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IPRO 312

APPLYING RAPID PROTOTYPING TECHNIQUES TO PRODUCTION TOOLING

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www.iit.edu/~ipro312f06

TEAM MEMBERS

Faculty Advisors:

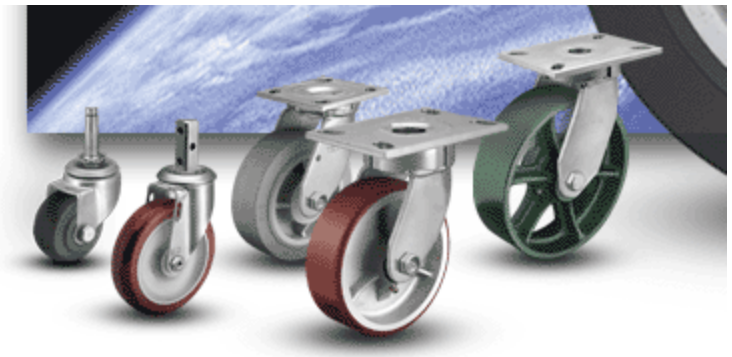
- William Maurer
- Keith McKee

Student Members:

- Abdulkamal Abdullahi
- Shan Iqbal Hussain
- Daniel Nosse
- Rachid Amine
- Muhammad Atta
- Udit Dave
- Chun Yiu Fu
- Kenneth Hicks
- Sourabh Manjrekar
- Oluwaseun Craig
- Annie Ranttila
- LaShawna Taylor

PROJECT SPONSOR

- Our Sponsor
- One of the largest caster and wheel manufacturers in North America and beyond
- 40,000 different combinations of casters and wheels



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OUTLINE

- Introduction
- Goals
- Team Organization
- Caster Design Choice
- Equipment
- Finishing Options
- Process Design

- Site Choice
- Building Cost Analysis
- Factory Layout

- Feasibility Analysis

- The IPRO Experience

- Questions

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INTRODUCTION

- For 120 years, industrial casters have been manufactured using the same methods

- Custom Caster Orders

- The current process creates lead times of 6 to 8 weeks for custom orders

- Customers reluctantly accept these production times

- IPRO 312 Team came up with a revolutionary solution

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GOALS

- Establish / refine caster designs
- Determine the equipment required
- Develop representative prototypes
- Design a facility
- Determine the economics involved

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TEAM ORGANIZATION

- Product Design Team
- Equipment Team
- Factory Design Team
- Business Team

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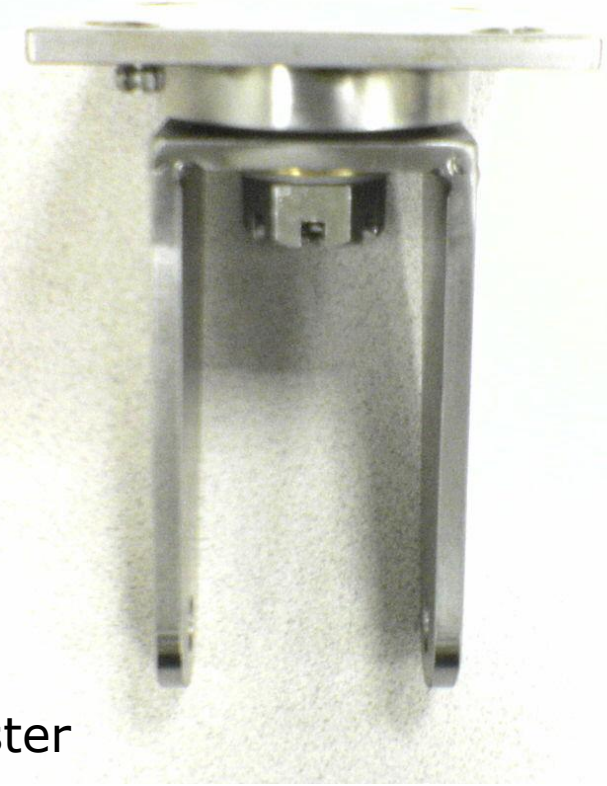
FIRST PROTOTYPE



