

# **IPRO 333: Fab Lab**

## **FINAL REPORT**

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# I. Executive Summary

Fabrication Laboratories, or Fab Labs, were started as a community outreach program by the Massachusetts Institute of Technology and provide digital fabrication tools for rapid prototyping to the general public. The Museum of Science and Industry has partnered with this IPRO to further develop the Fab Lab at their site. IPRO 333 currently works with the administration in the Fab lab of MSI to design materials and activities for increasing the use of the laboratory. IPRO 333 aims to broaden the possible uses of the lab, promote membership at the museum, and increasing participation by the community in science and technology programs at the museum.

In order to accomplish our goals IPRO 333 divided into two teams, each of which focused on different, but not necessarily independent, aspects of the lab. The project creation team was responsible for designing and creating new projects, tutorials, and activities for users of the Fab Lab, principally 4<sup>th</sup> – 12<sup>th</sup> grade students. The lab preparation and organization group was responsible for the following: networking within the museum; marketing the Fab Lab; disseminating information about the lab to employees within and volunteers and community members outside of the museum; promoting the lab's presence within the community.

To begin the semester the projects team reviewed the Illinois education standards and began to brainstorm ideas for potential projects. After a list of potential projects was created the members of this team began to make designs for some of the projects and prototype them. Eventually, final models were built after all flaws had been worked out and projects had been tested. Throughout this process, team members encountered a few issues, mainly that not all of the necessary materials and equipment could be found in the Fab Lab. These issues caused some of the projects that were initially brainstormed to be scratched from the list. The conclusions were drawn that although the MSI Fab Lab is a quite advanced Fab Lab, it is still limited by some simple issues that need to be worked out in the future.

Members of the organization and preparation team began the semester by inventorying the materials and equipment in the lab, and also by repairing broken machines and locating and publishing user manuals for each piece of machinery. Once all of this had been completed the focus began to shift towards organizing the lab and making it more user-friendly. This was accomplished by labeling the various storage spaces throughout the lab and organizing them so that they were designated storage for certain projects and materials, rather than the unorganized system that had been in place previously. In addition to labeling the storage spaces, an introductory and informational video was made about the Fab Lab that can be shown to users and visitors of the Fab Lab. Also a very important issue was addressed by this team, that being a lack of satisfactory safety instructions, which have been created and displayed, near the respective machines along with their manuals.

Marketing was a key issue that needed to be addressed this semester, and members of the Fab Lab IPRO team addressed this issue in multiple ways. In an attempt to expand our potential user groups the marketing sub-team mailed out over 100 marketing letters to various groups throughout the area inviting each group to visit the Fab Lab. Additionally, members of the marketing team traveled to the Fab Lab conference to learn more about the Fab Lab community and to network. This has developed many connections that we are able to communicate with and learn more about the possibilities of the lab. Finally, ideas for a website were generated based on other Fab Lab websites, although this project was halted due to a lack of participation by the Museum of Science and Industry staff.

The Fab Lab has become a more functional and organized place for students to work and learn. This IPRO still needs the support of the museum to help run the lab and complete it. Other IPRO and IIT students have found the lab useful to complete projects.

## **II. Team Purpose and Objectives**

### **A. The Problem**

The problem presented to this IPRO is that the Fab Lab is underdeveloped and underutilized. An example of the lack of development in the Fab Lab is the lack of dedicated staff; there is currently only a single dedicated staff member who supervises the lab. To speak to the underutilization of the lab, only two small student groups, the Science Minors and Science Achievers, currently use the Fab Lab; the Science Minors meet only ten Saturdays a year. This is an extreme underutilization compared to other Fab Labs that are in use every day by a variety of users. In addition to the small number of users, the operating hours of the lab are very limited as well. The only time the Fab Lab is operating is when the MSI student groups, this IPRO team, and MSI staff are using the lab. This team attempted to work with the Museum of Science and Industry to develop plans to improve the lab and expand its usage. Some of the existing issues that the team decided that needed to be addressed during this semester's work included: lab safety, organization, potential users, machine tutorials and maintenance, relevant user projects and programs, amongst other issues.

### **B. The Sponsor**

The Fab Lab IPRO is sponsored by the Chicago Museum of Science and Industry. This museum houses many science and technology based exhibits, as well as, student and teacher education programs. This semester's team was under the direct supervision of MSI staff members. Throughout the course of the semester the IPRO team had to remain aware of the impact of its work with regards to the reputation and image of the museum and in some cases even had to gain approval from various staff members before proceeding on with certain tasks.

