

## Customer Background

The model was initially built as a trade show demonstration unit showing how the NATCO line for machining cylinder heads operates. At the time, this piece of machinery was used in industry 2.0 and 3.0. It was created as one of the earliest automation forms that produced many products. The model is now located at the Bechtel innovation design center in inoperable condition. Our team's goal is to restore this model so that it can be used for teaching and learning about the evolution of the manufacturing process.

#### **Problem Statement**

Restore the NACTO (National Automatic Tool Company) transfer line model to full function. This was a trade show demonstration unit that showed the functions of the system with automated movements. Once restored, this can then be used for teaching and learning about the evolution of manufacturing processes. The problem with the device currently is that it does not work completely or reliably. The stand needs to be completely redesigned to match the rest of the device.

### Requirements

ceq.	DESIGN REQUIREMENTS	DESIGN TARGETS	VALIDATION							
#	RATIONALE									
1	The stand must be at a reasonable height	3ft-4ft	Measure							
•	Do no	t have to bend down to far								
2	The stand must be able to split apart in	latches	Inspection							
	Transferable to different locations easily									
3	The stand must be portable	caster wheels	Inspection							
3	Transferal	ole to different locations easily								
4	The stand must be painted to match piant	Ford Grey	Inspection							
•	Presentable	for presentations and viewers								
5	The casing must be touched up with paint	Ford Grey	Inspection							
5	Presentable for presentations and viewers									
	The casing must have a clear shield	Plexiglass covering	Inspection							
6	around the machine line		mspection							
- 2		nachine line from outside material								
7	The casing side panels must be clear	Plexiglass covering	Inspection							
	The inner workings should be visible to the viewers									
8	120 Volts must run the system	Operates everything	Test							
	An outlet can run everything									
9	Lights must light the inner workings	Bright LED Bulbs	Test							
•	Provide adequate lighting to see the inner workings of the machine									
10	Lights must light the clear shield	Bright LED Bulbs	Test							
~	Provide adequate lighting to see the machine well									
	Light board working showing each station	wire up the light board and make the	_							
11	light up with designated limit switch	LEDs are all the same length	Test							
	Restore the light board to the best condition possible									
		Make sure each bicycle cable is attched								
	Banais and station to made assessed	properly and springs are tensioned.	Test							
12	Repair each station to work properly	Also refer to the timing sheet to make	Test							
		the timing right								
	Provide a proper presentation to the spectator and restore system									

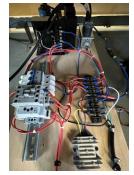
# Model Transfer Line Restoration

Team Members: Brian, Evan, Chris, Kyle

# **Experimentation and Concepts**







# Final Design



### Team # 7

Mentors: Prof. Merrick

Testing

Test Id	Test Name	Test Method	Test Description	Test Requirement
1	120 Volts	Functionality	Using the start/stop button that runs the 120 Volts to run the machine	Everything powered by one source and lower lights
2	24 Volts	Illumination	Once power is on from the 120 Volts power will be on for the 24 Volt bulbs	Upper lights illuminate the rail
3	5 Volts	Functionality	The drum switch rotates and lights different rows on the on the light board	Light board works with drum switch
4	Station Movement	Functionality	The stations move back and forth properly at the proper time	All stations move and correspond to light board

#### FEMA

DESIGN FAILURE MODE AND EFFECTS ANALYSIS (DESIGN PACA)

		PLANNING AND PREP Company Name Engineering Location Customer Name Model Year(s)/Platform(s)	Group 7 Bechtel Impaction David McMillian			Subject DFMGA Start DFMGA Review Cross Function		Timing Belt 8-Nov-2023								
	Improvement	STRUCTU	IRE ANALYSIS (STEP 2)		FUNCTION ANALYSIS (STEP 3)		FAILURE ANALYSIS (STEP 4)			RISK ANALYSIS (STEP 5)						
	listory / V Authori V (As Applicable)	1. Next Higher L	2. Focus E	1. Rost Loss or V Characteristic Type	1. Next Higher Function an Requirement	2. Focus Elemi Function and Resourcement	1 Next lower 1 Futction or Requirement or Observable	1. Failure (FE) to th V Higher Lavel Element and/or Vehicle End User	pertty (55 c	2. Failure Mod of the Focus E	1 Falure (FC) of the ' Lower Comment or Characteristic	Current Prevention C (PC) of RC V	Occurrence (O) 4 <	Curi Deten V Controls (DC) of FC or PM		
İ		Transfer line	Toning Belt		Prevents oil from souking in and ruining the belt	prevents socking from constantly greated gears	Timing belt not kept overly dry	Belt could slip from each gear	0	Shuft does not spin	Too much or not enough lubebricant added to the gears	Remove or add more lube to gears	7	See the Belt Slip	6	
				Turing of Shaft and attachment to motor	Used to make the transfer process work	Transfers model motors	Model engines move at smare time as the drifts to simulate	Movement of model engines could be not coinciding with the drills		Taines not fined up: drifts not timed correctly	Belt corredes and breaks	Replace the timing belt	7	Timing belt is snapped and not connected	6	
					Used to light the model switchboard through turning of shaft	turns care gears on shall		Cam gears could be out of order		Camgears are not in the same orientations		Sop turning cars without moving all together	40	Seeing como not symmetrical	00	
						lights as shaft is turned	Each light will turn on due to what com is turning at the certain time	Lights are not turning on	69	LEDs will not work	LEDs were not wired correctly	ED test continuity	6	Use DMM to lest each connection	00	
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