- Made from few parts
- No Heat Treating required
- Similar to Colson's Series 4 Caster
- Easily adaptable for different sizes
- Surpassed performance requirements

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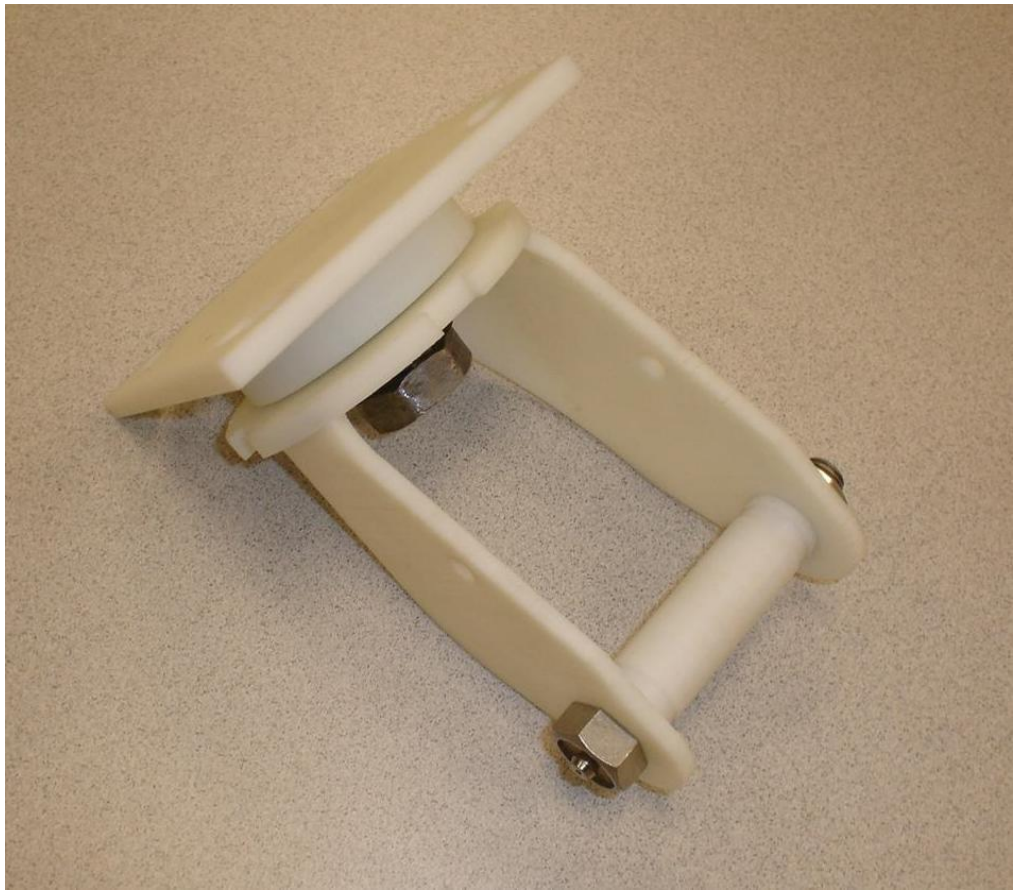
SECOND PROTOTYPE

