

IPRO 312 - APPLYING RAPID PROTOTYPING TECHNIQUES TO PRODUCTION TOOLING

process and product

OVERVIEW

PROBLEM

For over a century, industrial casters have been manufactured using the same rigid technology – hard tooling. “Customization is a fact of life” but it is disruptive and delays deliveries. The current caster manufacturing methods create lead times of as long as eight weeks for custom orders! Customers want their orders fulfilled in the least amount of time possible.

With this in mind, our solution was to design a caster and manufacturing process that would reduce the lead times on custom orders to two to three days.

ACCOMPLISHMENTS

- Conceived and refined caster designs approved by Colson
- Created prototypes based on original and refined caster concepts
- Designed a flexible process that eliminates the need for hard tooling, thus significantly reducing inventory and other costs
- Created appropriate cost model based on new business model, with accommodations for direct costs
- Identified two possible locations for the proposed factory site (compared Illinois to present site in Arkansas)
- Drafted designs for the facility with accommodations for expansion



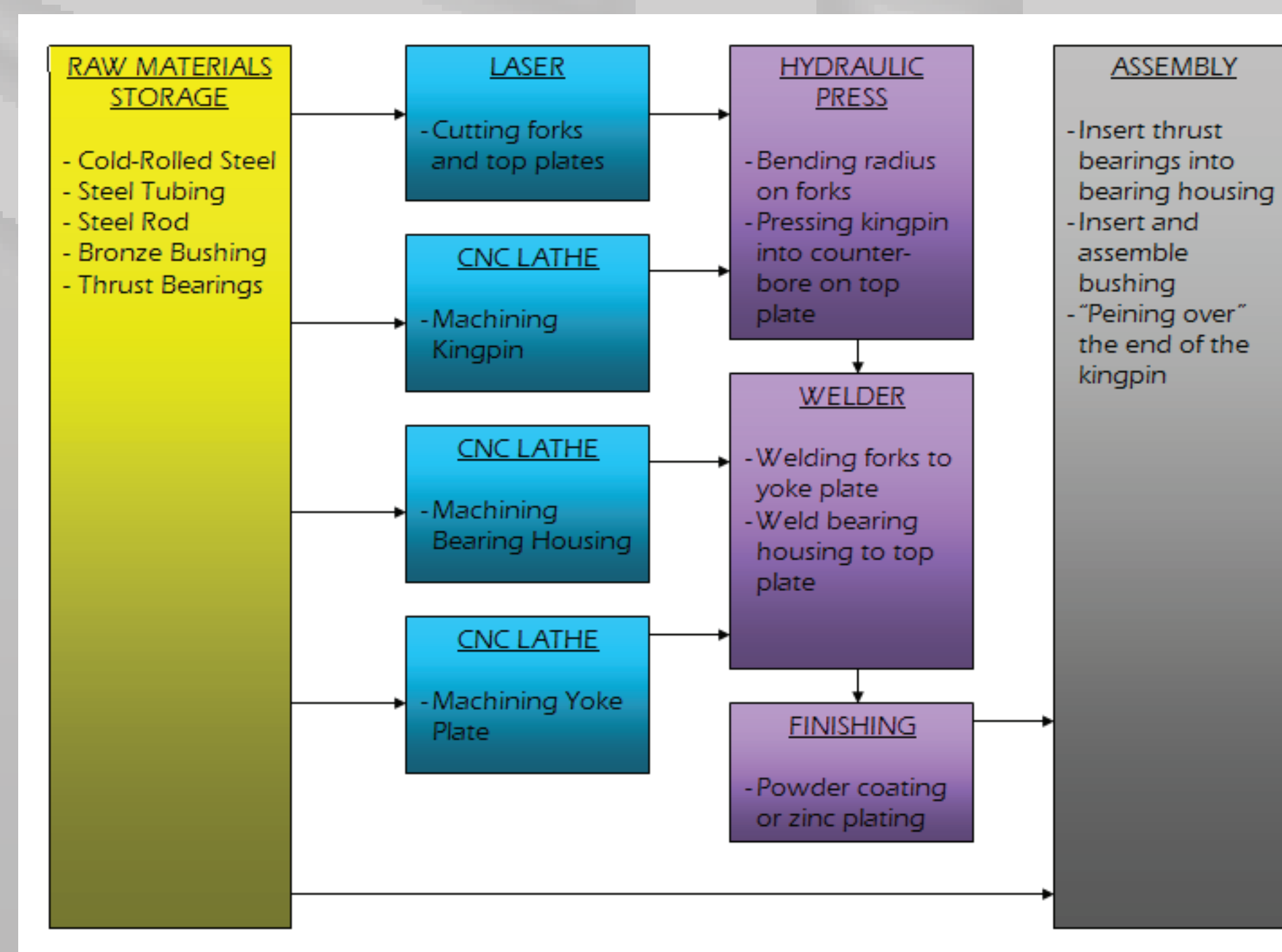
IPRO-312 FALL 2006 TEAM

PROCESS

Raw Materials

- 1018 COLD-ROLLED STEEL (for top plate, forks and yoke plate)
- STEEL TUBING (for bearing housing)
- STEEL ROD (for kingpin)
- BRASS / BRONZE BUSHING
- THRUST BEARINGS

