IPRO 312 Project Plan

Applying Rapid Prototyping Techniques to Production Tooling

Fall 2006

1.0. Objectives

- Establish / refine caster component designs capable of being produced from flexible technologies that meet sponsor's performance and responsiveness requirements.

- Achieve caster production with a 24-hour turnaround time and a 48-hr maximum lead time

- Determine the equipment required to produce caster components that meet quality, economic and flexibility requirements to produce casters

- Develop representative prototypes (if possible)

- Determine the economics involved: equipment cost, cost per part, floor space, staff, return on investment

- Meet or exceed the performance criteria set by ICWM (International Caster and Wheel Manufacturers)

2.0. Background

This IPRO was started as a *Rapid Prototyping* project in the semester of spring 2006. The main goal was to make casters in a short time period for the caster manufacturing company *Colson Associates*. As the project advanced, the team realized that the real **objective** of this IPRO was to:
'Investigate techniques for rapidly and effectively manufacturing casters to satisfy "rush orders" for special casters.'

Colson Associates is a recognized leader in new product design and development and uses the most cutting edge caster and wheel technology. They have been the pioneers of many new caster innovations as a result offering major improvements in performance to their customers. Innovation has been Colson's legacy, and innovation will continue to drive the future success of the company.

Colson Associates wanted to change a few aspects of their operation and try to cater to the many different needs of the customer as efficiently as possible. Some of the changes that they wanted to make were as follows:

1. Reduce lead time to 24 hours at maximum
2. Flexibility of caster design to accommodate customer special requests
3. Identify and reduce critical time consuming processes:
    a. Heat treatment
    b. Stamping
    c. Welding
    d. Coating
4. Meet or exceed the performance criteria set by ICWM (International Caster and Wheel Manufacturers)

The IPRO 312 team in spring 2006 came up with 3 different concepts that would help make the changes that Colson Associates wanted in their caster manufacturing process. Colson had to make the final choice about which concept they liked the best. The 3 concepts were:

I. Concept 1

A) Basic Concepts

- Use of CNC Turning, milling and cutting
    i. Creates Flexible Manufacturing
    ii. Eliminates the need for hard tooled stampings.
    iii. Removes need for forging processes and associated forging dies.
    iv. Eliminates requirement for casting processes and required cores.

- Completely remove the process of Welding
    i. Eliminates the need for special welding fixtures
    ii. Reduce cost between use of skilled worker vs. assembler
    iii. Reduce lead time
    iv. Provides smoother surface, and improves appearance of caster

- Flexible use of laser
    i. Cutting
    ii. Heat treatment of raceway

B) Advantages

- Looks a lot like the current Colson caster
- Requires very changes in processing "special orders"
- All components can be made by the use of a limited amount of machinery
- No special tooling needed
- Low or no inventory
- Focuses on flexibility: components, machinery, etc…

II. Concept 2

A) Basic Concepts

The main difference of this design from the design in Concept 1 was the use of 'standard tapered roller bearings.' Using tapered roller bearings allows us to eliminate heat treatment process, which was the biggest time constraint.

B) Advantages

- Heat Treatment is not required.
- All components can be made by simple turning and water jet or laser cutting within hours.
- No special tooling required for different products.
- Customized items can be made faster by simply modifying computer programs.
- Ideal for small batch sizes of 500 to several thousand pieces.
- Low inventory.

III. Concept 3

i) Concept 3.1

A) Basic Concepts

This design was approached from the ground up. The idea came about by thinking of the purpose of a caster and designing a simple mechanism to achieve the same task a current caster fills today. This will theoretically make the movement of any load the caster is holding easier. It is also assumed the friction between the walls of the tube, the top plate, and the roller balls is small enough to allow free rolling between the main sphere and the roller balls.