- Introduced a bending radius on the forks

- Changed the shape of the yoke plate



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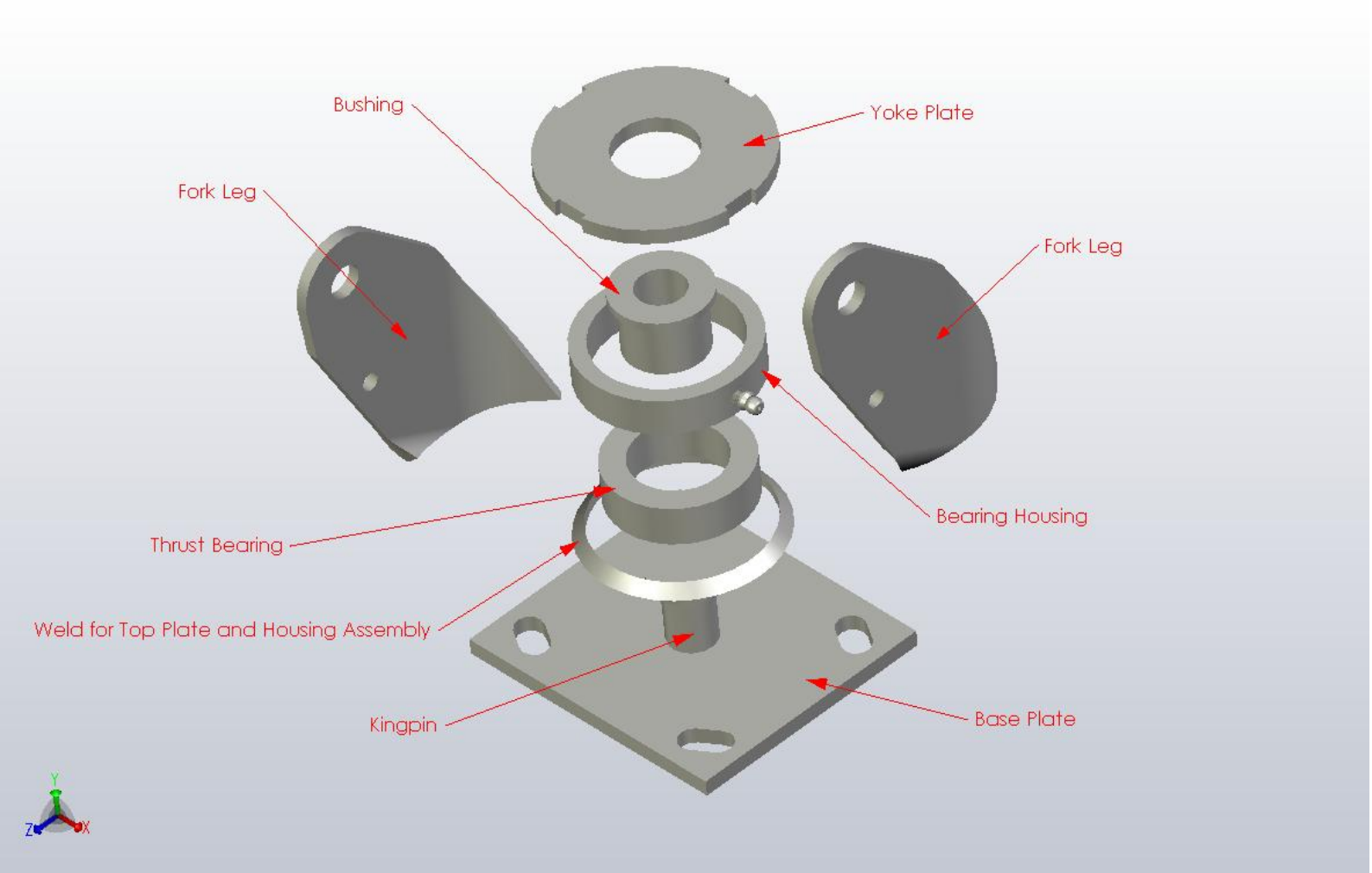
CASTER EXPLODED VIEW



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EQUIPMENT

- Mitsubishi Laser
- CNC Lathe / Duraturn 2030
- CNC Lathe / Duraturn 2550
- CNC Lathe / Duraturn 2550
- 100 Ton Enerpac Hydraulic Press
- Miller Multiprocess Welder Model #XMT 456 CC/CV (x 2)

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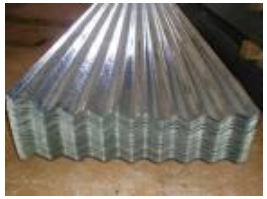
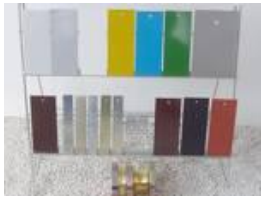
FINISHING OPTIONS