Process Schematic Diagram



Equipment



Laser Cutter



Hydraulic Press



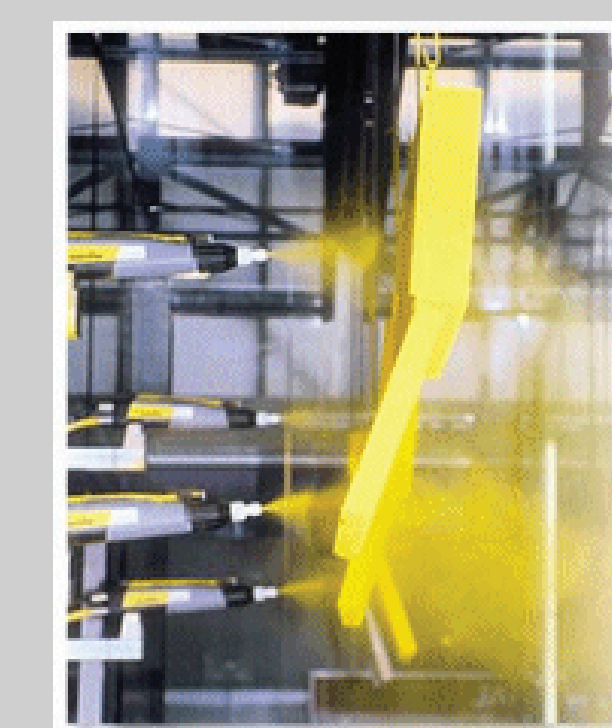
Welder



CNC Lathe



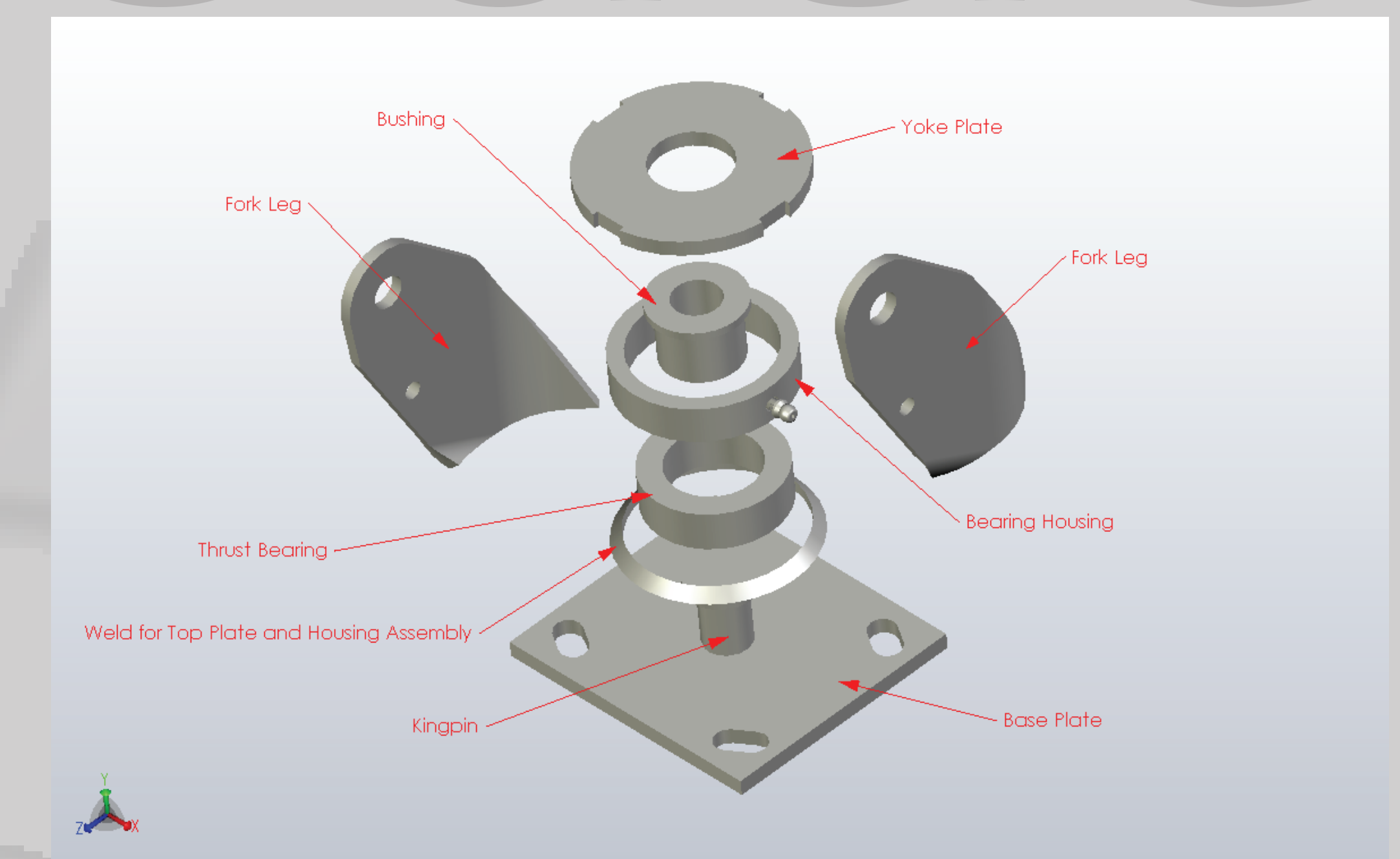
Zinc Coating Equipment



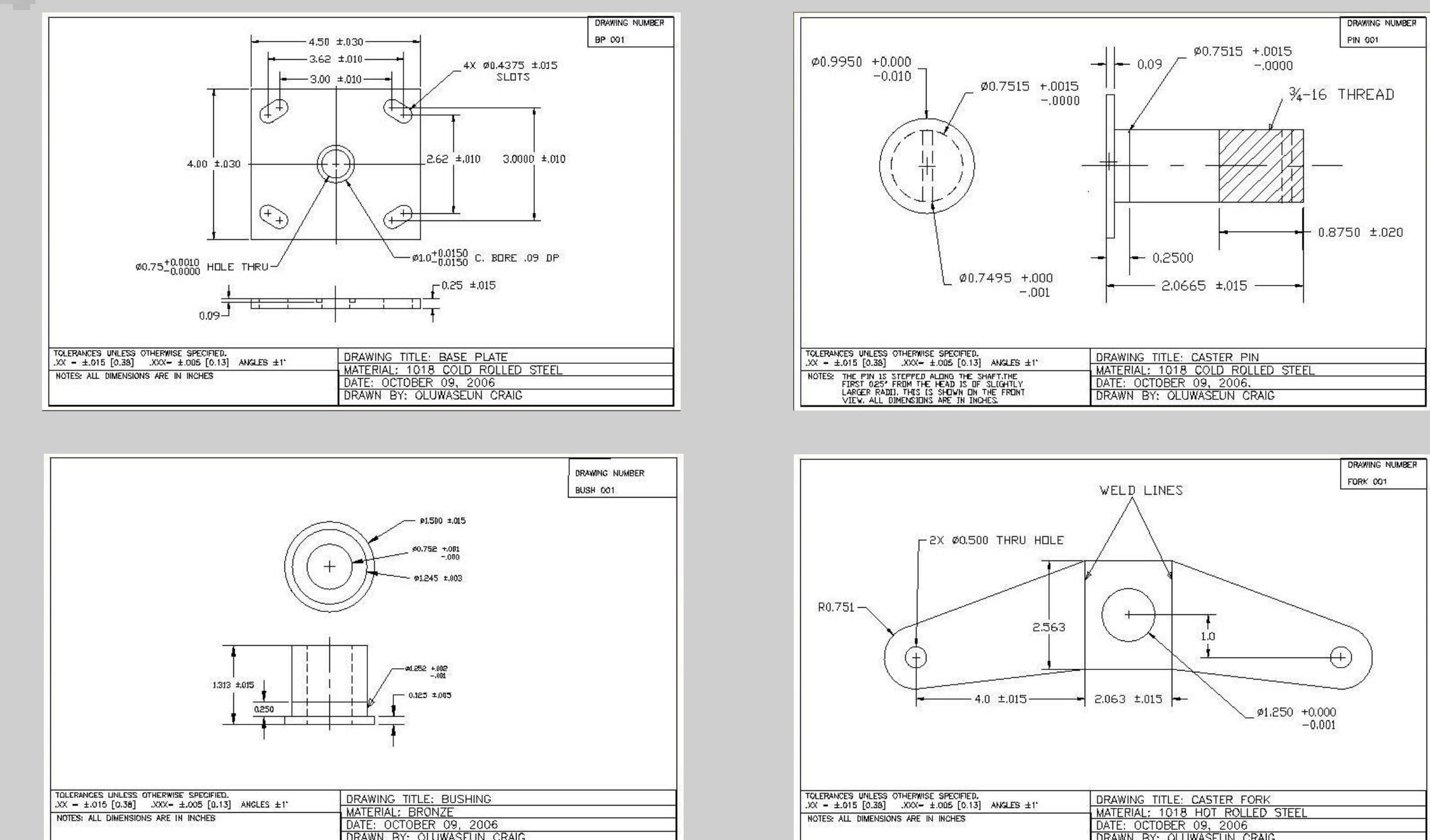
Powder Coating Equipment

PRODUCT