B) Advantages

The advantages of this design would be that there is no torque required on the wheels in order for the carried-load to be turned. The "caster" would sit directly beneath whatever it was supporting and therefore there would be no wheels to stick out and trip people or snag other items. The assembly is very simple and would be very quick. This is very important because the main goal of the project is to be able to ship a caster out very quickly. All of the need materials could be ordered standard from the market except possibly the main sphere, but that will need to be determined experimentally.

ii) Concept 3.2

A) Basic Concepts

This concept was arrived at by first looking at the previous concept and trying to improve on it, however both concepts are equally plausible and therefore both are being presented. The main difference from the previous concept is that instead of a space filled with balls there is now a ring of balls that will act as a bearing. The design of this new bearing should allow the main sphere to roll in any direction at anytime and allow turning without the need for torque on the "caster" (it sits directly beneath the load). The ring of balls will also support the vertical load.

B) Advantages

The assembly of this design would be relatively simple. The thick wall tube would need to be cut into two separate pieces. One piece would be turned to achieve the "crimping effect." The other end would have the top plate welded to it. The top plate needs to be cut from sheet steel using prior mentioned methods i.e. water jet or laser cutting. Then the holes would need to be cut and tapped. The reason the thick wall tube is cut into two pieces is to allow the main sphere to be loaded in. The crimped end is smaller than the main sphere and the raceway is smaller as well and hence the main sphere needs to be loaded between the to halves and then welded inside. A hole will be needed that connects the outer wall of the tube to the inner raceway. This way the steel balls can be loaded in after the weld and this will secure the main sphere in place. The whole could then be plugged. This would also allow for the roller balls to be further lubricated if need be or completely replaced in the event of a failure of the material.

3.0 Methodology / Brainstorm / Work Breakdown Structure

A) Problems

In the caster manufacturing industry, hard tooling methods, such as stamping are currently being utilized. Although effective, the downside to this method is extremely long production time, which, for the time being, customers grudgingly accept.
One of the main reasons for this lengthy manufacturing process is the die fabrication and installation. In addition, this situation is quite far from being ideal, as new dice would have to be cut for each castor type, creating wait times of up to 8 weeks!
In a case where a customer requires some kind of special / customized caster, wait times are extended by up to a further 2 weeks!
The team is paying special focus to such a situation, as customized orders usually involve moderate produced quantities at a higher selling price. The ultimate aim is to be able to rapidly produce a moderately-sized order of casters and deliver within a 48-hour time frame.

B) Plan of Attack

This project is a continuation / development of the spring 2006 IPRO 312. There is also some collaboration, in the way of research data sharing, from the spring 2006 IPRO 323. It was decided that the two methods that should be looked at, in the attempt to eliminate hard tooling, are laser cutting and abrasive jets.
Each of the two mentioned methods has its advantages and disadvantages, but, in terms of versatility / cost, preference leans towards the laser cutting method.
The team will be broken down into 3 groups.
In the early stages one of the teams would be concerned with Project Planning. The other two groups would be concerned with Design and Equipment selection. After the initial planning stages, project planning team would be absorbed by either or both of the other two teams, depending on where more hands are needed.
The main criticism of the previous group's castor designs is that they did not look very similar to the castors currently being supplied by the Colson Castor Company. The design team would be engaged in researching methods to rectify this.
The equipment selection team would have the initial responsibility of selecting the technology to be utilized. Subsequently, all the machinery required to have a fully-operational rapid castor fabrication factory would be selected.

<u>What We Know</u>

- We need a 24-hr Turnaround
- Design needs to be capable of producing a variety of casters (series 4 & 16 for now)

<u>What We Think We Know</u>

- Basic Design of Caster
- Ease of Manufacture / Design
- Materials Involved

What We Need To Know

- Cost Analysis
- Deliverable Quantity
- Specific Machinery Required

C) Testing of Potential Solutions

After findings have been reviewed and refined as necessary, the group would take one or more field trips to factories where the technologies in mention are utilized. Fabrication times would be recorded, as well as identification of possible bottlenecks. Any issues that didn't arise during the planning process that may arise during the test runs would be identified and recorded. The teams would then take that feedback and review their initial approach as necessary.
The first prototype will be fabricated at the Wrigley Company. The second prototype will be fabricated at Colson Associates.
Heat treating, physical and performance testing would be carried out at both companies.