	Coating	
	Zinc	**Powder**
Quantity of parts	5,000 parts/ mo.	5,000 parts/ mo.
Used system cost	$20,000	$30,000
New system cost	$40,000	$60,000
Line size	Assume 1,500 ft^2	1,800 - 2,500 ft^2
Thickness of coat	0.0003 in.	0.003 in.
Oven Temperature	Assume 375 – 500 F	375 – 500 F
Power requirements	480V 3-phase	100 amps

- Powder cost per caster = $ 0.64



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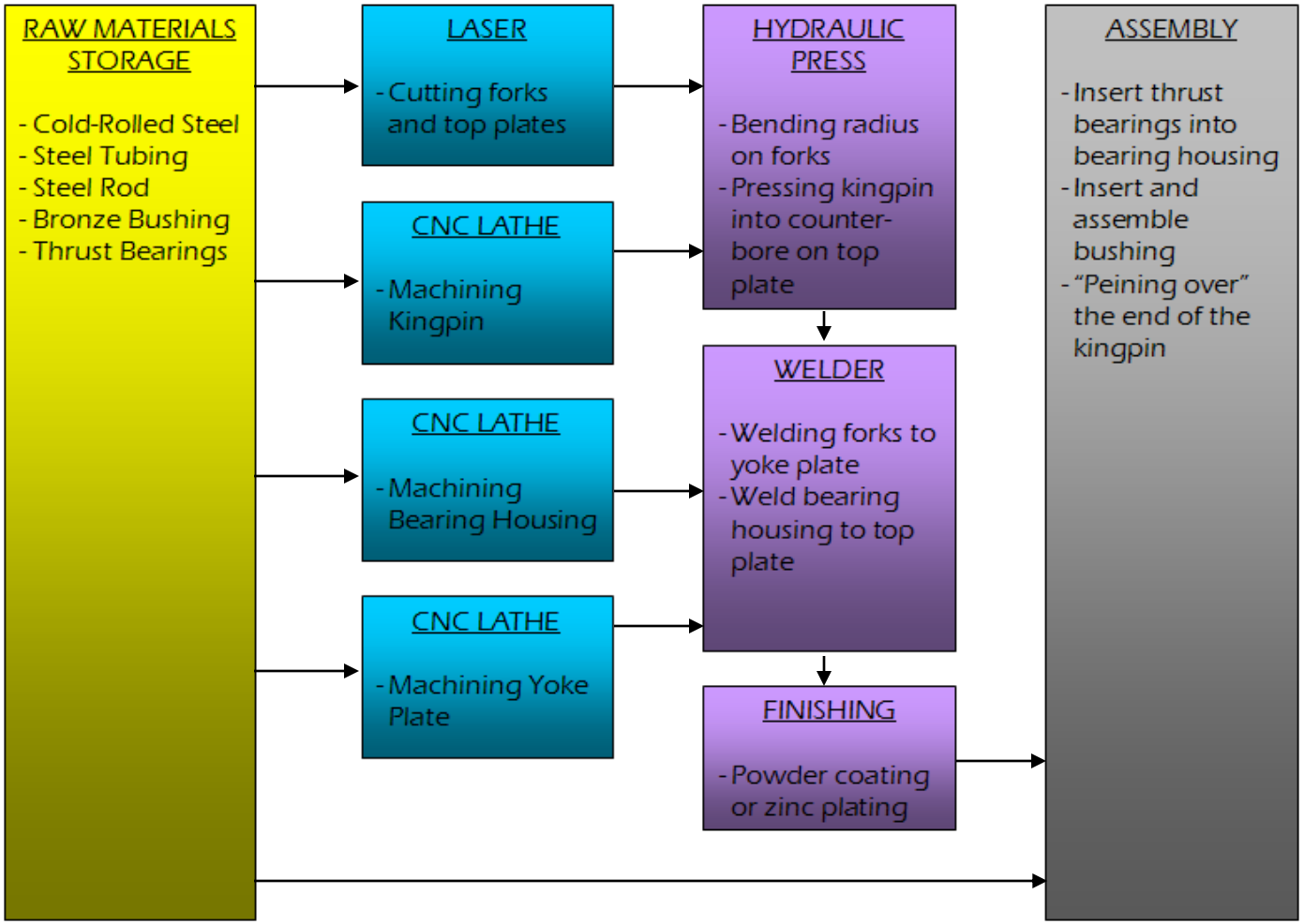
PROCESS DESIGN