Exploded View of Caster Concept 4



CAD Prints of Caster Concept 4



Pictures of Caster Concept 4



First Prototype



Second Prototype

FUTURE WORK

- Modify cost model to maximise Return on Investment
- Modify schematic to accommodate more caster families
- Liaise with Colson's marketing department to contact potential customers to find out their interest in custom casters



PROJECT SPONSORS



FACULTY ADVISORS

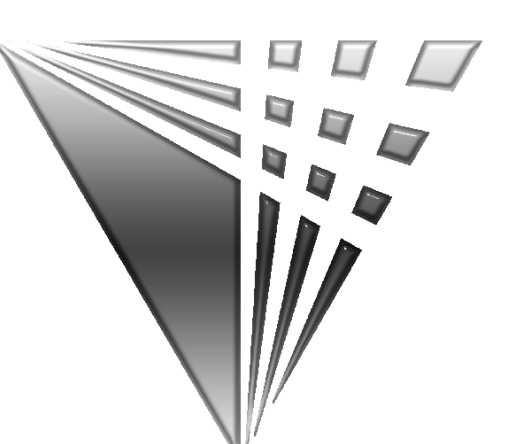
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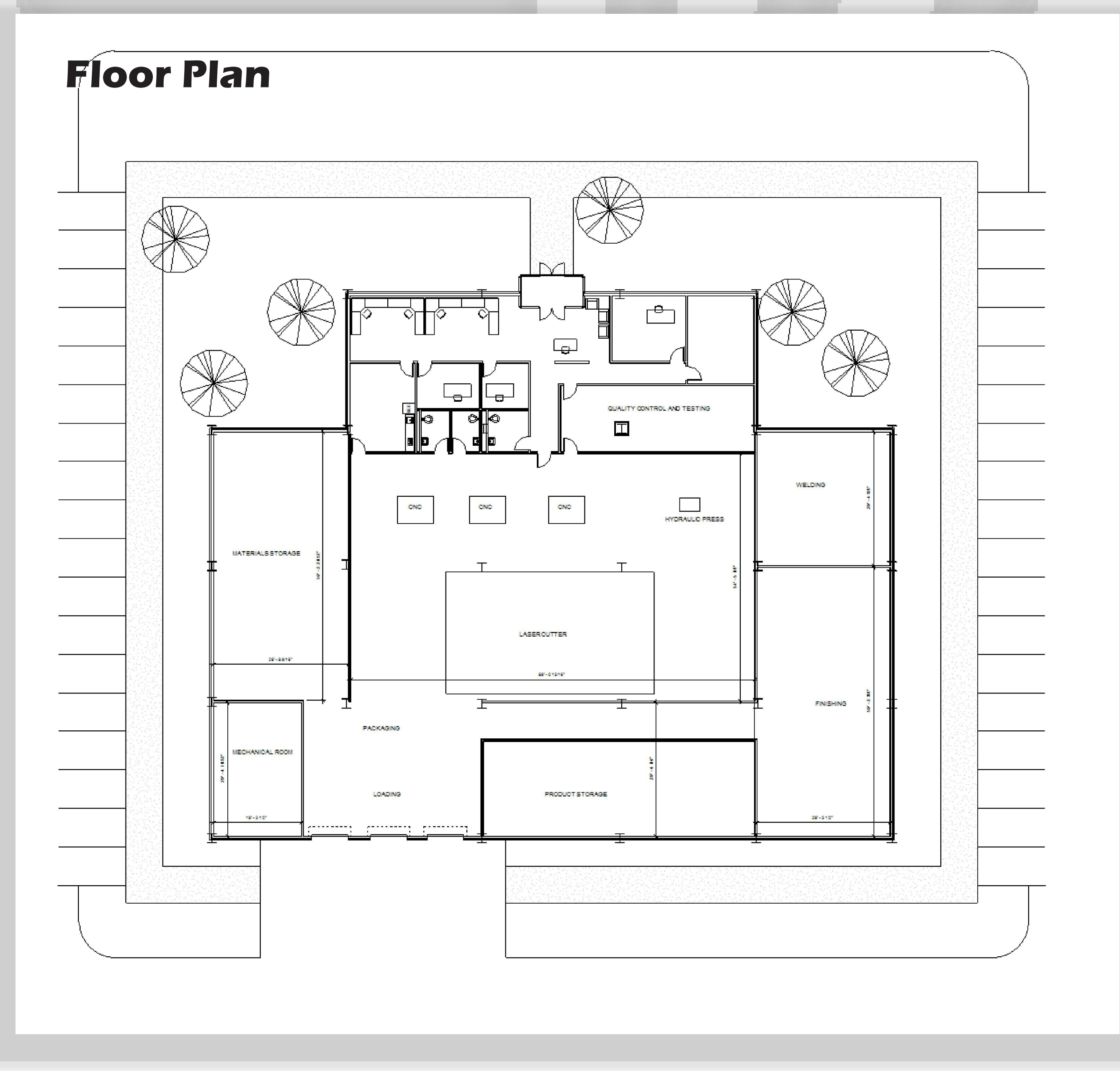