D) Documentation of Results

The ultimate goal is to develop a process that maximizes quality and minimizes cost. Quality, in this case, comprises of the following:

i. Design / Capability
ii. Speed
iii. Variety of additional caster families producible

Design / Capability address how well the designed casters match the existing models. Speed essentially deals with how many casters can be fabricated using the chosen method. Another very important criterion is how versatile the chosen method is – how many other types of caster families can be fabricated using the same equipment.
The different fabrication options would be ranked according to how well they meet the criteria listed above during the field trip tests.

E) Analysis of Test Results

First and foremost, the caster has to meet operational standards. The process by which this is reached is secondary, but still ultimately very important. The acquired results from the tests would be reviewed and any optimizations to the process that need to be made as a result of that would be made. Based on previous research, it is expected that trade-offs would have to be made when choosing a fabrication method over the other.

F) IPRO Deliverables

Deliverables like the Project Plan, Mid-Term Report, Project Abstract and Final Report would be taken care of by the members of the project planning team, in collaboration with other members of the IPRO team. Design notes, ideas and sketches would be documented every meeting, this increasing the volume and quality of material available to be included in the IPRO Deliverables.

Two or more team members would be chosen / could volunteer to handle the Website Design and Comprehensive Deliverables CD.
Team information can be collected at any of the general meetings or via electronic methods (such as e-mail / iGROUPS / iKNOW).

G) Detailed Documents

Kindly see attached Gantt chart.

4.0. Expected Results

The overall expectation is to design a castor system with a 24 hour turnaround.
We expect to accomplish this by:

- Obtaining a Complete understanding of IPRO 312S06.

- Tweaking and Improving Concept 1 from IPRO 312S06 that fulfill requirements set by the following tests:
    i. Performance Testing
    ii. Speed Testing
    iii. Swivel Testing
    iv. Design Testing
    v. Shear Stress Testing
    vi. Tensile Stress Testing, and
    vii. Compression Testing

- Identifying all the equipment needed for the manufacturing process while studying equipment catalogs and selecting machinery.

- Identifying the process layout by denoting such things as the:
    i. Laser cut
    ii. Turn
    iii. Drill
    iv. Mill
    v. Forge, and
    vi. Other manual assembly, such as screwing

- Completing the Program factory Layout by denoting such things as the:
    i. Factory specifications (such as the design of the building and the setup of project apparatus in the factory)
    ii. Space requirements, and
    iii. Laser specifications

- Determining the quantity of order (assistance given by Chuck Harris of Colson). This is needed to decide the cost of the project procedure. By determining this we expect to get an idea of what is expected for customized items and standard items.

- Determining the actual time of delivery (lead time) – for example suppose we receive the order, how long will it take to produce it will be determined by the time line.

5.0. Project Budget

Both budgets assume that the laser cutting method would be chosen over the abrasive jet (as would most likely be the case). The differences in required equipment are as a result of the different part shapes / specifications for the two different design concepts

Concept 1:

Equipment	Cost
CNC Lathe	$200,000.00
CNC Mill	$200,000.00
Mill Turn	$350,000.00
Laser Cutting	$1,200,000.00
Forging Press	$120,000.00
Total + 5%	$2,200,000.00

Concept 2:

Equipment	Cost
Welding Machine	$5,000
CNC Mill	$200,000.00
Hydraulic Press	$120,000.00
Laser Cutting	$1,200.000
CNC Lathe	$200,000.00
Total + 5%	$1,850,000.00

Additional Expenses:

Building (one time cost)	$1,200,000.00
Labor-12 personnel (yearly)	$650,000.00
Advertising Expenses (start up)	$25,000.00
Materials (start up)	$50,000.00
Operating Costs (yearly)	$100,000.00
Other (e.g furnishing, renovations)	$100,000.00
Total + 5%	$2,200,000.00

6.0. Schedule of Tasks and Milestone Events

Week	Tasks and Deliverables
Aug 28 – Week 1	➢ Meeting with team and review of previous semester's IPRO results ➢ Gathering of information of team members ➢ Briefing on project description and information about sponsors ➢ Discussion of project expectations ➢ **Syllabus distribution / discussion**
Sep 4 – Week 2	➢ Further discussion / familiarization with IPRO material ➢ Selection of preferred caster concept ➢ Breaking up into groups ➢ Begin work on Project Plan ➢ **Pre-IPRO Experience Survey (w/briefing)**
Sep 11 – Week 3	Equipment ➢ Make a rough list of equipment that could be used for rapid caster manufacturing ➢ Contact equipment companies and get estimates of machinery costs Design ➢ Do a break down of concept 1 and iron out issues brought up by Colson Associates ➢ Brainstorm on what optimizations could be made to design concept 1 Business ➢ Assign tasks to teams ➢ Work on Project Plan
Sep 18 - Week 4	Equipment ➢ Prepare mini presentation for Joe Arvin of Arrow Gear Corporation ➢ Prepare questions for Joe Arvin of Arrow Gear Corporation Design ➢ Tweaking of design concept one and choice making on final concept designs for both plate and kingpin designs Business ➢ Complete work on Project Plan ➢ Mail project plan to advisor for review ➢ **Submit Project Plan to iKNOW**

Sep 25 – Week 5	All ➢ Meeting with Joe Arvin of Arrow Gear Corporation ➢ Field Trip to Mori Seiki Machine Tool Company Equipment ➢ Identify different equipment available in the market and their capabilities ➢ Create list of actual equipment required to set up working plant ➢ Record better cost estimates based on information from Mori Seiki Company and Joe Arvin of Arrow Gear Corporation Design ➢ Collaborate with Equipment Group to discuss any design modifications that need to be made based on available equipment ➢ Begin discussions on design process flow scheme
Oct 2 – Week 6	Equipment ➢ Make a rough list of equipment that could be used for rapid caster manufacturing ➢ Contact equipment companies and get estimates of machinery costs Design ➢ Do a break down of concept 1 and iron out issues brought up by Colson Associates ➢ Brainstorm on what optimizations could be made to design concept 1 Business ➢ Begin preparing material for mid-term report
Oct 9 – Week 7	All ➢ Field trip to Arrow Gear Corporation ➢ Equipment ➢ Update list of available equipment ➢ Make modifications to process flow scheme as necessary Design ➢ Review performance ratings of manufacturing equipment and come up with first guess of turnaround time

Oct 16 – Week 8	All ➢ Meeting with Chuck Harris of Colson Associates ➢ Meeting with Robert Pritzker of Colson Associates Equipment ➢ Fabrication of caster prototype at Wrigley ➢ Caster physical tests ➢ Caster performance tests Design, Equipment ➢ Review of caster test results ➢ Making necessary modifications Factory Design ➢ Begin preliminary research into factory design based on chosen equipment Business ➢ **Mid-Term Progress Report (w/ optional presentation)**
Oct 23 – Week 9	Equipment ➢ Final review of equipment and equipment surveying at Colson Design ➢ Retesting of design at Colson – thorough performance and design tests. Factory Design ➢ Visit to Colson to study current equipment and layout ➢ Preliminary layout and design work for the proposed new factory Business ➢ Co-ordinate website development ➢ Look into poster requirements and start planning a timeline for Colson and IPRO deliverables
Oct 30 – Week 10	Equipment ➢ Work with ‘factory design’ on the layout exact placement of equipment Design ➢ Final modifying of design, if necessary ➢ Final testing and documentation for deliverables Factory Design ➢ Work on equipment placement and factory layout ➢ Preliminary layout and design work for the proposed new facility Business ➢ Co-ordinate website development ➢ Start working on both Colson and IPRO deliverables