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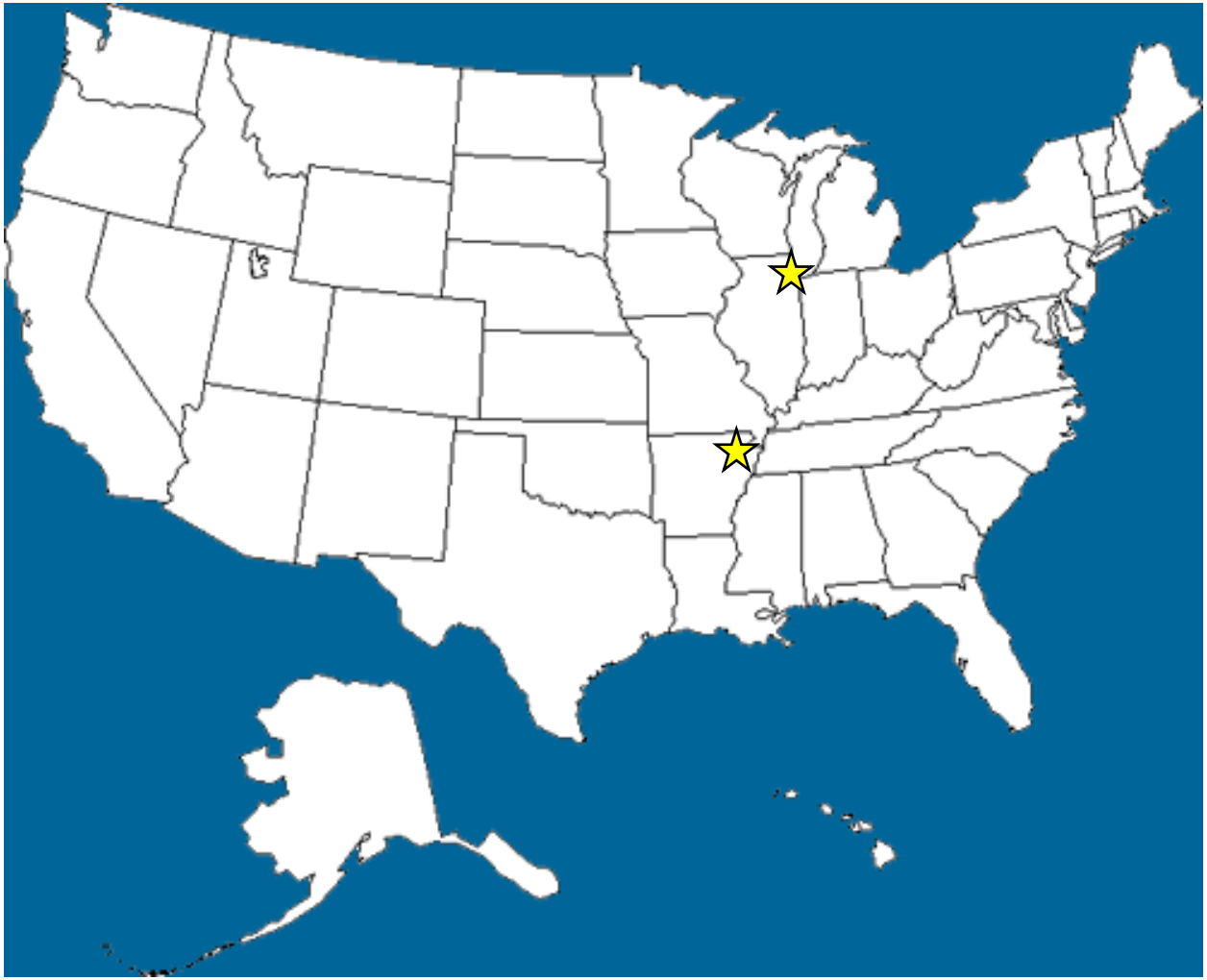
Site Choice



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Building Cost Analysis

Total Building Square Footage : 16,200 S.F.

