

2015 International Forum on DFMA

June 2 -3

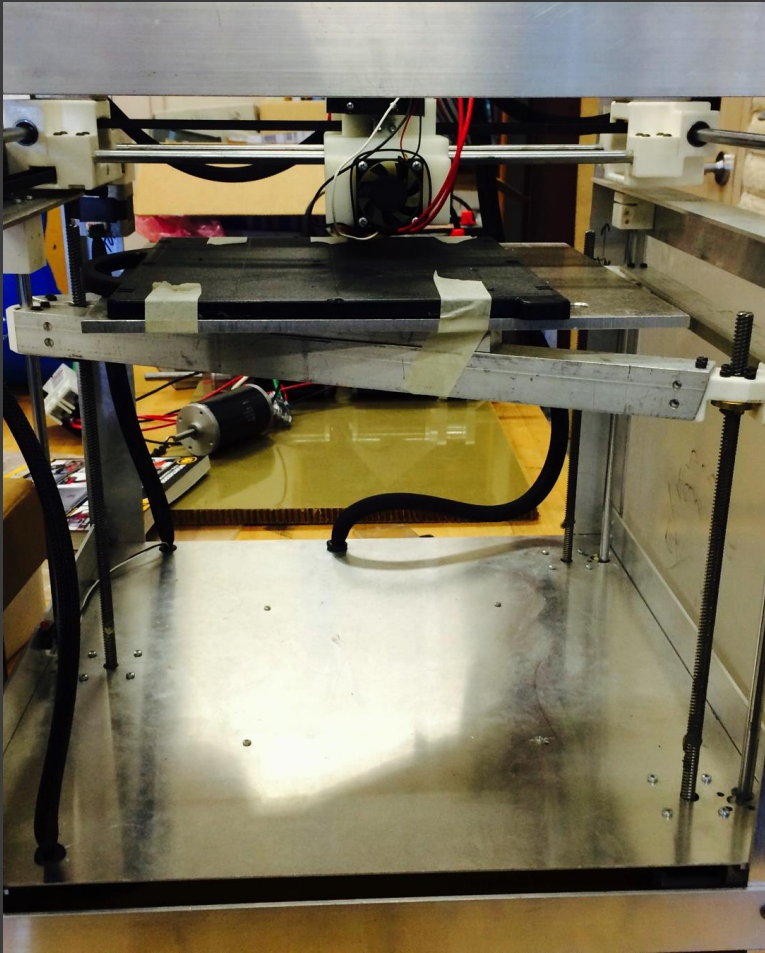
THE RAPTOR

BY ANDREW RICTOR

Overview

- Side View
- Gantry
- Extruder
- Hot End
- Heated Plate
- Power Consumption
- Initial Price & DFA Index
- Printer Back
- Redesign Price & DFA Index
- Summary
- Acknowledgements