### **C. The Community**

One of the main issues with the Fab Lab at the beginning of the semester was that it did not target any specific user groups. The only two groups utilizing the Fab Lab were two student groups called the Science Achievers and Science Minors, and even their usage of the lab was limited. One of the major problems facing this semester's team was to find and contact specific user groups who would be interested in using the Fab Lab.

### **D. Objectives**

This semester's objectives were created to cover a variety of issues that had been identified by the Fab Lab team. The entire team was divided into two subgroups, which focused on the organization of the lab, and the creation of educational projects for student users.

The subgroup that focused on the organization of the Fab Lab set out at the beginning of the semester with a focus on general organization and maintenance. In order to accomplish this broad goal, this subgroup wanted to organize the lab and take an inventory of all materials, repair all broken equipment and machinery, and also to locate and publish user manuals for all machines in the lab and publish. After all of this had been completed the next objective was to begin to increase awareness of the Fab Lab by creating and implementing new marketing strategies for the Fab Lab, and also to begin to make the lab a safe facility to work in. One of the main tasks to be completed by the individuals working on safety was to create appropriate signage for the lab and to post the signs in clear and easily visible areas. Another objective that was laid out for this team was to create tutorials for the various machines and software programs used in the lab, and this was to be a semester long project.

The project group's main objective for the semester was to create a variety of projects that varied in difficulty and were grounded by Illinois educational standards. One main method to complete this goal was identified, and that was to study the Illinois Education Standards and create a list of potential projects. From this point the project team was tasked with making the list of potential projects material objects by designing and building prototypes for future student groups.

In addition to the subgroup specific objectives, a separate set of general objectives was created. This team hoped to educate Fab Lab staff on how to properly use each piece of equipment, and to do so by introducing knowledgeable individuals from the community into the lab who could share their experiences and expertise with the IPRO team and staff. Another objective that was carried over from previous semesters was to begin to integrate the Fab Lab into the current working exhibits as well as future exhibits. Finally, this IPRO team set out to coordinate a program with other Fab Labs that allows for the sharing of ideas, past experiences, and failures.

### **III. Organization and Approach**

The first major organizational step taken this semester was to break the IPRO team down into two smaller subgroups. The focus of the first subgroup was education and projects for the Fab Lab and its users. The focus of the second subgroup was the organization and preparation of the Fab Lab. The tasks and focuses of both groups are as follows:

#### **Group 1 (Education and Projects):**

- Conceive, design, and implement educational materials, projects, and activities for 4<sup>th</sup> – 12<sup>th</sup> grade students
  - Becoming familiar with the education standards of the National Science Foundation and other sources, such as the Benchmarks for Science Literacy, the Atlas of Science Literacy and the National Science Education (and curriculum) Standards. These standards will aid us in gauging the educational content and difficulty level of projects for different grade levels, particularly 4-12. These will be utilized to guide the writing of the projects.
  - Searching various sources in order to find examples of projects that can be used or modified in order to fit the education requirements dictated by the standards, and the capabilities of the MSI Fab Lab.
  - Organizing the projects into workable programs made specifically for a grade level.
  - The programs developed will be user tested at the MSI Fab Lab. The success of the tests will determine the validity of the program.

#### **Group 2 (Organization of Fabrication Laboratory):**

- Research what has already been done by other Fab Labs
- Take an inventory of all tools and materials, label them, and organize them
- Create Fab Lab safety guidelines and post them throughout the Lab
- Make sure all Fab Lab equipment is fully functional
- Create user-friendly software and machine manuals in hard copy, digital, and video formats
- Create informational videos about the Fab Lab for users to watch and to use as marketing media
- Have training and certification for all machinery to register individuals who can operate each machine
- Create a marketing plan that starts with identifying Lab users and issues, as well as working closely with MSI to market internally and externally

The education and projects team took a simple approach to covering the tasks that were set out at the beginning of the semester. To create project ideas the team members first familiarized themselves with the Illinois educational standards and requirements. After becoming familiar with these guidelines the projects team brainstormed potential projects that would meet the criteria so that each project could be used as an educational tool. After brainstorming potential projects the members of this team had to begin to materialize the projects.

After debating which projects were feasible to build in the Fab Lab the team members chose projects that they wanted to work on and they began their work. In order to create each project, team members had to create a design for what they were to build, outline a process of how everything was to be built, and choose the appropriate materials for their projects. At this point team members had to learn how to use the various Fab Lab machines that would be needed to build their projects. This was accomplished through tutorials, guessing and checking, and also asking other IPRO team members that knew how to operate a particular machine. Once the design was finalized and the project team member had acquired the necessary skills and knowledge about the machinery they began to manufacture prototypes of their projects.