Average Building Cost per S.F. : $55.50

Median Building Estimate : $889,100.00

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 = **$1,053,565.38**

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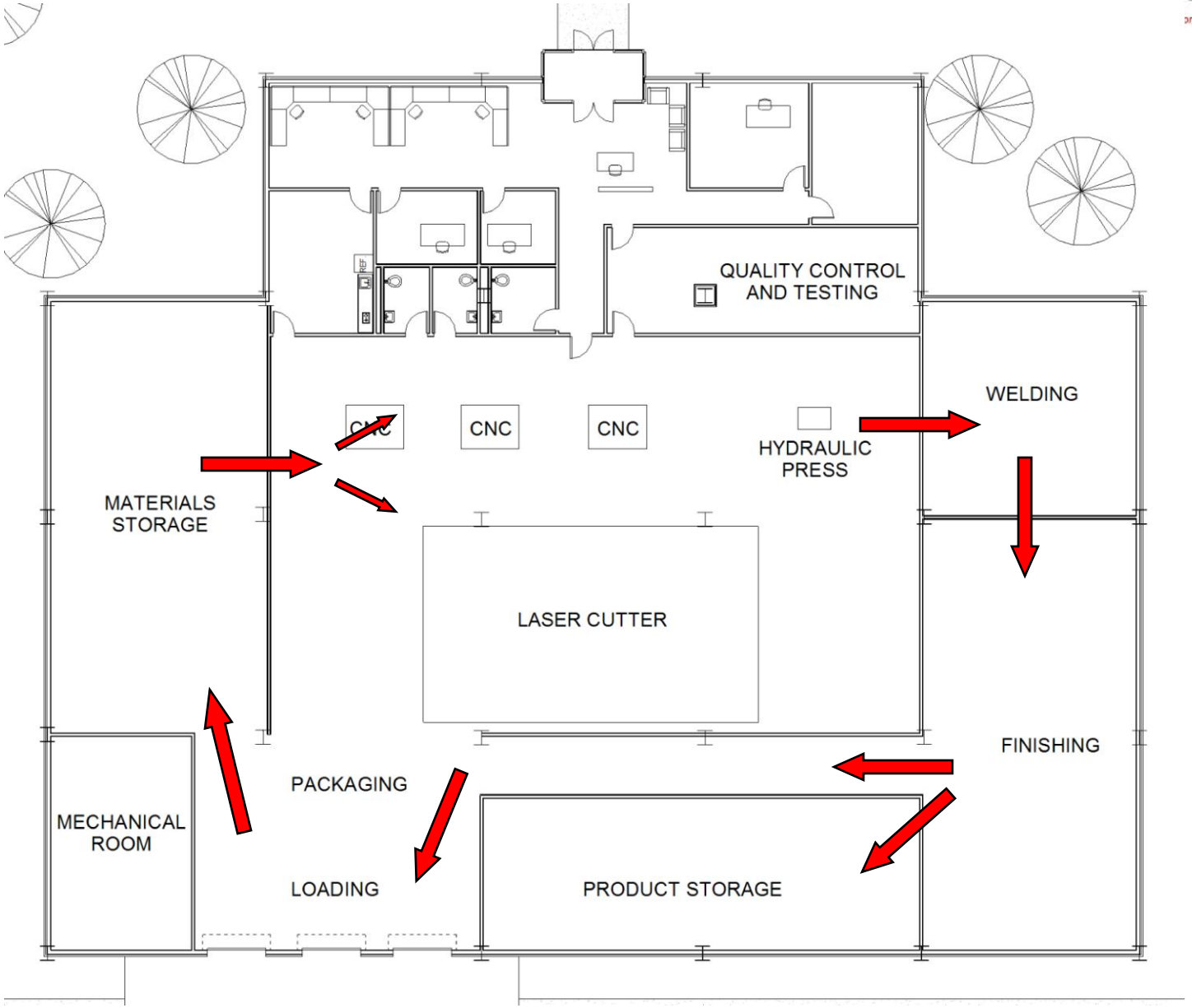
QUALITY CONTROL AND TESTING
CNC
CNC
CNC
HYDRAULIC PRESS
WELDING
MATERIALS STORAGE
LASER CUTTER
FINISHING
PACKAGING
MECHANICAL ROOM
LOADING
PRODUCT STORAGE