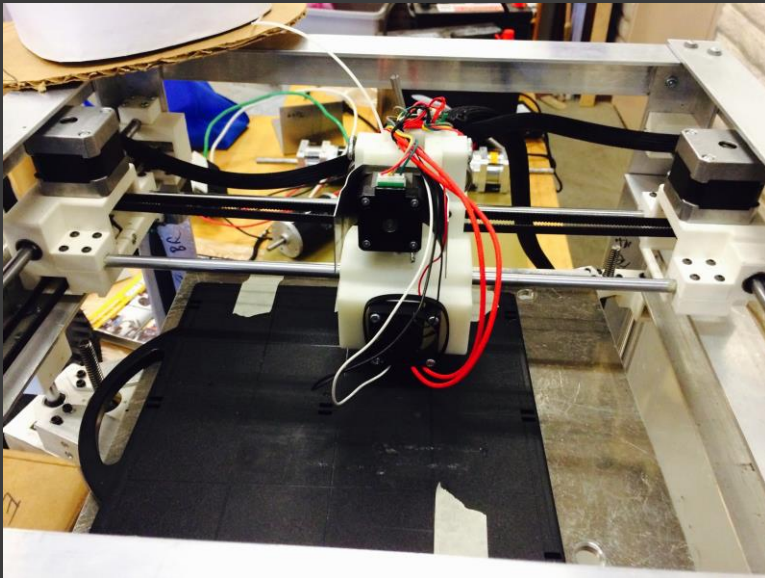
Side View



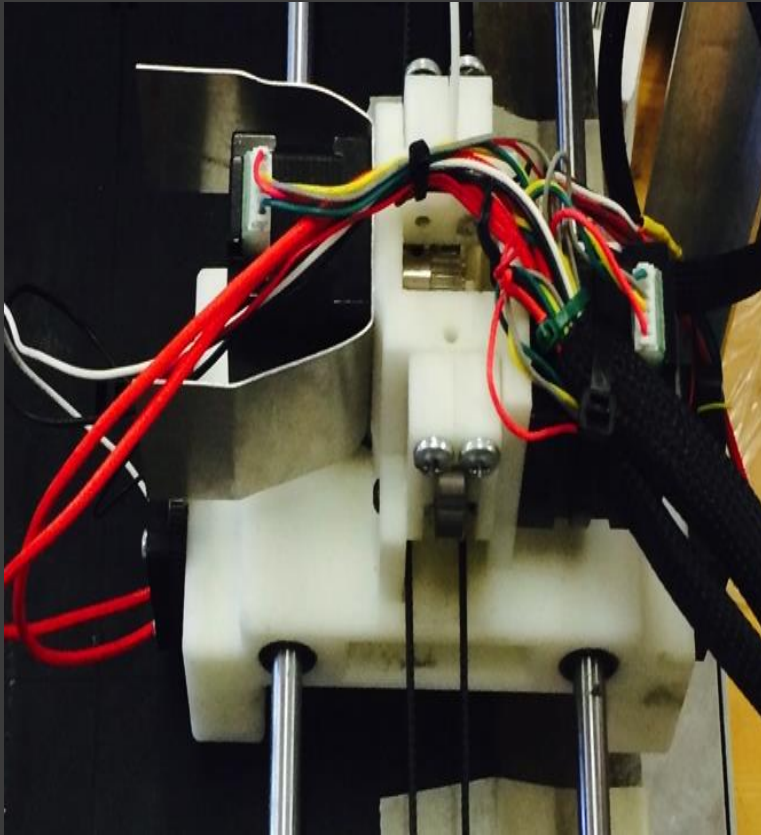
- 3 ACME Screws
- Dual Fans
- Printed Blocks

Gantry

- Dual Nema Stepper Motors for X and Y-Axis



Extruder



- Single Printed ABS Block
- Integrated Cooling Passages
- 2 Nema Stepper Motors

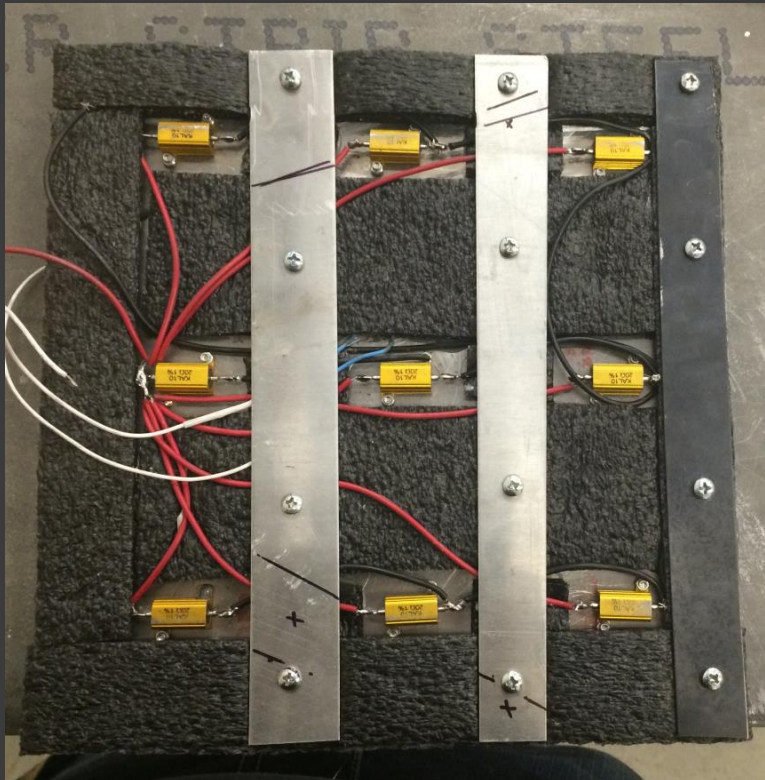
Hot End

- ⦿ Dual 40W Heater Cartridges
- ⦿ 2 Cooling Fins
- ⦿ Interchangeable Print Nozzles
- ⦿ Kevlar Insulation



Heated Plate

- 9-20 Ohm Resistors
- High Temperature Foam Insulation



Power Consumption

Subsystem	Supply Voltage (V)	Power (W)	Current (A)
Hot End	12	80	6.7
Heated Plate	12	53	4.5
Motors	12	72	6
Electronics	12	18	1.5
Total	12	223	18.7

Initial DFA Index Value



Analysis Totals for Design for Assembly (DFA)

Entries including repeats	Original
Parts meet minimum part criteria	91
Parts are candidates for elimination	731
Analyzed subassemblies	14
Separate assembly operations	917
Total entries	1753

Assembly labor time, s	
Parts meet minimum part criteria	756.00
Parts are candidates for elimination	8892.95
Insertion of analyzed subassemblies	135.58
Separate assembly operations	7407.84
Total assembly labor time	17192.37