Typically, prototypes were created out of a more economical material so that flaws could be fixed easily without much cost. After building many prototypes, team members would build final models out of their chosen materials and create a tutorial on how to build the project so that others could do so in the future. The final step taken by these team members is to have their tutorials tested by other students or guests to make sure that the directions are clear and thorough so that the project can be easily completed by other users. The feedback from these testers is then used to make any necessary changes to the tutorials to make them the best products possible.

The organization team started the semester out by brainstorming ideas as a group, and then subdividing themselves into groups which would handle different tasks. The groups were flexible, so that at different points in the semester, different numbers of people might be working together. At the beginning, our first two subgroups were the machine maintenance group and the lab organization group.

The machine maintenance group was tasked with getting all the machines working. They started by seeking out manuals for each machine and reading through them to familiarize themselves with the mechanisms. After that, they used what they had learned to diagnose the problems within the broken machines, and fix them. Anything that they couldn't find in the manual they searched online forums and user groups for. They also spoke with museum staff to update them with how the machines were doing and notify them if anything needed new parts. Throughout the semester, the maintenance group became more acclimated with the machines and was able to help the rest of the IPRO out if anything started to malfunction.

One of the tasks of the lab organization group was to clean and organize the lab. The lab had to be cleaned of garbage and old projects, and tools that were lying around had to be put back in their places. Lab organization played a large part in the cleaning of the lab, because everything had to find a place. A map was created of the lab which detailed where specific tools were located, and corresponding labels were created for the cabinets and drawers themselves which identified what was inside. Throughout this process, an inventory was also taken, to quantify the amount of each material that the lab.

Another task of the lab organization group was to create machine tutorials which explained step by step how to use the different machines in the Fab Lab. These tutorials were created using firsthand experience, the product manuals, and online resources. These tutorials were tested on friends who were not familiar with the machines, and their feedback was used to improve them.

After the lab organization was done, the group became more focused on marketing the Fab Lab. The first step they took was to look up what the previous semester's IPRO had done and think of ways to improve on that. After looking at that, they realized that they wanted to reach a wider audience. In order to do so, they worked with the Ethics Center at IIT to access the Associations Unlimited database and find user groups based on interests and locations. Then they created a marketing letter and mailed over a hundred letters to different groups which might benefit from use of the lab. A video was also planned out which included information about the Fab Lab and contact information for anyone interested.

Throughout the course of this semester, both teams worked on their separate tasks but also shared their progress with one another through team meetings. Teams met their deadlines and kept open communication. These approaches taken helped lead the team to the successes outlined in the next section.

## **IV. Analysis and Findings**

Since the IPRO group was split into two smaller sub-teams focused on different aspects of the Fab Lab this group was able to accomplish a wide variety of things. Accomplishments were made in the development of projects, organization of the Fab Lab, networking, and the marketing of the lab.

The majority of milestones reached by the project development team were directly related to the creation of new projects. These projects were more grounded in educational standards than the projects of previous semesters. The new educational projects that were created this semester include a rail gun, yo-yo, planetarium, Pi circles, and an electrical circuit board. These projects encompassed ideas and principles based in physics, mathematics, electricity, and magnetism, amongst others.

The project development team found that although the Fab Lab has a lot to offer, it still does not offer everything. After the brainstorming phase of project idea creation some of the potential projects had to be cancelled due to a lack of proper materials and equipment to build the projects.

The organization team found early on that the lab would really benefit from a new organizational system. Everything was sorted and arranged into cabinets and the shelving units according to what type of instrument it was, which machine it was used with, or what sort of project it might be used for. A map was created to be posted around the lab for quick reference on where different tools could be found. In addition, the cabinets and shelves were labeled with a letter or number, and which tools were inside. One of the difficulties that arose is that the lack of professional staff made it hard to ensure that the organizational system was followed when other groups were in the lab. Often we would enter the lab to find a mess of tools and scrap material scattered about.

The organization team also worked to define safety rules for each of the machines in the lab. Safety goggles, a first aid kit, and a fire extinguisher were in the lab but there were no regulations for their use. Members of the organization team investigated the manuals for each of the machines and created a list of the important safety rules to be posted on an acrylic sign near the machine. The signs will include images indicating potential hazards and also the manual including the machine instructions and tutorials for projects. The team is also working with the Museum to supply a paper towel and a soap dispenser for the hand washing station.

The machine maintenance group spent a lot of their time learning as much as possible about each machine. The CNC machine required a lot of work because it was broken, and so machine manuals and online resources were consulted in order to diagnose the problem. Once the CNC was working again, along with most of the

other machines, tutorials were created for them so that in the future they could be fixed by others. The biggest problem encountered was with the 3d printing machine. The machine group spent a lot of time learning about its mechanisms, but in the end they were unable to fix it and contacted the museum to help figure out what they should do. Hopefully next semester the 3d printer can be fixed by a trained professional.