Nov 6 – Week 11	Equipment ➢ Complete working 'factory design' on the layout exact placement of equipment Design ➢ Work specifically towards documentation for deliverables to Colson Associates Factory Design ➢ Complete and finalize exact equipment placement and factory layout Business ➢ Work on website development ➢ Co-ordinate and work specifically towards documentation for deliverables to Colson
Nov 13– Week 12	All ➢ Complete and finalize all documentation and deliverables for Colson and IPRO ➢ Presentation to Faculty Advisors
Nov 20 – Week 13	All ➢ Review and finalize all documentation and deliverables for Colson and IPRO, according to faculty advisor recommendations ➢ Preparation, co-ordination and completion of all final deliverables for the IPRO office ➢ Complete and finalize website ➢ Presentation to Colson Associates personnel – Bob Pritzker and Chuck Harris ➢ **Project Exhibit due** ➢ **Project Abstract due**
Nov 27 – Week 14	All ➢ Finalize all documentation and deliverables for IPRO Day ➢ Prepare and rehearse presentation for IPRO DAY ➢ **Final Website due** ➢ **Final Oral Presentation to Faculty** ➢ **Final Report due** ➢ **Team Information due** ➢ **Comprehensive Deliverables CD due** ➢ **IPRO Day**
Dec 4 – Week 15	All ➢ Finalize all documents and upload to iKNOW ➢ Organize all materials for next semester's IPRO team ➢ **IPRO Debriefing** ➢ **Peer Evaluations online** Business ➢ Write Thank you notes to everyone concerned

7.0. Individual Team Member Assignments

A) Team Members

- Annie Ranttila, **Architecture**
- Chun Yiu Fu, **Architecture**
- Shan I. Hussain, **Chemical Engineering**
- Ken Hicks, **Manufacturing Technology and Management**
- Udit Dave, **Manufacturing Technology and Management**
- Sourabh Manjrekar, **Business, Finance**
- Daniel Nosse, **Manufacturing Technology and Management**
- Muhammad Atta, **Computer Science**
- Rachid Amine, **Chemical Engineering**
- Seun Craig, **Mechanical Engineering, Business**
- Abdulkamal Abdullahi, **Chemical Engineering**
- LaShawna Taylor, **Chemical Engineering**
- William Maurer, **Advisor**
- Keith McKee, **Advisor**

B) Teams

- Equipment: Members of the equipment team will research and identify the proper machines to effectively reduce the lead-time of specialty casters from 6 weeks to 24 hours.

    i. Ken Hicks (Team Leader)
    ii. Chun Yiu Fu
    iii. Shan I. Hussain
    iv. Muhammad Atta
    v. Sourabh Manjrekar
    vi. Abdulkamal Abdullahi

- Design: Members of the design team will refine and finalize the design of last semester's concept 1 caster to meet the needs of the manufacturer and the requirements for a reduced production time.

    i. Udit Dave (Team Leader)
    ii. Seun Craig
    iii. Rachid Amine
    iv. LaShawna Taylor

- Factory Design: Members of the factory design team will work with members of the equipment team to design and layout the most effective and efficient production process.

    i. Chun Yiu Fu (Team Leader)
    ii. Daniel Nosse
    iii. Annie Ranttila

- Business: Members of the business team will work with the three other teams to compile information in a neat and organized manner for presentation to Colson Associates and to the IPRO Office.

    i. Annie Ranttila (Team Leader)
    ii. Abdulkamal Abdullahi
    iii. Sourabh Manjrekar
    iv. LaShawna Taylor
    v. Daniel Nosse

