

IPRO 341

Design and Global Market Analysis of a Tool Product



Sponsored By: Versatility Tool Works

SPONSOR

Who is VTW?

- Located in Alsip, IL
- Est. 1972
- Manufacturer of Sheet Metal Products
- Industrial Tool cabinet



OBJECTIVES

TESTING TEAM:

- Improve and enhance the performance of tool cabinet to increase durability

DESIGN TEAM:

- Develop a custom tool cabinet design to accommodate for the changing market



CONTINUATION OF IPRO 341

SPRING 2009

- Accuride® Rack Slides
- Increased drawer stiffness
- Shot peening



Accuride® Rack Slides

SUMMER 2009

- Roller bearing design
- Recommended thicker guides using harder material.



Current drawer sliding frame

TEAM ORGANIZATION

Faculty Advisors
William Maurer
Sheldon Mostovoy

VTW
SPONSOR

Coordinator / Secretary
Hyejin Park (MS)

TESTING TEAM

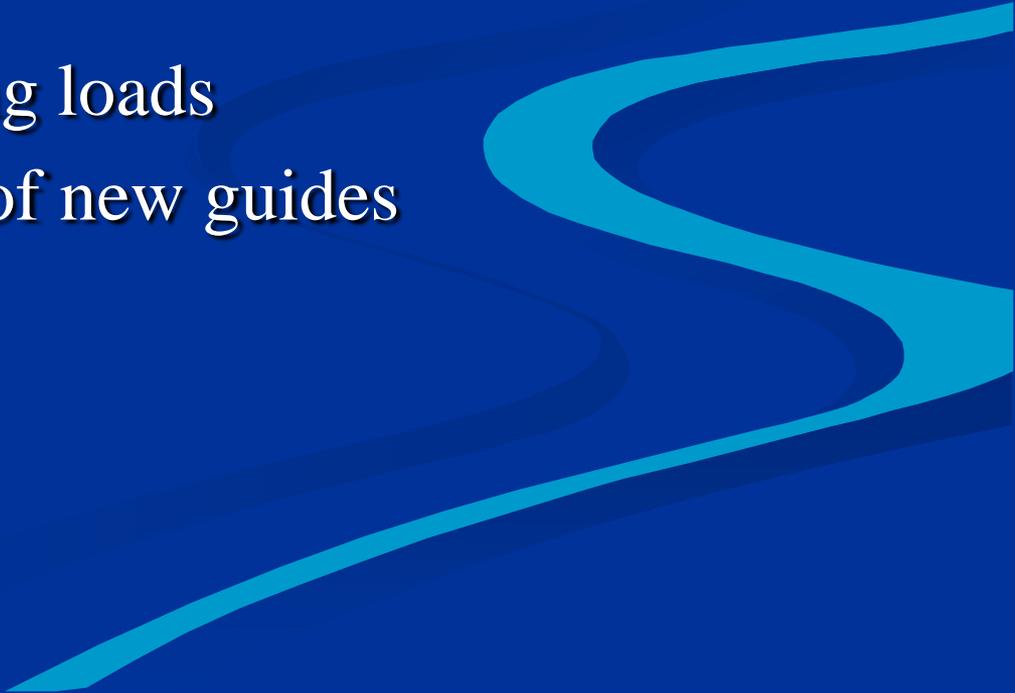
Saad Sarvana (leader) (ME, AE)
Jae Lee (Applied Mathematics)
Jeffrey Bart (MS, ME)
Mark Ende (AE, ME)
Shahmeer Khaliqdina (EE)
Raihan Rahman (EE)

Design Team

Sara Cantonwine (leader)
(ME,MS)
Erica Pauley (ME)
Arence Gowe (ME)
Thomas Hotz (ME)
Andrew Kitaka (ITM)

TESTING TEAM

SCOPE OF WORK

- Thicker material (Cor –Ten Steel)
 - Increase in Hardness
 - Accommodate varying loads
 - Continue evaluation of new guides
- 
- A decorative graphic consisting of several overlapping, wavy, horizontal bands of varying shades of blue, extending from the right side of the slide towards the center.