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FEASIBILITY ANALYSIS

No. of casters manufactured per month	=	4,800
Estimated Manufacturing Cost per caster	=	$ 13.11
Total cost to company for Labor	=	$ 506,880.00
Estimated Labor Cost per caster	=	$ 8.80
Total year 1 Overhead costs	=	$ 1,520,640.00

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YEAR ONE COST OF GOODS SOLD

Number of casters sold annually	57,600
Cost of goods sold per caster	$40.12
Total year 1 cost of goods sold	**$2,310,912**

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CAPITAL EXPENSE

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**

REVENUE EXPECTANCY FOR YEAR ONE

Number of casters sold annually	57,600
Average sales price per caster	$70.21
Annual revenue	**$4,044,096**

YEAR ONE PROFIT & LOSS PROJECTION

Revenue		
	Gross revenue	$4,044,096
	Cost of goods sold	$2,310,912
	Gross margin	$1,733,184
	Total revenue	**$1,733,184**
Operating expenses		
	Depreciation	$398,946
	Maintenance, repair, and overhaul	$192,860
	Other	$4,000
	Total operating expenses	**$595,806**
Operating income		$1,137,378
Interest expense on long-term debt		$104,893
Earnings before taxes		$1,032,485
Taxes on income (30%)		$309,745
Net income (loss)		**$722,739**

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HIGHLIGHTS (FOR YEAR ONE)

Number of casters sold annually	57,600
Cost of Goods Sold per caster	$40.12
Net capital investment	$2,337,721
Selling Price per caster	$70.21
Net revenues	$1,733,184
Net Operating Expenses	$595,806
Earnings before tax	$1,032,485
Net income	$722,739
Return on Investment	37%
Monthly amortization payment	$43,997

