			X	X	X	X		
	High Resolution		X				X	X	X		

House of Quality



Project Plan



	Task	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13
1	Meet With Client													
2	Define Project Objectivess and Constraints													
3	Decision Matrix													
4	Quality Function Deployment													
5	Research Designs													
6	Research Coding Techniques													
7	Flow Chart For Coding													
8	Select Final Design													
9	Create CAD Models													
10	Create Code													
11	Select Materials/Components													
12	Estimate Cost													
13	Create Prototype													
14	Test Prototype													
15	Finalize Project Proposal													
	Deliver Project Definition and Project Plan Presentation													
	Deliver Concept Generation and Final Decision Presentation													
	Deliver Proof of Concept Demonstration													
	Deliver Project Proposal													

State of The Art Research

BigRep.com

BigRep One

- Build Volume: 1.1m x 1.0m x 1.0m
- Minimum Layer Height: 100 microns
- Accuracy: 100 microns
- Cost: $30,000
- Print Speed: 150mm/s

State of The Art Research

Stratasys.com

Fortus 900mc

- Build Volume: 0.9m x 0.6m x 0.9m
- Minimum Layer Height: 178 microns
- Accuracy: 90 microns
- Cost: $200,000
- Print Speed: N/A

Conclusion

- The client is Novakinetics.
- Novakinetics requires a more efficient manufacturing process in order to reduce lead time for molds & tooling.
- This can be achieved with 3D printing by scaling up the size.
- The objectives therefore are to create a large, fast 3D printer while maintaining accuracy and affordability.

Conclusion

- The print volume must be larger than $8ft^{3.}$
- The QFD revealed that time, vibrations, and efficiency are the most important engineering requirements.
- SOTA Research revealed that current large scale 3D printers lack either speed, or affordability.

References

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Questions?