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real estate ANALYSIS & revenue PROJECTION



Average Building Cost per SF.	Total Building Square Footage
Lower Half SF. Cost = \$ 41.50	16,200 SF.
Median SF. Cost = \$ 55.50	
Upper SF. Cost = \$ 74.50	
	Building Type
	Manufacturing and Office
Median Building Estimate	List of Spaces
16,200 SF. x 55.50 = \$ 899,100.00	Administration 2700 SF.
	Assembly 5400 SF.
Mean Spec. Building Size	Welding 900 SF.
25,000 SF.	Finishing 1800 SF.
	Material Storage 1800 SF.
Size Modifier	Product Storage 1800 SF.
0.648	Loading 900 SF.
	Mechanical Room 900 SF.
Cost Modifier	
1.05 (source: Building Construction Cost Data 2006)	
Location Factor	
Little Rock, AR = 81.2	
Fayetteville, AR = 71.8	
AR Average = 75.1	
Chicago, IL = 111.6	
Final Estimated Building Cost	
Little Rock, AR = \$ 766,572.66	
Fayetteville, AR = \$ 677,831.49	
AR Average = \$ 708,985.31	
Chicago, IL Average = \$ 1,053,565.38	



Assumptions	Other Expenses
No. of casters manufactured per month: 4,800	Total year 1 depreciation expenses = \$ 410,454.00
No. of casters manufactured per year: 57,600	Total year 1 Maintenance, repair, and overhaul expenses = \$ 192,860.00
	Total year 1 other miscellaneous expenses = \$ 4,000.00
Basic Costs	
Estimated Manufacturing Cost per caster = \$ 13.11	
Total cost to company (Labor) = \$ 506,880.00	
Estimated Labor Cost per caster = \$ 8.80	
Estimated Cost of Goods sold per caster = \$ 40.00	
Total year 1 cost of goods sold = \$ 2,275,776.00	
Total year 1 Overhead costs = \$ 1,520,640.00	
Year 1 Data	Total Year 1 Profit & Loss projections
1. Year one revenue expectancy	
Number of casters sold annually <Custom Series> \$7,600	
Average sales price per caster \$69	
Annual revenue \$3,982,608	
Total year 1 revenue \$3,982,608	
2. Year 1 cost of goods sold <Custom Series>	
Cost of goods sold per caster \$40	
Total year 1 cost of goods sold \$2,275,776	
Amortization Schedule	
Loan payment calculator (Amortization Schedule)	
Annual interest rate 5.0%	
Monthly rate 0.41%	
Loan amount \$2,337,721	
Term of loan (months) 60	
Payment (\$43,996.84)	
Initial Capital Expenses	
Buildings \$709,000	
Land \$250,000	
Property Tax \$57,540	
Facility Maintenance \$35,450.00	
Machinery and equipment \$1,285,731	
Net property / equipment \$2,337,721	