Design efficiency	
DFA Index	1.95

Initial Price



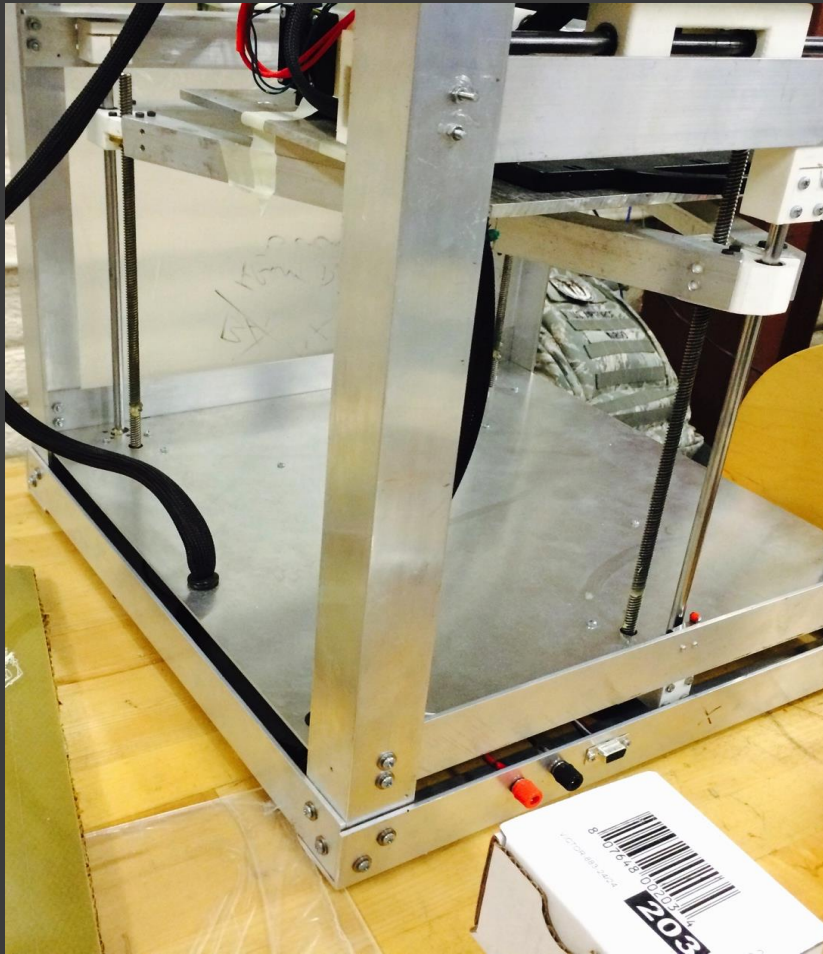
Analysis Totals for Design for Manufacture and Assembly (DFMA)

Per product costs, \$	Original
Assembly process	224.74
Manufacturing piece part	3338.40
Total cost without tooling	3563.14
Total tooling cost	0
Total cost	3563.14

Total tooling investment, \$	
Assembly tools and fixtures	0
Manufacturing tooling	0
Total investment	0

Production life data	
Life volume	10,000
Total production life cost, \$	35,631,369

Printer Back



- Frame Screws Eligible for Redesign
- Plastic Block Screws Eligible for Redesign

Redesign DFA Index Value



Analysis Totals for Design for Assembly (DFA)

Entries including repeats	Original
Parts meet minimum part criteria	91
Parts are candidates for elimination	495
Analyzed subassemblies	14
Separate assembly operations	917
Total entries	1517

Assembly labor time, s	
Parts meet minimum part criteria	756.00
Parts are candidates for elimination	5697.35
Insertion of analyzed subassemblies	135.58
Separate assembly operations	7407.84
Total assembly labor time	13996.77

Design efficiency	
DFA Index	2.39

Redesign Price



Analysis Totals for Design for Manufacture and Assembly (DFMA)

Per product costs, \$	Original
Assembly process	182.96
Manufacturing piece part	3310.40
Total cost without tooling	3493.36
Total tooling cost	0
Total cost	3493.36

Total tooling investment, \$	
Assembly tools and fixtures	0
Manufacturing tooling	0
Total investment	0

Production life data	
Life volume	10,000
Total production life cost, \$	34,933,644

Summary

- ◎ 12V, 18.7A Draw
- ◎ DFA Index: 1.95 to 2.39
- ◎ 18.4% Index Improvement
- ◎ Unit Price: \$3563.14 to \$3493.63
- ◎ 1.95% Price Reduction
- ◎ Assembly Time: 4.78hr to 3.89hr
- ◎ 18.6% Assembly Time Reduction

Acknowledgments

- Maxwell Duke
- Kellie Wallace
- Morgan Smith
- Alan Islas
- Jordan Rivers
- Scott Ertle
- Dr. Douglas Isenberg
- Dr. Alfredo Herrera