Once the lab was up and running, the marketing team was very active in seeking out potential clients. The first step was to investigate the work completed last semester and use that as a starting point. The team found that the scope of potential clients could be broadened, and a greater effort could be invested towards contacting these clients and advertising the lab. The team visited the ethics center at IIT and accessed their associations unlimited database to find groups around Chicago which might benefit from the Fab Lab. They created a marketing letter and mailed it to these groups with information about the lab, and included contact information for interested parties to respond to. Another resource they utilized was film. A video was carefully planned out and a script written up which would showcase the lab's capabilities and machinery. The goal is that this video will be posted online, or included in future advertisements so that potential clients can see for themselves what the lab is about. This video was filmed in the lab and edited to include the narrated script. Again, contact information was included so that interested parties could contact us.

While the marketing team was working on the tasks mentioned above, another part of the organization group was working on creating machine tutorials. The tutorials were created for the laser cutter, vinyl cutter, Modela milling machine, and CNC router. These tutorials contain step by step instructions and pictures, as well as safety information to teach Fab Lab guests how to properly use the machines. The tutorials were printed onto 8.5"x11" paper and will be made available to all visitors of the lab.

In an effort to learn firsthand from users of other Fab Labs, a delegation of team members attended the Midwest Fab Lab Network Symposium about Fab Labs in Appleton, Wisconsin, at the Fox Valley Community College. The focus of the conference was to discuss networking and the idea that knowledge is an entity which can be shared and multiplied. Additionally, several successful Fab Lab business models were discussed, and it was emphasized that each Lab must find its own niche within the community. For example, a Fab Lab in Norway is used by local entrepreneurs to create molds for chocolate and boxes to package them in. Also a lab in Ohio is being used to build guitars in less than 60 days for under \$200. Upon returning back to Chicago, the team which attended the conference gave a short presentation to share what they had learned.

The major accomplishments of this IPRO were the lab organization, lab safety improvements, tutorials, machine repairs, and projects created. The projects were the jitterbug, catapult, rail gun, yo-yo, planetarium, pi circles, and the electrical circuit board. These accomplishments have been well documented so that next semester's IPRO can refer to them for help, and build off of them.

## **V. Conclusions and Recommendations**

In examining the successes and failures throughout this semester a number of conclusions can be gathered about the work of this IPRO team. These conclusions are drawn from a variety of team member input and cover multiple aspects of the Fab Lab and its environment.

One conclusion that can be drawn about the work of this team is with regards to the creation of the projects. The projects that were created this semester, compared to the work of previous semesters, is that the projects can be used to educate students of all ages in a fun and productive method, whereas in previous semesters projects were based on museum exhibits and individual interests. In terms of the work of the



organization and preparation team, it has been discussed that this IPRO team needs to find a broader audience to market the Fab Lab to, and send out mailings to people close to the IIT community and the museum who would find the lab useful. Finally, although this team has made great strides in organizing the Fab Lab, an appropriate method of inventorying and tracking must be found or created.

The conclusions that were drawn from this team about the museum and the environment of the Fab Lab are many. It has been found that other IPROs have found our lab useful for designing and making prototype models for their projects, and that the machines in the lab are similar to the equipment available on campus but the availability is not the same because the Fab Lab remains close a majority of the time. Additionally, it was concluded that the direct of the Fab Lab needs to be trained how to use the machines and how to properly maintain them so that they remain fully functional.

Based on the conclusions of this semester's IPRO team, recommendations have been developed for future IPRO teams. These recommendations also focus on the work of future IPRO teams and the environment of the Fab Lab and Museum of Science and Industry.

It is recommended that individuals responsible for marketing the Fab Lab in future IPRO teams continue to market and advertise the Fab Lab both within MSI and in the community, as this would assist in gaining support from non-IPRO members to help complete the IPRO, as well as, create a funding inflow from donors and Fab Lab users. Additionally, future IPRO teams should continue to work to make the Fab Lab self-sustainable and to be an exhibit that reflects the themes and purpose of the museum, which according to the museum mission is, "To inspire the inventive genius in everyone."

As for the environment of the Fab Lab, it is recommended that more full time staff are hired and trained because it would be beneficial to future lab users, and it would allow the lab to begin to sustain itself. It would also continue with all of the work that has been done by this team and previous IPRO teams to make the lab functional. This is recommended because although IPRO teams will come and go, full time staff members are more permanent forces in the Fab Lab and their knowledge and experience, and the knowledge and experience of all IPROs, can be passed on to future users.

