



Natco Transfer Line Restoration

Purdue Students: Sam Beaty , Sam Snyder , Alan Anderson, Daniel Gu, Mike La Bella, Trevor Duncan, and Stone Campbell
Purdue Mentors / Customers: Dave Merrick & David McMillan



Customer Background

The NATCO (National Automatic Tool Company) built large 'transfer line' automated manufacturing machinery. Many of the machines are still in operation today but the company has closed. This was a trade show demonstration unit that showed the functions of the system with automata movements. It is driven on the underside with a central power 'line shaft' very much like the factory lines of the generation before it.

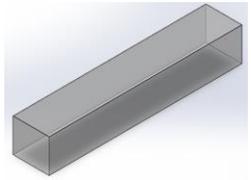
Problem Statement / Scope of Work

The NATCO factory transferline model will have many different tasks to get the model restored and able to be displayed. In no order, the work includes cleaning the model, creating proper documentation of the model, creating displays, raising the model off the ground, making the model visually appealing, fixing the electronics, fixing the broken mechanical issues, creating a testing bench, and getting the model completely restored.

Requirements Matrix

Req ID	Req. Matrix	DESIGN REQUIREMENTS	DESIGN TARGETS	VALIDATION	COMMENTS
		FUNCTIONAL	FUNCTIONAL	FUNCTIONAL	FUNCTIONAL
1	1	Restoration of the model's electrical system to functional state.	Test the three electrical sections of the model which are currently not in working condition.	Identify each circuit and associated components and fix each as needed.	Each circuit will need to be tested independently of each other and isolated from any other components that may be damaged.
2	2	Incorporate push buttons into model transfer line.	Install a push button onto the transfer line.	Test the circuit paths of the conclusion and capacity to print the button code.	It will drive rollers and rollers to interact with the model without being to constantly run it. The model will run for as long as the button is held.
3	3	Replace the model's light bulbs with LEDs.	The lights on the underside of the model do not currently work and are difficult to fix.	The lights will be swapped, both on the circuit, tested and connected through the push button.	LEDs have a wide range of testing for years without replacement. This adds to the longevity of the restoration.
4	4	Replace the model's secondary drive belt that transfers power from the motor to the front side drive shaft. Replace the belt that transfers the belt.	Install a new secondary drive belt and ensure it is properly tensioned. Replace the belt that transfers the belt.	Will use the cover open belt by removing the electronic and conclusion to make sure the belt is properly tensioned. The belt will be replaced with rubber to increase reliability.	New rubber belts will be made more reliable than the original belts and reduce the maintenance required on the model.

Experimentation / Concepts Exploration



Final Design



Failure Mode and Effect Analysis

Failure Mode	Effect	Cause	Severity	Detection	Prevention	Control
Oil Resistance	Prevents oil from reaching the motor.	Oil resistance in the motor.	High	Visual inspection.	Regular oil changes.	Use of oil-resistant materials.
Turning of Shaft and Attachment to Motor	Shaft does not turn, causing the model to stop.	Shaft is not properly attached to the motor.	Medium	Visual inspection.	Proper alignment and secure fastening.	Use of high-quality fasteners.

Testing

Test ID	Req. Matrix	Test Name	Specifications & Test Method	Test Description	Test Stage	Test Requirement	Test Responsibility
1	1	Electrical Restoration	Functionality	The circuits will be tested independently to identify working and damaged components to repair to full functionality.	DV	No shorts, lights power up	Sam Beaty
2	2	Push Button	Activation	A push button will be tested to activate the model for one cycle.	DV	Model activates for one cycle	Sam Beaty
3	3	Underside Illumination	Illumination	LED lights will be tested to provide adequate lighting for the underside of the model.	PV	Entire underside of the model is adequately illuminated.	Sam Beaty
4	4	Informational Display	Readability	An informational display will be tested for grammar, readability, historical depth, and brevity.	DV	Display is easily readable with depth and brevity.	Sam Beaty
5	5	Model Light Replacement	Activation	All lights on the model will be tested for activation.	DV	All lights on the model power up when supplied voltage.	Sam Beaty
6	6	Drive Belt Replacement	Functionality	The drive belt will be tested for durability and length to properly drive the model.	DV	Model moves properly when the belt is moved.	Alan Anderson
7	7	Panel Installation	Visibility	Side panels will be tested for low opaqueness and visibility to the underside of the model.	CV	Model underside is visible through side panels.	Alan Anderson
8	8	Stand Installation	Height and Visibility	Stand will be installed to elevate the model and provide improved visibility to model underside.	CV	Model is elevated 12-18 inches and is more observable.	Alan Anderson
9	9	Reconnection	Functionality	Each mechanical station will be tested when the motor activates, seeing if they move smoothly during the transfer line run time.	PV	The stations are able to move fluidly with no issues.	Sam Snyder