

IPRO 341

Abstract

Versatility Tool Works and Manufacturing (VTW) is a small metal works company based in Alsip, Illinois. Recently, the company has started producing tooling cabinets to accompany press brakes manufactured by Amada America Inc. However, the company has run into a few problems and decided to contact Illinois Institute of Technology for help. The IPRO 341 team was charged with two tasks: (1) determining the cause of premature failure of the tooling cabinet drawer and developing potential solutions and (2) gathering market intelligence data to help the company improve and expand.

In order to accomplish all of the objectives in time, the IPRO team was split up into testing and marketing sub-teams. The testing team took up the task of performing numerous tests on the jamming drawer slides and researching possible solutions. The marketing team performed market research, conducted surveys, and created a video testimonial for the company. Throughout the semester, the IPRO team as a whole met with the sponsor and kept them up to date on the progress.

The IPRO team has made a lot of progress in the time span of one semester. A significant amount of data and insight has been obtained about the root causes of the premature failure of the tooling cabinet drawers. The marketing team has conducted the first-ever marketing efforts for VTW and was able to collect data on potential improvements and additions to the tooling cabinet, which will serve to expand the customer base and increase sales.

Background

- The sponsor for this IPRO is Versatility Tool Works manufacturing company. The company specializes in producing precision tooling and sheet metal components. The company was established in 1972 as a tool and die operation, but has since expanded to have the most diverse product line in the industry. The company has recently decided to begin manufacturing custom tooling storage cabinets.
- The current tool chest drawer design does not produce desired performance and longevity. The drawers tend to bend when loaded with heavy weights and have trouble closing.
- The solution to the problem will involve a significant amount of mechanical engineering and material science.
- The company already has a working product. Other companies may have cabinets with better drawer performance.
- Some drawer rail designs may already be patented, so care should be taken to avoid using those designs.
- The potential costs to VTW may include material and prototype manufacturing costs.
- The current implementation plan includes research into drawer design followed by prototype development.

-There are a few companies selling similar tooling cabinets. These include but are not limited to: Boscotek, Lista, Lyon, Cisco-Eagle, Meyer Material Handling.

Objectives

A Tool's objective is to first and foremost satisfy the problem set forth by our sponsor Versatility Tools. The problem is that their tool cabinet does not accomplish the day-to-day needs of the companies that purchase it. Our task is to try for a cost effective way of improving the cabinet.

Team Objectives:

- Clearly identify the current issues with the drawer design
- Schedule a meeting time with Versatility Tool.
- Obtain a current model of the cabinet from Versatility Tool for testing and analysis
- Gather information about max loads and placement of those loads for load analysis
- Find reliable heavy-duty designs for tool drawers
- Combine desired features
- Import drawings into CAD for product manipulation
- Import designs to a Finite Element Analysis Program to analyze moments and stress, fatigue and deformation of materials
- Create possible solutions with AutoCAD or ProEngineering and then test those designs in a Finite Element Analysis Program
- Take the top performing designs and create prototypes in the IIT machining lab for actual testing and see how results compare with original product
- Revision of any prototypes that fail drastically
- Test different types of materials within the budget scope for weight savings and stiffness
- Offer suggestion on which designs should be taken biased on cost, size, and strength
- Find potential buyers and competitors for VTW
- Make marketing recommendations based on findings

Primary Objectives:

- We wish to determine how the current tool box model is used.
 - oWhat aspects wear out first and what lasts the longest?
 - oWhat complaints are there with the current model?
 - This includes both customer and manufacturer.
 - oDecide what issues are needs as opposed to wants.
- Upon receiving a working model we would like to:
 - oAnalyze the design
 - This allows us to determine problems and assess possible solutions.
- Upon receiving schematics or CAD drawings we would like to:
 - oDetermine the present state

Methodology

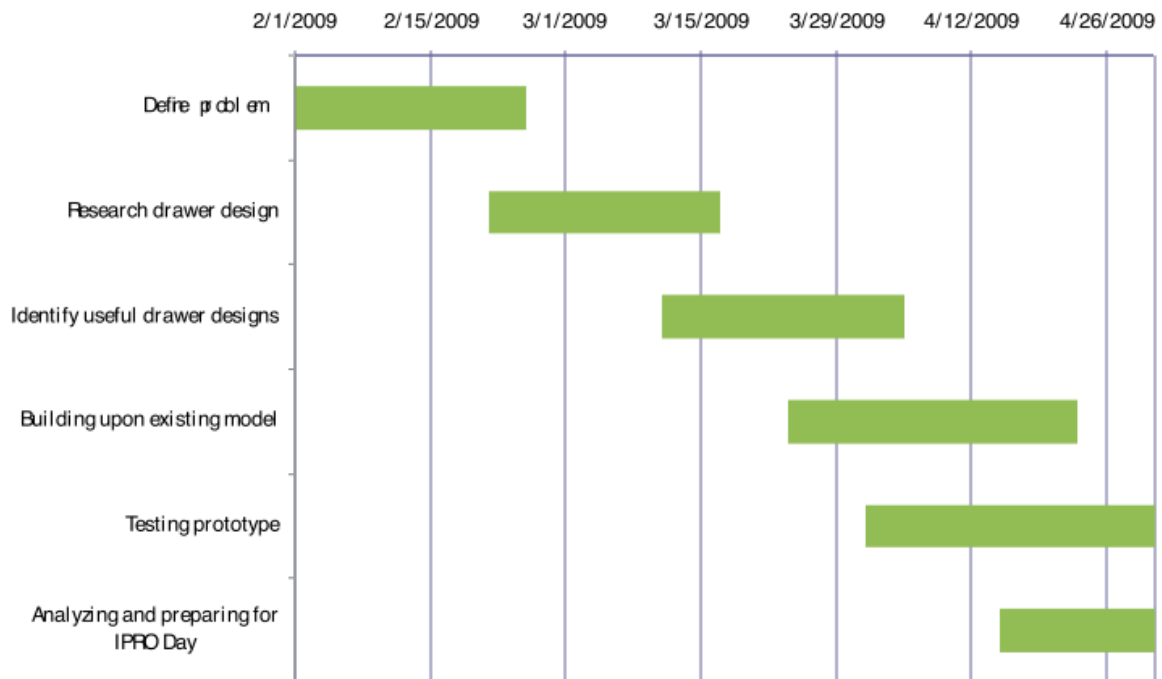
The problem as defined by Versatility Tool is that the 220 lb cabinet design has a greater endurance than the 440 lb design. We are here to come up with a solution to change this both cost effectively and efficiently.

We will accomplish this by doing various amounts of market analysis and research. In addition we are researching current drawer design and manufacturing processes as well as receiving feedback from Versatility Tool about current methods for making their cabinet; this knowledge will help us understand the performance difference between the two weight class models. By developing various models and mockups through CAD we hope to be able to come up with a model to present to the sponsor.

The various solutions will be tested with engineering analysis and laboratory testing through Versatility Tool.

Results will be documented through various files and folders on the teams laptops.

The deliverable reports will be generated electronically.



Team Structure and Assignments

Team Leader/Coordinator: Nehal Gosalia

Sub Teams:

I. Marketing Team

1. Kathan Amin
2. Rachel Fleming
3. Raj Gala
4. Nehal Gosalia
5. Justin Roediger
6. Aurimas Vinckevicius

II. Testing Team

1. Christopher Ashworth
2. Luke Grabowski
3. Taewoo Kim
4. Sangkyoung Lee
5. Kwong Tan

Budget

Category	Detail	Date	Amount
Services	Printing (surveys, questionnaires, etc.)	02/23/2009	\$100
	Phone calls		
	Subscription (marketing sites)		
Equipment	Slides, bearings, etc. for testing	02/27/2009	\$300
Travel	Cost of public transportation	02/27/2009	\$200
	Cost of personal car use to visit sponsors throughout the semester (weekly visits)		
	Meals for the team		

Code of Ethics

By performing market research we will avoid infringing on already existing IP's and technology on the market. Our team will work together by exercising great communication and cooperation. Contribution and Enthusiasm from every member of the team is essential to success. In addition every member is expected to shoulder a similar load of the overall project allowing for more efficiency. Our group has decided to be open as far as complaints are concerned. If there is a problem it is your responsibility to either bring it up yourself or inform somebody else who may bring it up to the team as a whole.

If a problem does arise, it will be dealt with first through the group coordinator. If the problem is bigger than the students are able to solve we will bring the issue to the Professor. From here further measures can be taken if necessary.

Results

Testing Team Findings

Yield strength of the original slides was too low (HRB 55). Slides deformed and caused drawer failure after only 5,000 cycles of opening and closing drawer.

Slide deformation allows drawer to bend in, which led to scraping against bottom of the cabinet.

Accuride® slides were tested to be significantly harder than original (HRB 72). Drawer showed no signs of failure even after 7,000 cycles.

As a cost effective solution, stiffeners were added to inside of drawer to prevent bending. Drawer started jamming after 8,000 cycles.

Original slides were hardened using shot-peening (HRB 67). Drawers showed no signs of failure after 10,000 cycles.

Marketing Team Findings

Using SurveyMonkey.com, the team created an electronic customer satisfaction survey that addressed the major areas VTW was using to promote their tooling cabinet.

A list of 104 VTW customers was obtained and each was contacted by phone to obtain email addresses for survey delivery.

Surveys emailed to 62 customers who provided their email addresses. 5 customers responded so far.

A testimonial by Amada America Inc. tooling supervisor was video recorded and edited into a short video clip to be displayed on VTW website.

Obstacles

The entire IPRO team had to put in a lot of effort to satisfy the requirements of this IPRO. The testing team had to spend extra time learning how to use AutoCAD, ProEngineer, and other software. The marketing team, composed entirely of non business majors, had much to learn about marketing research tools and techniques. A great amount of time was also spent on weekly meetings with VTW in order to determine their expectations and keep them updated on the progress.

Recommendations

The future IPRO teams will need to continue testing of the drawers and determine the best, most cost-effective solution. The team may help VTW design new tooling cabinets that meet the specific requirements for its customers. On the marketing side, the next IPRO team should be able to collect even more data from the surveys and conduct further market analysis to determine the best methods to reach more customers and increase VTW's market share.

Acknowledgements

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- Dr. David Mogul (IIT BME Department)