## **VI. Appendices**

A: Budget

B: Team Schedule

C: Acknowledgements

D: Description of the IPRO program

E: Example Marketing Letter

F: Team Structure Chart

G: Gantt Chart

**A: Budget**

Item	Estimated Cost (\$)	Actual Cost (\$)
Transportation Reimbursement	\$375.00 (5 vehicles, \$75.00/vehicle)	\$375.00
Prototyping Materials	\$450.00 (e.g. 1' x2' acrylic piece = \$15.00)	\$314.96
Public Relations	\$150.00	\$122.47
Miscellaneous	\$50.00	\$0.00
<b>Total</b>	<b>\$1025.00</b>	<b>\$ 812.43</b>

**B: Team Schedule**

<b>Monday</b>	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM															
9:00 AM															
10:00 AM															
11:00 AM															
12:00 PM															
1:00 PM															
2:00 PM															
3:00 PM															
4:00 PM															
5:00 PM															
6:00 PM															
7:00 PM															
8:00 PM															
9:00 PM															

<b>Tuesday</b>	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM															
9:00 AM															
10:00 AM															
11:00 AM															
12:00 PM															
1:00 PM															
2:00 PM															
3:00 PM	<b>IPRO CLASS</b>														
4:00 PM															
5:00 PM															
6:00 PM															
7:00 PM															
8:00 PM															
9:00 PM															

Wednesday	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM	Yellow				Blue	Pink	Orange	Cyan	Red	Green	Purple	Yellow		Green	
9:00 AM	Yellow		Green		Blue	Pink	Orange			Green	Purple	Yellow	Blue		
10:00 AM	Yellow		Green		Blue	Pink	Orange			Green	Purple	Yellow	Blue		
11:00 AM	Yellow		Green		Blue	Pink	Orange			Green	Purple	Yellow	Blue		
12:00 PM	Yellow		Green	Grey	Blue	Pink	Orange		Red		Purple	Yellow	Blue	Green	Black
1:00 PM				Grey	Blue	Pink			Red			Yellow	Blue	Green	
2:00 PM									Red			Yellow			
3:00 PM					Blue				Red			Yellow			
4:00 PM					Blue				Red			Yellow			
5:00 PM					Blue		Orange		Red			Yellow			
6:00 PM			Green		Blue		Orange		Red	Green		Yellow			
7:00 PM			Green	Grey	Blue			Cyan	Red	Green		Yellow			
8:00 PM			Green	Grey	Blue			Cyan	Red	Green		Yellow			
9:00 PM				Grey	Blue			Cyan	Red	Green		Yellow			

Thursday	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM	Yellow				Blue	Pink	Orange	Cyan	Red						Black
9:00 AM	Yellow		Green		Blue	Pink	Orange	Cyan	Red						Black
10:00 AM	Yellow		Green		Blue	Pink	Orange	Cyan	Red						Black
11:00 AM			Green		Blue	Pink	Orange	Cyan					Blue	Green	Black
12:00 PM			Green			Pink	Orange	Cyan					Blue	Green	
1:00 PM	Yellow		Green			Pink	Orange	Cyan							
2:00 PM	Yellow		Green			Pink	Orange	Cyan							
3:00 PM	IPRO CLASS														
4:00 PM		Pink	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple				
5:00 PM		Pink	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple				
6:00 PM	Yellow		Green	Grey	Blue			Cyan	Red		Purple				
7:00 PM	Yellow		Green	Grey				Cyan	Red		Purple			Green	
8:00 PM	Yellow		Green	Grey				Cyan	Red		Purple			Green	
9:00 PM	Yellow			Grey				Cyan	Red		Purple			Green	

Friday	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM	Yellow			Grey		Pink	Orange	Cyan	Red		Purple		Blue	Green	Black
9:00 AM	Yellow		Green	Grey		Pink	Orange	Cyan	Red		Purple		Blue	Green	Black
10:00 AM	Yellow		Green	Grey		Pink	Orange		Red		Purple		Blue	Green	Black
11:00 AM	Yellow		Green	Grey		Pink	Orange		Red		Purple		Blue	Green	Black
12:00 PM	Yellow		Green	Grey		Pink	Orange		Red		Purple		Blue	Green	Black
1:00 PM				Grey					Red				Blue	Green	Black
2:00 PM									Red				Blue	Green	Black
3:00 PM									Red				Blue	Green	Black
4:00 PM					Blue				Red				Blue	Green	Black
5:00 PM					Blue		Orange		Red				Blue	Green	Black
6:00 PM				Grey	Blue		Orange		Red			Yellow	Blue	Green	Black
7:00 PM	Yellow		[1]	Grey	Blue		Orange	Cyan	Red		Purple	Yellow			
8:00 PM	Yellow		Green	Grey	Blue		Orange	Cyan	Red		Purple	Yellow			
9:00 PM	Yellow		Green	Grey	Blue		Orange	Cyan	Red		Purple	Yellow			