PROCESS

OBSTACLES:

- Testing space
- VTW's machine breakdown

APPROACH:

- Changing one or two variables per test
- Analyzing failed test results to implement further changes

TESTING



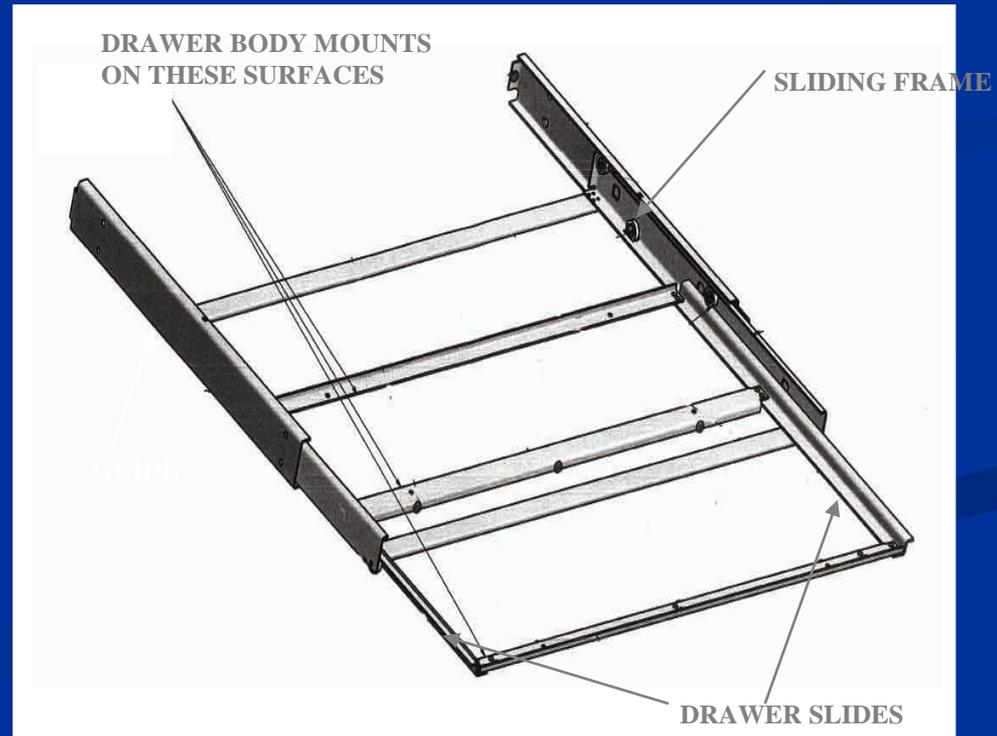
One cycle represents opening and closing of drawer

KEY COMPONENTS



Locking Mechanism patented by VTW

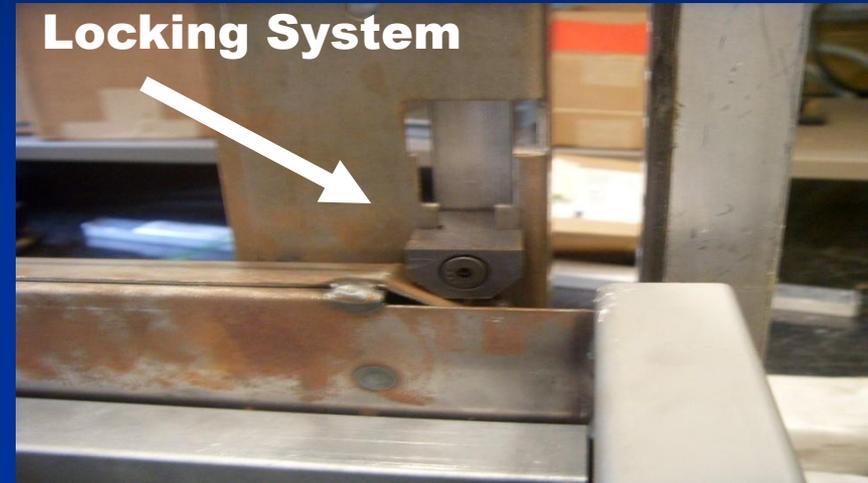
Restricted to one drawer opening at a time



TEST 1

TEST PARAMETERS:

- Thicker Guides (Cor-10 Steel)
- Load of 550 lbs
- Locking mechanism engaged



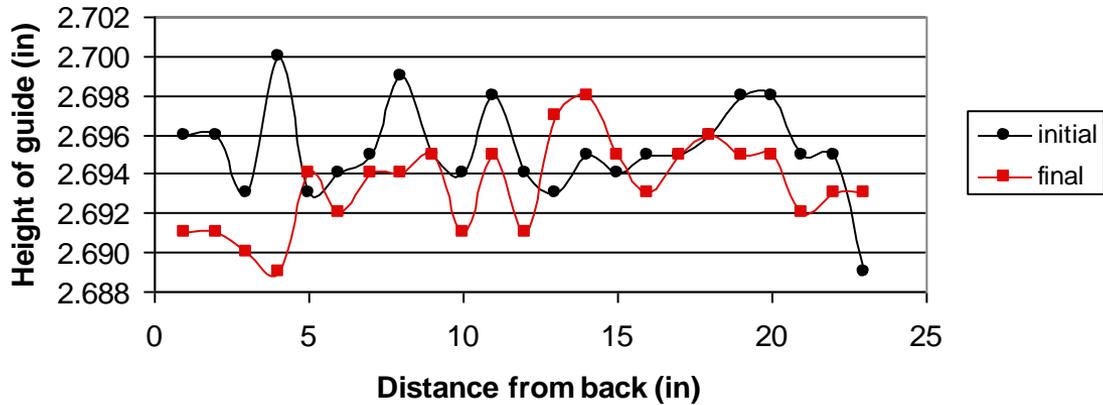
MODE OF FAILURE:

- Failed after 632 cycles
- Pivoting of drawer due to locking mechanism.

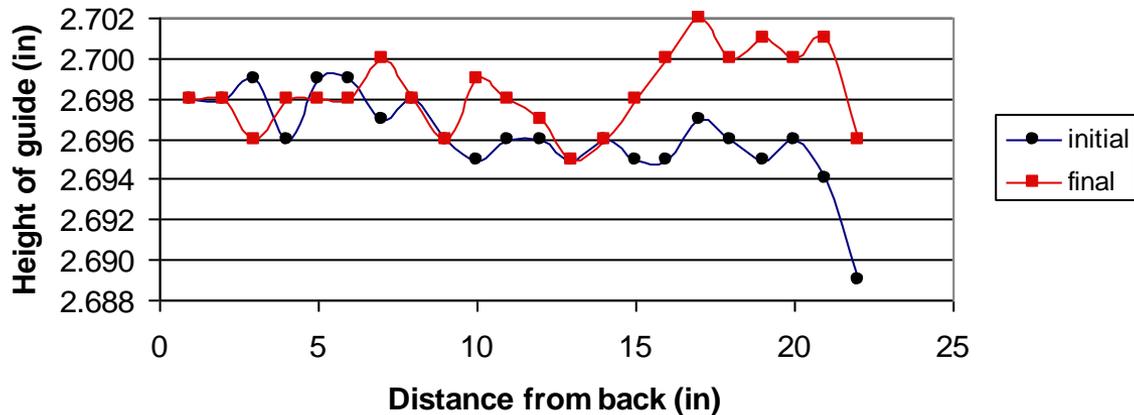


TEST 1

Left Guide Deformation 632 Cycles



Right Guide Deformation 632 Cycles



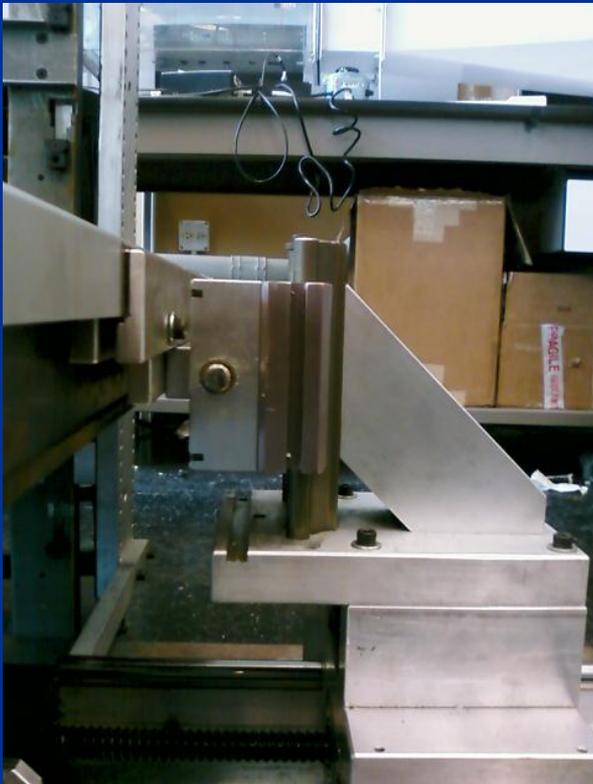
TEST 2

TEST PARAMETERS:

- Removal of locking mechanism

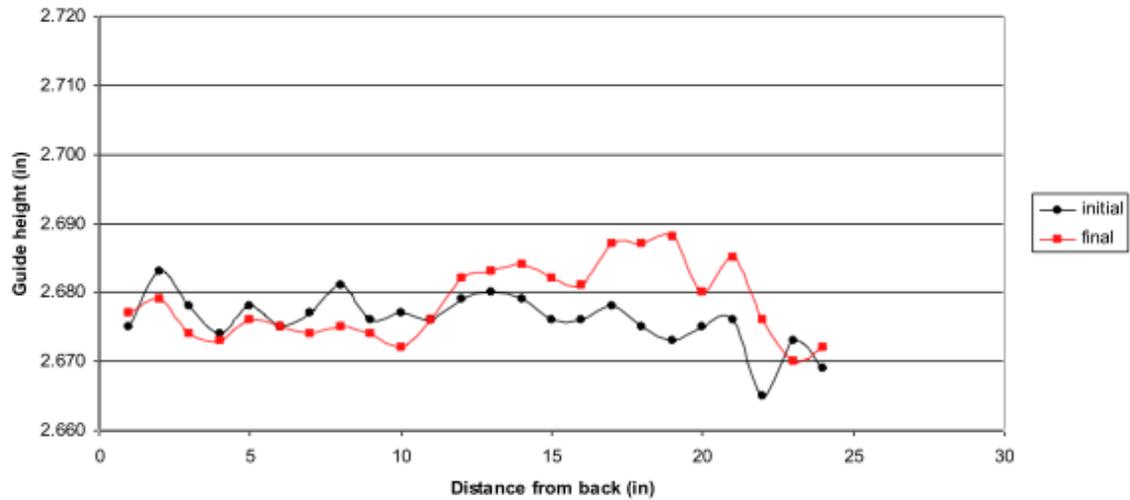
MODE OF FAILURE:

- Tests stopped after 3450 cycles
- Improper testing rig setup
- Testing rig was supporting ~ 120 lbs

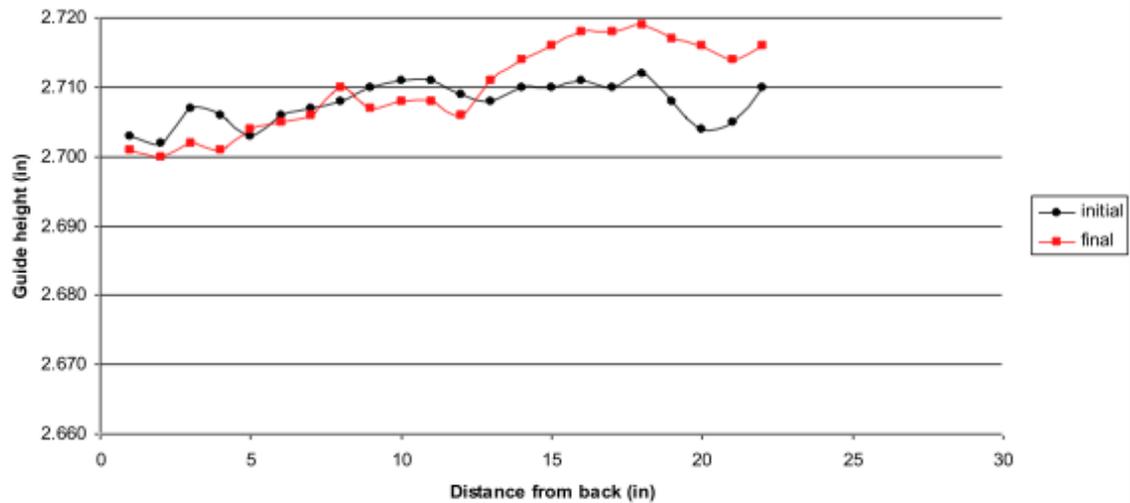


TEST 2

Left Guide Deformation 3450 Cycles



Right Guide Deformation 3450 Cycles



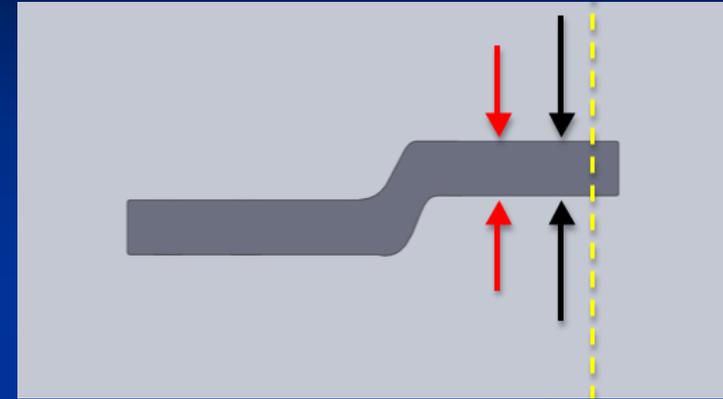
TEST 3

TEST PARAMETERS:

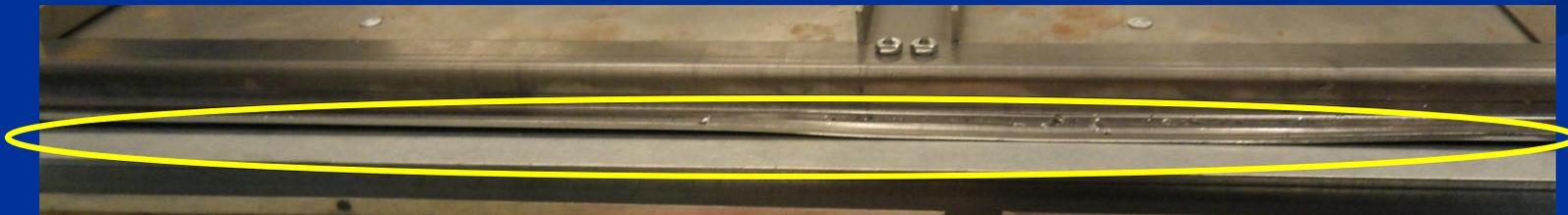
- Testing rig readjusted
- Reduction of load to 450 lbs
- Locking mechanism engaged
- Installation of angle brackets under guides
- Reduction of moment on drawer slides

MODE OF FAILURE:

- Failed after 3486 cycles
- Left side roller required replacement after 500 cycles
- Major deformation of left drawer slide 0.078 in.
- Deformation region same as in trial 1

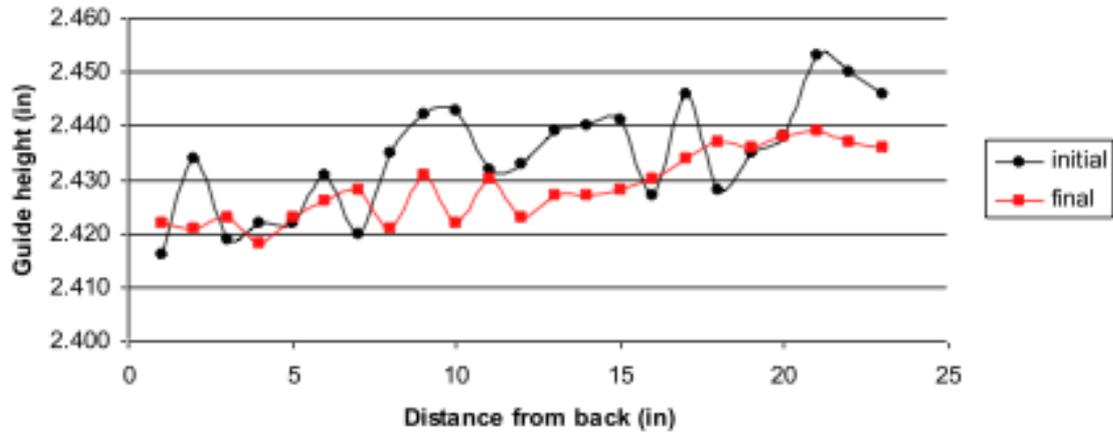


Current roller bearing contacts at black arrow
By removing material shown by yellow dotted line, the point of contact is moved to red arrow.