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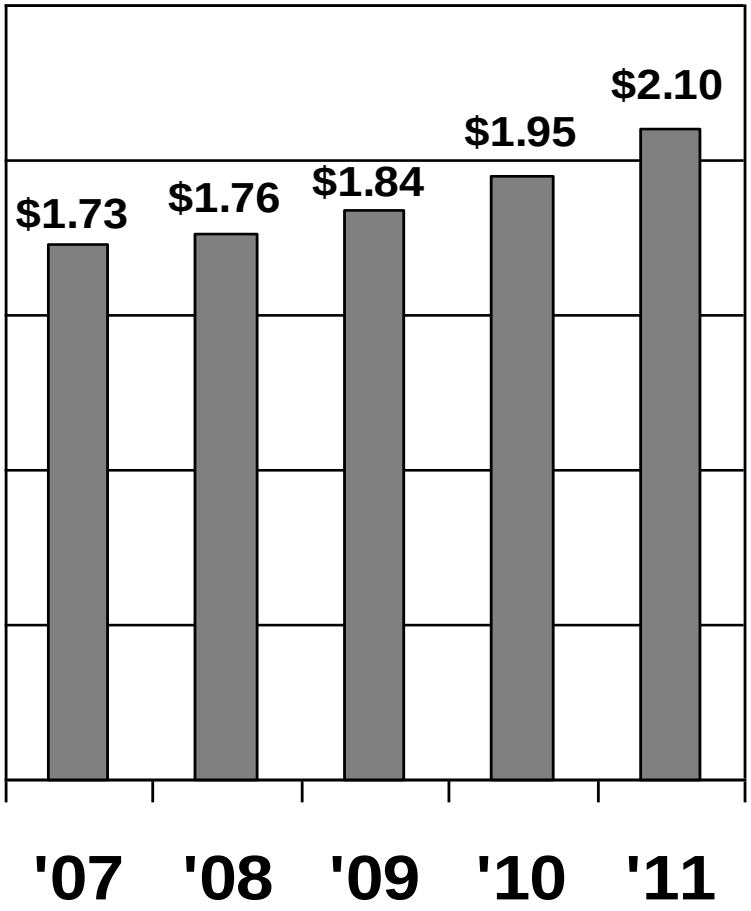
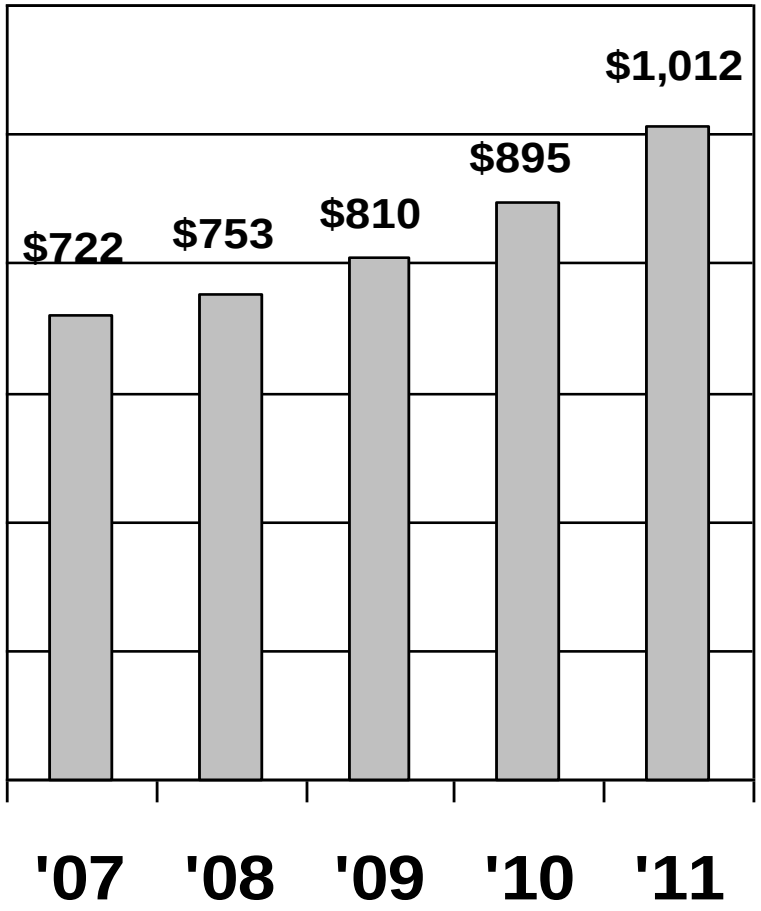
5 YEAR REVENUE AND INCOME PROJECTIONS

Net Revenues (in millions)



Net Income (in thousands)



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BARRIERS/ OBSTACLES

- Working as a team
- What part various disciplines play
- Understanding how research is done
- Information sharing
- Gathering information

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ACHIEVEMENTS

FASTER
+
MORE RESPONSIVE
+
FLEXIBLE

↓

HAPPY CUSTOMERS,

FAST ROLLOVER,

COMPETIVENESS

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FUTURE WORK

- Reduce equipment cost
- Incorporating new caster families into the production line
- Work with marketing department at Colson

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THANK YOU!

- Project Sponsors:
  - Mr. Robert Pritzker
  - Colson Associates
- Faculty Advisors:
  - Professor William Maurer
  - Professor Keith McKee
- External Resources:
  - Mr. Chuck Harris, Colson Associates
  - President Joe Arvin, Arrowgear
- IPRO Faculty and Staff

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QUESTIONS

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