8.0. Designation of Roles

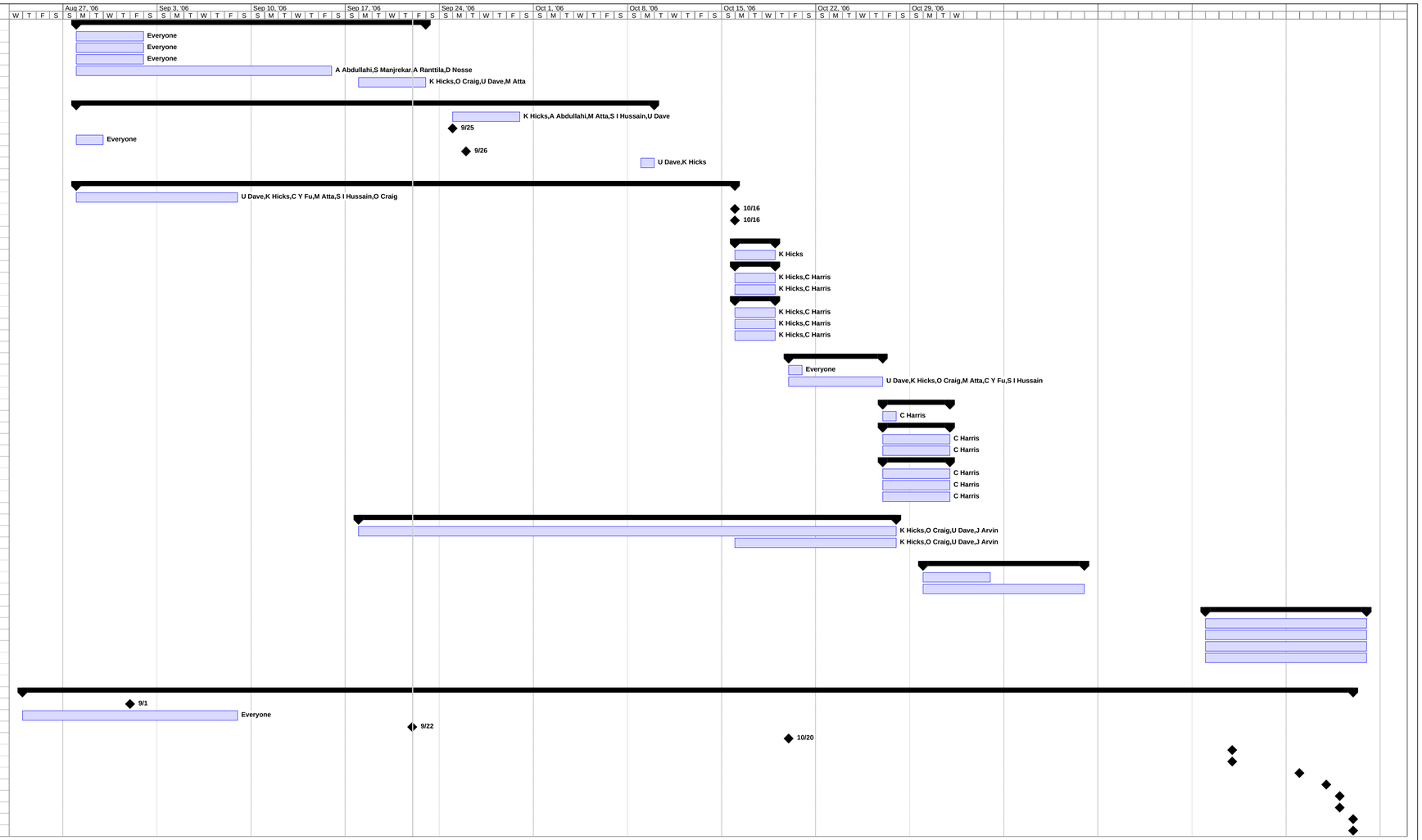
A) Meeting Tasks

- Minute Taker: Annie Ranttila
- Agenda Maker: Abdulkamal Abdullahi
- Time Keeper: Sourabh Manjrekar