Saturday	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
9:00 AM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
10:00 AM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
11:00 AM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
12:00 PM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
1:00 PM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
2:00 PM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
3:00 PM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
4:00 PM	Yellow	Magenta	Green	Grey	Blue		Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
5:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink	Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
6:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink	Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
7:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink	Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
8:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink	Orange	Cyan	Red	Green	Purple	Yellow		Green	Black
9:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink	Orange	Cyan	Red	Green	Purple	Yellow		Green	Black

Sunday	Andy B.	H. Andrew	Carlie	Mike	Keenan	Rachel	Clayton	Jered	Paul	James	Cindy	Sabina	Carl	Jeremy	Ray
8:00 AM	Yellow		Green	Grey	Blue			Cyan	Red		Purple	Yellow			
9:00 AM	Yellow		Green	Grey	Blue			Cyan	Red		Purple	Yellow			
10:00 AM	Yellow		Green	Grey	Blue			Cyan	Red		Purple	Yellow			
11:00 AM	Yellow		Green	Grey	Blue			Cyan	Red		Purple	Yellow			Black
12:00 PM	Yellow	Magenta	Green	Grey	Blue			Cyan	Red	Green	Purple	Yellow	Blue	Green	Black
1:00 PM	Yellow		Green	Grey	Blue	Pink		Cyan	Red	Green	Purple	Yellow	Blue	Green	Black
2:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink		Cyan	Red	Green	Purple	Yellow	Blue	Green	Black
3:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink		Cyan	Red	Green	Purple	Yellow	Blue	Green	Black
4:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink		Cyan	Red	Green	Purple	Yellow	Blue	Green	Black
5:00 PM	Yellow	Magenta	Green	Grey	Blue	Pink		Cyan	Red	Green	Purple	Yellow	Blue	Green	Black
6:00 PM	Yellow		Green	Grey	Blue	Pink		Cyan	Red		Purple	Yellow	Blue	Green	Black

**C: Acknowledgements**

The Museum of Science and Industry

Steven Willis - Director, Fabrication Laboratory

IIT Ethics Center

John Kriegshauser – IIT Shop Supervisor

## **D: Description of the IPRO Program**

### ***The Interprofessional Projects (IPRO®) Program at Illinois Institute of Technology***

An emphasis on multidisciplinary education and cross-functional teams has become pervasive in education and the workplace. IIT offers an innovative and comprehensive approach to providing students with a real-world project-based experience—the integration of interprofessional perspectives in a student team environment. Developed at IIT in 1995, the IPRO Program consists of student teams from the sophomore through graduate levels, representing the breadth of the university's disciplines and professional programs. Projects crystallize over a one- or multise semester period through collaborations with sponsoring corporations, nonprofit groups, government agencies, and entrepreneurs. IPRO team projects reflect a panorama of workplace challenges, encompassing research, design and process improvement, service learning, the international realm, and entrepreneurship. (Refer to <http://ipro.iit.edu> for information.) The *[Project Title Here]* team project represents one of more than 40 IPRO team projects for the *[semester date]* semester.

## E: Example Marketing Letter



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3300 S. Federal Street  
Chicago, IL 60616-3793  
312.567.3000

October 15, 2009

Mr. Jeff Segola  
Vice Chairman  
Audio Engineering Society  
Shure Inc. c/o Nick Kettman  
5800 W. Touhy Avenue  
Niles, IL 60714

Dear Mr. Segola,

IPRO 333, an interprofessional project team from the Illinois Institute of Technology, would like to extend an invitation to visit the Fab Lab (short for Fabrication Laboratory) at the Museum of Science and Industry, Chicago.

The Fab Lab at the Museum of Science and Industry is one of thirty-four labs across the world. Through everyday use, Fab Labs have evolved into a community outreach program that encourages entrepreneurs to take their ideas from simple ambition to reality. In short, a fabrication laboratory is an open access workshop that houses digital fabrication equipment for rapid prototyping. The concept of a Fab Lab is to provide the general public with tools used typically in product development. Please see attached brochure for a more detailed description of the Fab Lab at the museum.

In collaboration with the Museum of Science and Industry, the mission of our team includes to increase public awareness of the Fab Lab and to establish a market of knowledgeable users. Therefore, a open call to associations, organizations, clubs, creative and innovative minds around the Chicagoland area is being issued to allow us present the mechanics of the Fab Lab and discover ways of working together. Consider attending one of our open house sessions at the Fab Lab, which includes a tour, overview of the equipment, and hands-on activities.

