

Illinois Institute of Technology
Inter-professional Project
IPRO 341

Design and Global Market Analysis of a Tool Cabinet

Sponsored by: Versatility Tool Works

Spring 2010 Semester
Final Report (rough draft)



1.0 Abstract:

The goal of this project was to build upon last semester's progress in assisting Versatility Tool Works with the design and testing of an industrial strength tool cabinet. Currently, no tool cabinet exists on the market that can hold very large amounts of weight and have a long lifespan, while at the same time providing the user with features to make their job easier. Tools frequently get misplaced on the job, and a way to keep track of them would be very desirable in the workplace.

This semester, two different cabinet prototypes were tested, and a lighting system and barcode-based tool tracking system were investigated. Features of competitors' tool cabinets were also researched for comparison purposes.

2.0 Background and Objective:

I PRO 341 is sponsored by Versatility Tool Works, based out of Alsip, Illinois. Established in 1972 as a tool and die operation, Versatility Tool Works has since diversified their product line to include sheet metal fabrications, roll formed products, stamping tools, precision machined components, and most recently, custom made tool cabinets.

Previous teams of this project analyzed the tool cabinet and developed improvements to its performance. Shot-peened slides and Accuride slides were incorporated, as well as testing materials that were harder. (The "hardness" of a material was determined with hardness testing.)

The team from the past semester made recommendations to continue the development of a tool tracking system, and a lighting design, as well as improving the crossbars in the drawer, replace the rubber blocks of the locking mechanism with roller bearings, and to include angle brackets in the design of the cabinet. Last semester's team showed a gain of nearly 3000 cycles of cabinet lifespan.

VTW has been pleased with the results of the previous three semesters of this I PRO, and is expecting that working with IIT students again will further improve the design of the tool cabinet.

The objective of I PRO 341 this semester was to continue to assist Versatility Tool Works with the design, testing, and marketing of an industrial strength tool cabinet. Ideally, one or more of the drawers in the cabinet should be capable of holding 450 pounds of equipment, and have a lifespan of 20,000 cycles. (One (1) cycle is defined as one opening and closing of the drawer.) Emphasis was placed on the testing of tool cabinet prototypes, the development of testing standards, and the research of a tool tracking system.

3.0 Organization and Approach:

In order to gain a better understanding of the project's goals, and to meet and talk with our sponsor, a meeting was set up to visit our sponsor at their location in Alsip, Illinois on January 27th, 2010. All members of the I PRO and Prof. Maurer were in attendance. After meeting with VTW, a coordinator was selected, and the design team and testing team subgroups were formed, each with a team leader.¹

The task of the design team was to research and develop features for the tool cabinet. Emphasis was placed on a lighting system, and tool tracking system, and improved slides for the cabinet. (A few members of the testing team also helped with the search for improved slides.) The idea for a lighting system that had been developed by the previous semester was

¹ See Appendix I: Team Structure for details on the I PRO team subgroups.

investigated, but pursuit of this was cancelled due to sponsor disinterest. Corrugations for improved drawer structure were developed and fabricated by March 5th, 2010. A complete tool tracking system was completed by Wednesday, April 14th.

Members of the testing team were tasked with developing a testing protocol, and testing two different cabinet prototypes. A total of four tests were conducted, two on each prototype (each prototype was fitted with two drawers each, one intended for 220 pound testing, and the other intended for 440 pound testing).² Different slides were suggested by the design team, but this concept was cancelled due to its associated cost.

4.0 Findings and Analysis:

The design team researched both RFID chips and barcodes for purposes of tool tracking. After some time, it was concluded that a barcode system would be employed. The RFID system would need to be debugged, and was too expensive. A barcode scanner was purchased by the team (\$119, made by ID Automation) and software was developed that worked with Microsoft Access to keep a database.

After testing was completed on the first cabinet prototype, it was evident that only having a locking mechanism on one side of the cabinet contributed greatly to the failing of the slides. Failures occurred at 660 cycles for the 220 pound drawer, and at 1186 cycles for the 440 pound drawer. When the IPRO team looked into acquiring better slides, it was determined this could prove to be too expensive. One set of slides that were investigated were priced at approx. \$800 per slide.

Testing on the second cabinet prototype was much more promising. This was the custom in-house design fabricated by VTW. The design relied on an undercarriage with ball bearing wheels mounted to the side rails. Failure did not occur for the 220 pound drawer, but after 20,000 cycles it was discovered that one of the ball bearing wheels suffered significant deformation. After informing VTW, VTW spoke with the ball bearing company (Kilian Bearings), they decided to run their own tests on the bearings, since they believe that they should not have failed for the 220 pound drawer. Failure occurred for the 440 pound drawer after 2445 cycles. Ball bearing wheels were damaged during this test as well. However, in both tests, no significant deformation was sustained by the side rails.

5.0 Conclusions and Recommendations:

Overall, this IPRO succeeded in helping Versatility Tool Works establish a baseline and progress towards the goals of 20,000 cycles at 440 pounds and increasing the cabinet's product desirability through features.

The design team concluded that the barcode system would be the most financially practical and effective solution to the issue to tool tracking. Recommend that this topic be pursued further (investigate laser etched barcodes, and the appropriate scanners), and the software be improved next semester, with focus on making it user-friendly for someone that is not familiar with the system.

The testing team concluded that only having the locking mechanism on one side contributes significantly to drawer failure, and that testing anything of this design in the future would be futile. The second prototype with the undercarriage design and locking mechanisms on

² Please refer to Appendix II: Gantt Chart for the dates associated with testing.

both sides was much more promising, and has more potential to be further improved. Recommend that the second prototype be improved upon to get closer to the goal of 20,000 cycles at 440 pounds. Investigate stronger sealed bearing or solid wheels to replace the failed wheels.

Both teams concurred that rack slides, for this application, would be impractical and ineffective. Standard heavy duty rack slides simply cannot take the load that they must bear for this application. The cost of functional rack slides would be very high, and out of the price range of consideration. Recommend to abandon the rack slide concept, unless inexpensive slides with capacity of 550 lbs per slide can be located.

6.0 Acknowledgements and References:

We would like to thank Dr. Mostovoy and Prof. Maurer for their support and assistance this semester with respect to moving the IPRO forward. We would also like to thank Versatility Tool Works for the opportunity to work with them this semester.

Appendix I: Team Structure

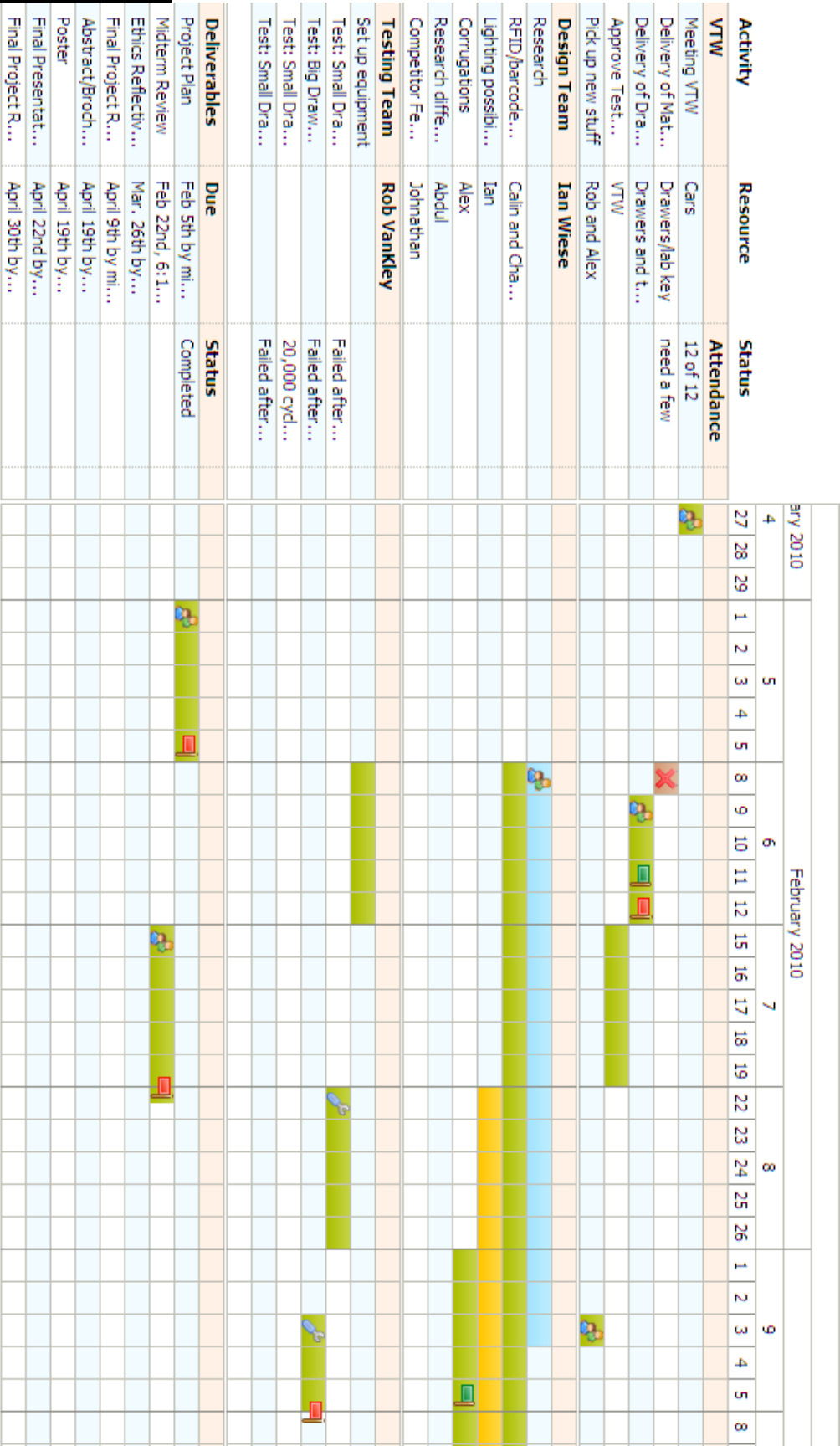
Team Structure:

Coordinator/Leader: Tom Kozmel
Design Team Leader: Ian Wiese
Testing Team Leader: Robert VanKley
Ambassador to VTW: Alex Jones

Design Team: Ian Wiese
Calin Gavris
Alex Jones
Hon-kyu (Charles) Chong
Johnathan Eckhardt
Abdul Aleem Syed

Testing Team: Robert VanKley
Tom Kozmel
Eric Hamann
Stephen (Steve) Falk
Taehoon Kim
Kaisar Syzdykov

Appendix II: Gantt Chart



Project: Design and Global Market Analysis of a Tool Cabinet
Sponsor: Versatility Tool Works
Duration: Spring 2010 Semester

Legend:

- IPRO Team Task
- Sponsor Task
- Pending/In Progress
- Completed
- Urgent
- Task Complete
- Expected Cor
- Group Effort
- Test

2010

March 2010

April 2010

10	11	12	13	14	15	16	17
9	10	11	12	13	14	15	16
10	11	12	13	14	15	16	17
11	12	13	14	15	16	17	18
12	13	14	15	16	17	18	19
13	14	15	16	17	18	19	20
14	15	16	17	18	19	20	21
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17	18	19	20	21	22	23	24
18	19	20	21	22	23	24	25
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23	24	25	26	27	28	29	30
24	25	26	27	28	29	30	31
25	26	27	28	29	30	31	1
26	27	28	29	30	31	1	2
27	28	29	30	31	1	2	3
28	29	30	31	1	2	3	4
29	30	31	1	2	3	4	5
30	31	1	2	3	4	5	6
31	1	2	3	4	5	6	7
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2	3	4	5	6	7	8	9
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30	31	1	2	3	4	5	6
31	1	2	3	4	5	6	7

ended Here
completion

Cancelled