B) Status Roles

- Weekly Timesheet Collector: Chun Yui Fu
- Master Schedule Maker: Daniel Nosse

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names
1	**Defining The Problem**	**20 days**	**Mon 8/28/06**	**Fri 9/22/06**		
2	Planning and Task Identification	1 wk	Mon 8/28/06	Fri 9/1/06		Everyone
3	Enumerating / Isolating Tasks	1 wk	Mon 8/28/06	Fri 9/1/06		Everyone
4	Task Assignment / Distribution	1 wk	Mon 8/28/06	Fri 9/1/06		Everyone
5	Project Plan	3 wks	Mon 8/28/06	Fri 9/15/06		A Abdullahi,S Manjrekar,A Ranttila,D Nosse
6	Tweaking / Improving Concept 1 from IPRO 312S06	1 wk	Mon 9/18/06	Fri 9/22/06	5	K Hicks,O Craig,U Dave,M Atta
7						
8	**Gathering Research / Background**	**31 days**	**Mon 8/28/06**	**Mon 10/9/06**		
9	Technology Research and Selection	1 wk	Mon 9/25/06	Fri 9/29/06	6	K Hicks,A Abdullahi,M Atta,S I Hussain,U Dave
10	Meeting with Joe Arvin, CEO ArrowGear	0 days	Mon 9/25/06	Mon 9/25/06		Everyone
11	Study of IPRO 312S06 and 323S06 Results	2 days	Mon 8/28/06	Tue 8/29/06		Everyone
12	Field Trip to Mori Seiki Machine Tool Company	0 days	Tue 9/26/06	Tue 9/26/06		K Hicks,D Nosse
13	Field Trip to ArrowGear	1 day	Mon 10/9/06	Mon 10/9/06		U Dave,K Hicks
14						
15	**Identifying Possible Solutions**	**35 days**	**Mon 8/28/06**	**Mon 10/16/06**		
16	Design review with Udit Dave	2 wks	Mon 8/28/06	Fri 9/8/06		U Dave,K Hicks,C Y Fu,M Atta,S I Hussain,O Craig
17	Meeting with Chuck Harris Eng. Manager Colson Associates	0 days	Mon 10/16/06	Mon 10/16/06		Everyone
18	Meeting with Robert Pritzker, Owner Colson Associates	0 days	Mon 10/16/06	Mon 10/16/06	17	Everyone
19						
20	**Testing**	**3 days**	**Mon 10/16/06**	**Wed 10/18/06**		
21	Fabrication of prototype at Wrigley	3 days	Mon 10/16/06	Wed 10/18/06	18	K Hicks
22	**Performance Testing**	**3 days**	**Mon 10/16/06**	**Wed 10/18/06**		
23	Speed Testing	3 days	Mon 10/16/06	Wed 10/18/06		K Hicks,C Harris
24	Swivel Testing	3 days	Mon 10/16/06	Wed 10/18/06		K Hicks,C Harris
25	**Design Testing**	**3 days**	**Mon 10/16/06**	**Wed 10/18/06**		
26	Shear Stress Testing	3 days	Mon 10/16/06	Wed 10/18/06		K Hicks,C Harris
27	Tensile Stress Testing	3 days	Mon 10/16/06	Wed 10/18/06		K Hicks,C Harris
28	Compression Testing	3 days	Mon 10/16/06	Wed 10/18/06		K Hicks,C Harris
29						
30	**Analyzing**	**5 days**	**Fri 10/20/06**	**Thu 10/26/06**		
31	Review of Results	1 day	Fri 10/20/06	Fri 10/20/06		Everyone
32	Redesigning as necessary	1 wk	Fri 10/20/06	Thu 10/26/06		U Dave,K Hicks,O Craig,M Atta,C Y Fu,S I Hussain
33						
34	**Retesting**	**3 days**	**Fri 10/27/06**	**Tue 10/31/06**		