We would greatly appreciate your participation in our project. Please feel free to contact us with any questions.

Sincerely,

Cindy Oblenida & Sabina Pop  
Members of IPRO 333, Fall 2009

## F: Team Structure Chart

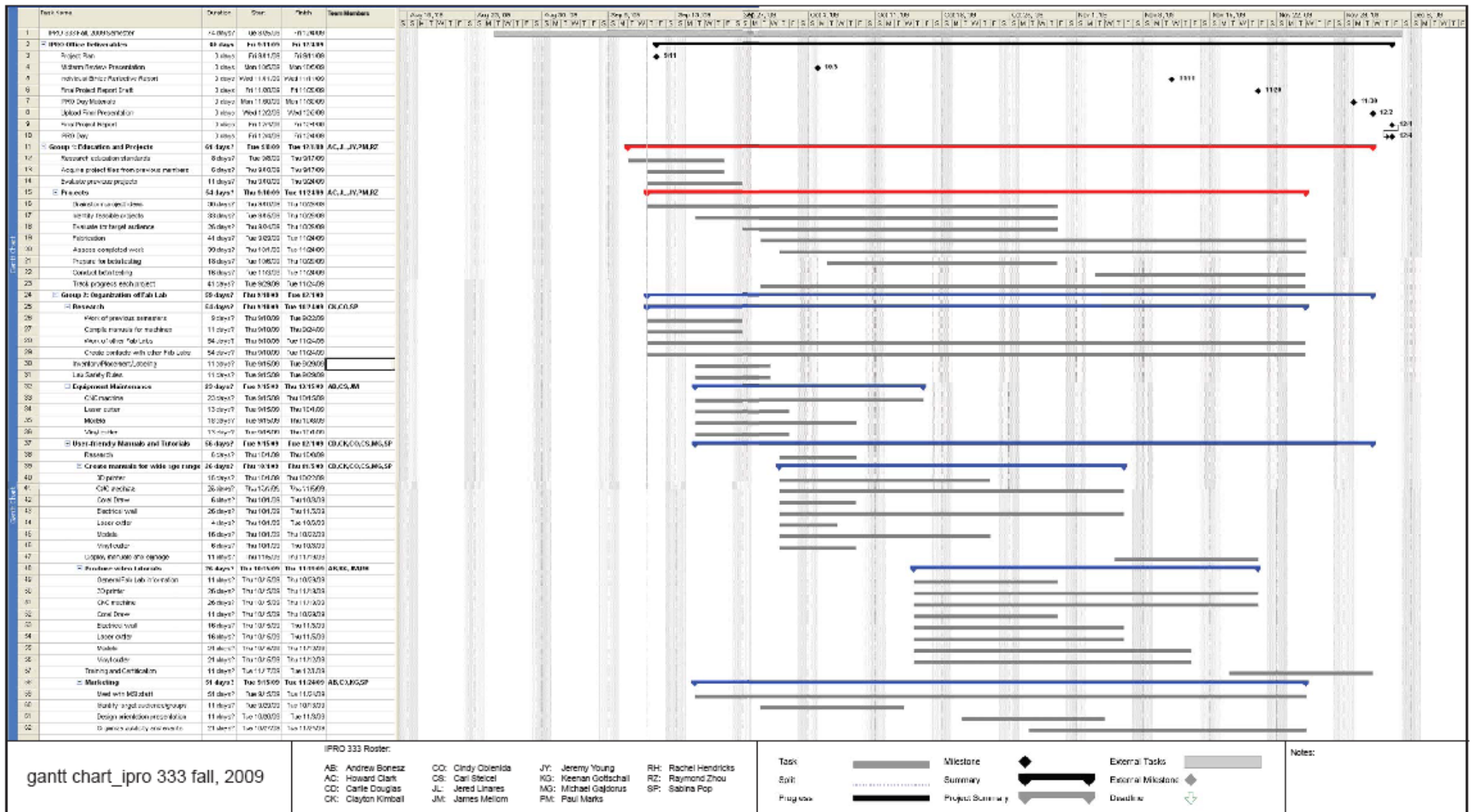
Name	Major	Skills/Interests	Experience	Expectations	Group
Andrew Bonesz	Architecture (5 <sup>th</sup> Year)	Graphics and web design, CAD, Adobe products, video editing	Fabrication, leadership, architectural intern	Develop problem solving experience	1
Howard Clark	Architecture (5 <sup>th</sup> Year)	CAD, BIM, design/build, modeling, Microsoft Excel & Word, graphics, construction & PR	Modeling, construction, presentation, IIT's laser cutter, wood-working	To assist MSI in promoting & utilizing its Fab Lab. To create a sustainable program in which it can be run in the future.	1
Carlie Douglas	Architecture (5th Year)	Proficient in AutoCAD, 3D Studio MAX, Microsoft Office Suite, Adobe Creative Suite time management, and communication	Model and full-scale construction experience. digital modeling, laser-cutter certified, leadership and teamwork experience	Learn Fab Lab capabilities, connect Fab Lab with MSI; leave Lab with better organization; improve employee knowledge of Lab	1
Michael Gajdorus	Architecture (5th Year)	Proficient in CorelDraw, Microsoft Office Suite, and Photoshop	Shop and digital fabrication experience	Get Fab Lab running safely; provide education to users	1, 2
Keenan Gottschall	Political Science (4th Year)	Proficient in AutoCAD, Microsoft Office Suite, and Quicken accounting software	Shop experience, laser-cutter certified, student organization leadership, previous IPRO experience	To take a step towards opening the doors to a self-sustaining Fab Lab	2
Rachel Hendricks	Biochemistry (4th Year)	Proficient in Microsoft Office, Sequencer, time and organizational skills. First aid and CPR	Safety training, administrative and leadership experience	To have defined lab safety rules and procedures for using in the Fab Lab	2
Clayton Kimball	Architecture (5th Year)	Proficient in AutoCAD, Adobe Creative Suite, filming and editing	Shop, laser cutter, film, graphic design	Learn new machines, work with students, practice teamwork	2
Jered Linares	Biomedical Engineering/ Computer Science (5 <sup>th</sup> Year)	Proficient in JAVA and C++ programming as well as website design	Medical device design, translational research, and leadership	Positively impact the community	1
Paul Marks	Biology (4th Year)	Solid communication skills, problem solving mindset, and adept at acquiring new skills quickly	Electrical, landscaping, and mechanical construction experience	To have the Fab Lab be a functional learning asset to MSI	1
James Mellom	Architecture (5 <sup>th</sup> Year)	CAD, Rhino, 3D max, Pro E., Microsoft Office Suite, Micro-station CAD, Adobe Creative Suite, design/build	Modeling, construction management, digital modeling, shop experience	Help to improve use and overall function of the Fab Lab, build teamwork skills	2



Cindy Oblenida	Architecture (5 <sup>th</sup> Year)	Proficient in AutoCAD drafting, Adobe Creative Suite, Microsoft Office	Experience with laser cutter, interest in graphic arts and education	To integrate the Fab Lab into an MSI exhibit and encourage creativity	2
Sabina Pop	Business Administration (5 <sup>th</sup> Year)	Develop business plans, marketing, surveys	I PRO experience, entrepreneurial project in previous classes	To learn team building and teamwork skills, communicate better, learn leadership skills	2
Carl Stelcel	Biomedical Engineering (4 <sup>th</sup> Year)	Proficient in MS Office, MatLab, C++, Java, Adobe Creative Suite, some AutoCAD	Construction experience, I PRO experience, team work skills	Work to get the Lab open to the public and make it user accessible	2
Jeremy Young	Biomedical Engineering (4 <sup>th</sup> Year)	Proficient in MATLAB, Microsoft Office Suite, Adobe Creative Suite, First Aid, CPR, and enjoys construction	Working with small children, teaching, electric car construction, leadership and teamwork through Boy Scouts and student organizations	To learn what the Fab Lab is capable of and to help make it fully functional	1
Raymond Zhou	Electrical Engineering (4 <sup>th</sup> Year)	Proficient in Microsoft Office, JAVA, MATLAB, Adobe Creative Suite, PSPICE	Shop, electrical, construction, web design experience	To have projects for K-12 students	1

- Group One: Education and Projects
- Group Two: Organization of Fabrication Laboratory

# G: Gantt Chart



gant chart\_ipro 333 fall, 2009

**IPRO 333 Roster:**  
 AB: Andrew Boriesz    CC: Cindy Oblerida    JY: Jeremy Young    RH: Rachel Hendricks  
 AC: Howard Clark    CS: Carl Steigel    KG: Keenan Gottschall    RZ: Raymond Zhou  
 CD: Carlie Douglas    JL: Jered Linares    MG: Michael Galjanus    SP: Sabina Pop  
 CK: Clayton Kimball    JM: James Mellom    PM: Paul Marks

**Task** [Solid Grey Bar]    **Milestone** [Diamond]

**Split** [Dotted Grey Bar]    **Summary** [Thick Grey Bar]

**Progress** [Thick Black Bar]    **Project Summary** [Thick Grey Bar]

**External Tasks** [Thin Grey Bar]

**External Milestone** [Diamond]

**Deadline** [Down Arrow]

**Notes:**