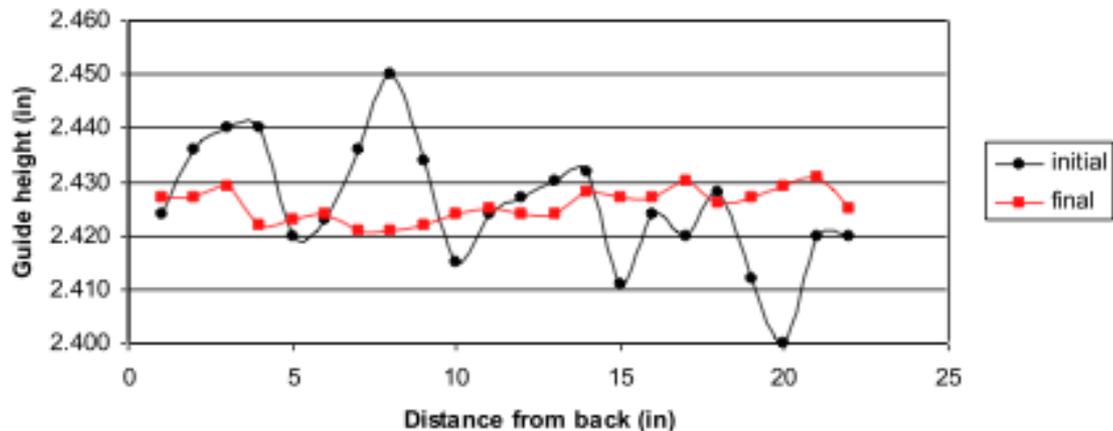


TEST 3

Left Guide Deformation 3000 Cycles



Right Guide Deformation 3000 Cycles



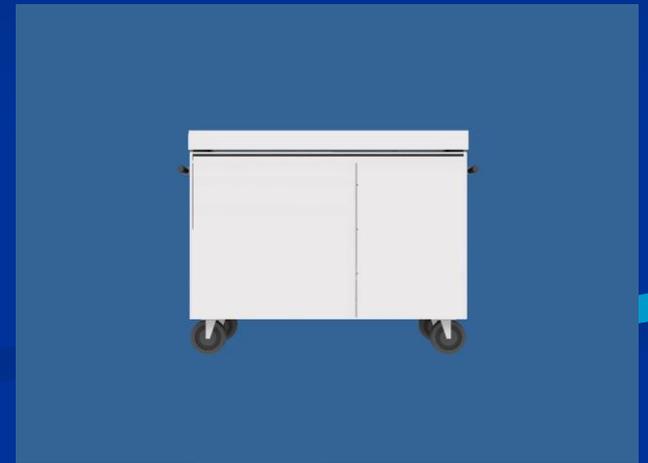
RECOMMENDATIONS

- Modify locking mechanism to use roller bearings instead of rubber blocks
- Angle brackets must be included in future design
- Incorporate lower reduced bending moment on drawer slide
- A major improvement is strengthening of crossbars on sliding frame cost effectively.

DESIGN TEAM

NEW FEATURES:

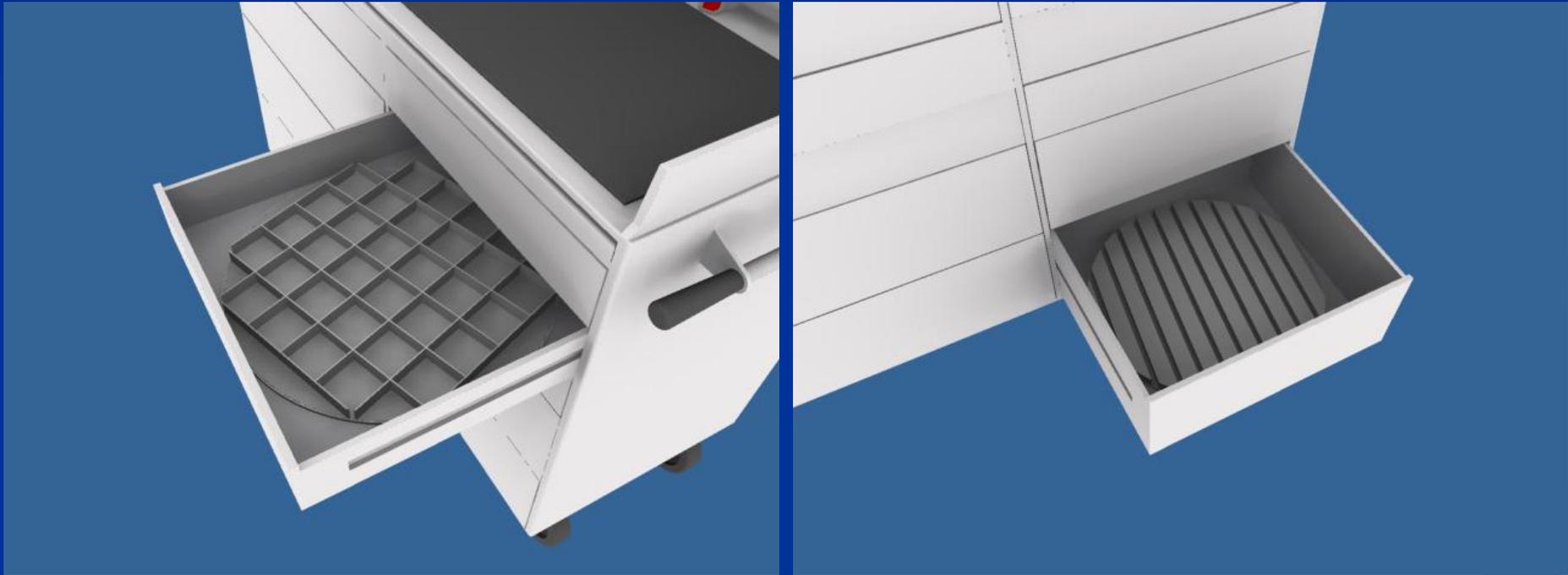
- Rotating/detachable cabinet
- Lighting system
- Detachable toolbox
- Scratch resistant coating
- Push-to-open drawers
- Integrated computer and tracking system
- Pull-out work bench



ROTATING CABINET

- Innovative design not seen in tool cabinets
- Turn table
- Easy access to tools
- Not extended to full length of guides
 - = less stress on guides
- Space saver

ROTATING CABINET DESIGN



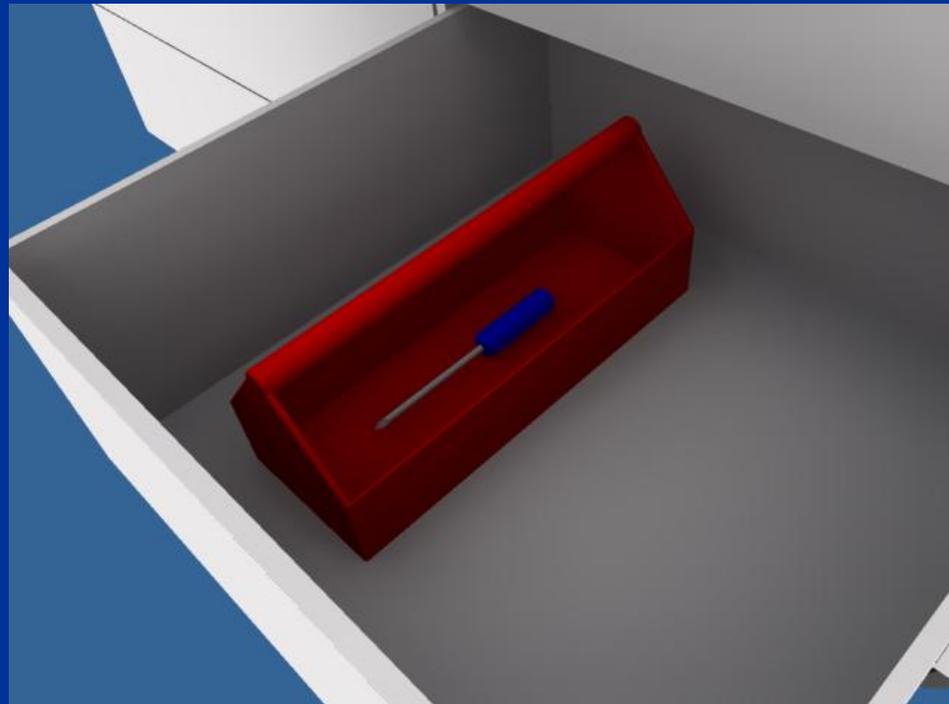
LIGHTING SYSTEM

- Long lasting LED
- Poor lighting in working environment
- Rotates to light draw position
- Magnetic Reed switches activate light when draw opens
- Hard housing for LEDs



DETACHABLE TOOL BOX

- Portability
- Fits into the existing cabinet



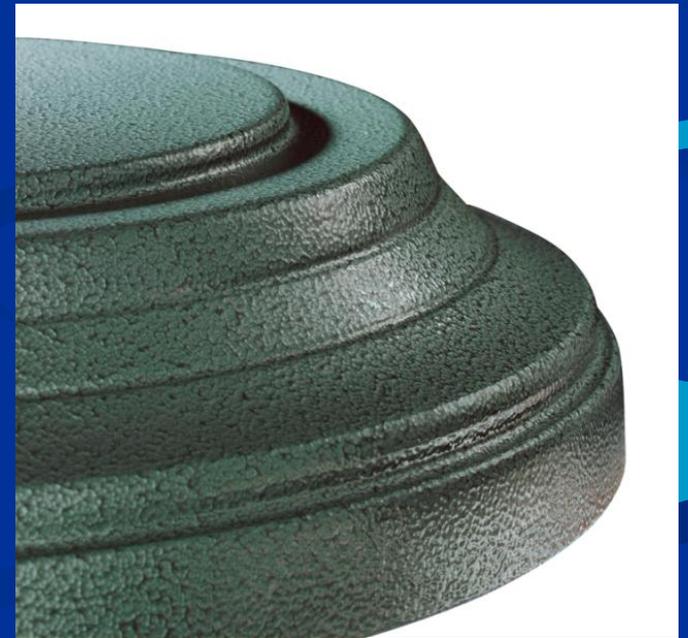
EXTRAS

Push-to-open Drawers

- stay ahead of the competition
- helps with overcoming static friction

Scratch resistant coating

- extend cabinet lifetime
- Texture powder coats



BARCODE TRACKING SYSTEM

- Records tool activity and history
- Must be scanned
- Handheld scanners or stationary
- Aluminum barcodes
 - scratch resistant
 - thin
 - inexpensive

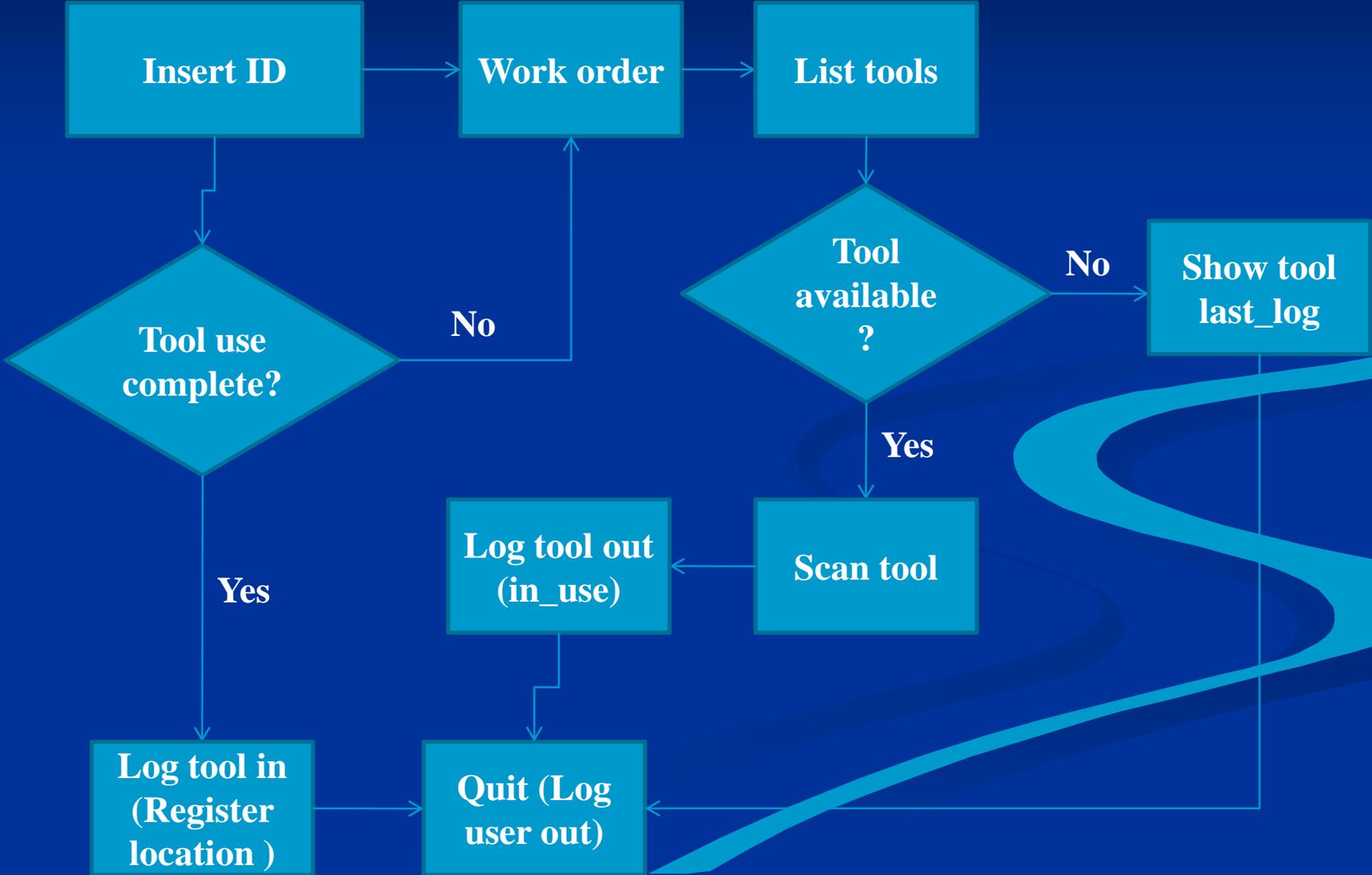


EXAMPLE BARCODE

- 000000- would be the tool tracking number



TRACKING SYSTEM PROCESS



TRACKING SYSTEM

- Aluminum Bar Coding



DESIGN PROGRESS

GOALS:

- Design features that add value
- Tracking system to manage tools

OBSTACLES:

- Features' feasibility
 - Spatial restrictions
 - Tracking system compatibility
 - Cost
- 
- A decorative graphic consisting of several overlapping, wavy, horizontal bands of varying shades of blue, extending from the right side of the slide towards the center.

DESIGN PROCESS_(cont.)

Achievements:

- Overall design
- Thin LED system
- Longevity of outer surface
- Additional attributes
- Functional tracking system



RECOMMENDATIONS

- Continue development of usable tracking system
- Continue ideas and search for new innovations that will push this tool cabinet to the next level
- Prototype the tool cabinet precisely to utilize the stress analysis program

ETHICAL ISSUES

- Non-Disclosure Agreement
- VTW reputation



ACKNOWLEDGEMENT

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