35	Refabrication of improved prototype at Colson Associates	1 day	Fri 10/27/06	Fri 10/27/06	32	C Harris
36	**Performance Testing**	**3 days**	**Fri 10/27/06**	**Tue 10/31/06**		
37	Speed Testing	3 days	Fri 10/27/06	Tue 10/31/06	32	C Harris
38	Swivel Testing	3 days	Fri 10/27/06	Tue 10/31/06	32	C Harris
39	**Design Testing**	**3 days**	**Fri 10/27/06**	**Tue 10/31/06**		
40	Shear Stress Testing	3 days	Fri 10/27/06	Tue 10/31/06	32	C Harris
41	Tensile Stress Testing	3 days	Fri 10/27/06	Tue 10/31/06	32	C Harris
42	Compression Testing	3 days	Fri 10/27/06	Tue 10/31/06	32	C Harris
43						
44	**Analyzing and Selecting**	**30 days**	**Mon 9/18/06**	**Fri 10/27/06**		
45	Identify all Eqipment needed for Manufacturing Process	1.5 mons	Mon 9/18/06	Fri 10/27/06		K Hicks,O Craig,U Dave,J Arvin
46	Study Equipment Catalogs and Select Machinery	2 wks	Mon 10/16/06	Fri 10/27/06		K Hicks,O Craig,U Dave,J Arvin
47						
48	**Design and Modifying**	**10 days**	**Mon 10/30/06**	**Fri 11/10/06**		
49	Identifying Process Layout	1 wk	Mon 10/30/06	Fri 11/3/06	46	K Hicks,O Craig,U Dave,J Arvin,A Ranttila,C Y Fu
50	Design / Program factory Layout	2 wks	Mon 10/30/06	Fri 11/10/06	46	L Taylor,K Hicks,U Dave,A Ranttila,C Y Fu,J Arvin
51						
52	**Preparing for IPRO Day**	**10 days**	**Mon 11/20/06**	**Fri 12/1/06**		
53	Review of Deliverables	2 wks	Mon 11/20/06	Fri 12/1/06		Everyone
54	Website Design	2 wks	Mon 11/20/06	Fri 12/1/06		M Atta
55	Presentation to Faculty Advisors	2 wks	Mon 11/20/06	Fri 12/1/06		Everyone
56	Presentation to Bob Pritzker and Colson Associates	2 wks	Mon 11/20/06	Fri 12/1/06		Everyone
57						
58						
59	**Deliverables**	**71 days**	**Thu 8/24/06**	**Fri 12/1/06**		
60	Syllabus	0 days	Fri 9/1/06	Fri 9/1/06		Everyone
61	Pre-IPRO Experience Survey	12 days	Thu 8/24/06	Fri 9/8/06		Everyone
62	Project Plan	0 days	Fri 9/22/06	Fri 9/22/06		Everyone
63	Mid-Term Progress Report	0 days	Fri 10/20/06	Fri 10/20/06		Everyone
64	Exhibit / Poster	0 days	Wed 11/22/06	Wed 11/22/06		Everyone
65	Project Abstract	0 days	Wed 11/22/06	Wed 11/22/06		Everyone
66	Web Site	0 days	Mon 11/27/06	Mon 11/27/06		M Atta
67	Final Oral Presentation	0 days	Wed 11/29/06	Wed 11/29/06		Everyone
68	Final Report	0 days	Thu 11/30/06	Thu 11/30/06		Everyone
69	Team Information	0 days	Thu 11/30/06	Thu 11/30/06		Everyone
70	Comprehensive Deliverables CD	0 days	Fri 12/1/06	Fri 12/1/06		Everyone
71	IPRO DAY	0 days	Fri 12/1/06	Fri 12/1/06		Everyone



Project: IPRO 312
Date: Fri 9/22/06

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary