Michigan Automotive Compressor, Inc.
2018 Supplier Day
'Good to Great – Together'
Welcome!

MACI's Safety Board

Restroom Locations: Lobby Hallway

Medical Emergency: Dial 4444

Severe Weather: Shelter in place

Fire: Dial 4444 and Follow MACI PIC to Evacuation Zone

Guest Badge Required: Badge In and Out All Doors

Visitor/Contractor Brochure: Review pertinent information

Plant Rules:
Safety Glasses Required
STOP LOOK POINT at all Intersections
NO Cell Phone Use
NO Smoking
Be Aware of Plant Hazards

MACI Management Philosophy

MACI Executives

Mr. Hugh Kusaba
President

Mr. Yohichi Kizukuri
Vice President

Mr. Bruce Verburg
Vice President

Mr. Steve Sauter
General Manager

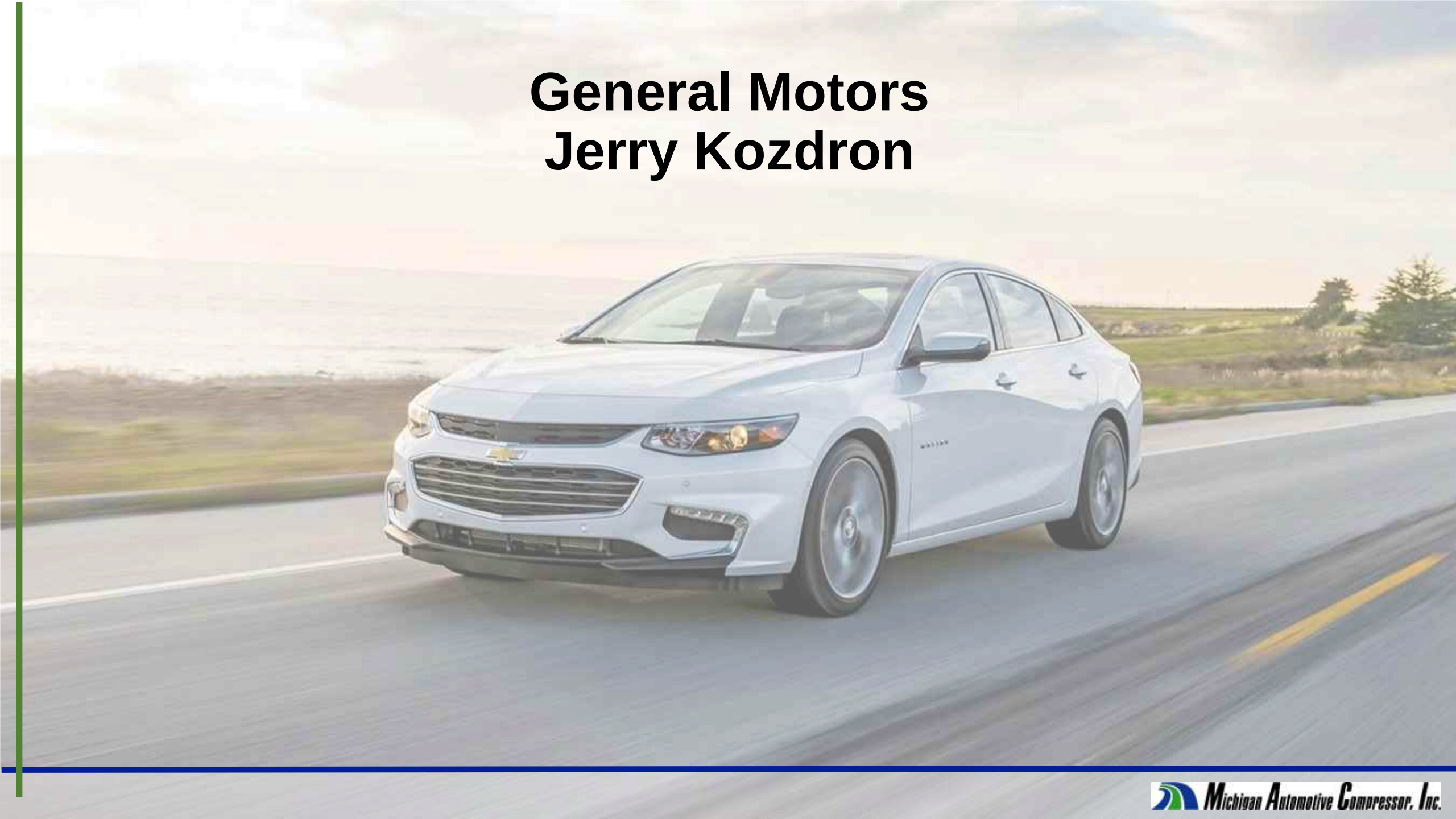
Mr. Joe Shaughnessy
General Manager

Supplier Day 2018
Good To Great - Together

Agenda:

8:15am – 9:00am	Reception	--
9:00am – 9:35am	Welcome and Introduction	Heidi Curl, Manager Purchasing
	General Motors	Jerry Kozdron, GM NAVO Supplier Quality HVAC Systems
	Economic Conditions	Brock L'Huillier, Sr. Specialist Business Planning
	MACI's Good to Great Journey	Steve Sauter, General Manager Quality & Purchasing
9:35am – 9:45am	Break	--
9:45am – 11:00am	MACI Training	Tom Huscio, Supervisor Training
	MACI Quality Control Circle	Rotor Rulers II
	MACI Quality	Alice Schneider, Manager Quality
	MACI Product Design	Patrick Flahie, Manager Product Design
	MACI Production Control	Beth Rowe, Manager Production Control
	MACI Purchasing	Steve Sitko, Supervisor Purchasing
	Final Comments	Mr. Kusaba, MACI President
11:00am	Optional Plant Tour 1	
11:10am	Optional Plant Tour 2	
11:20am	Optional Plant Tour 3	

General Motors
Jerry Kozdron



General Motors

Changes and Quality Risk

Q: When is it acceptable to make a change maybe a small one and not notify the customer?

A: NEVER! EVER!!!

General Motors

Automobile Warranty Drives Higher Quality Standards

- Cars = 3 years or 36,000 miles Bumper to Bumper Parts and Labor or More
- Powertrain = 5 years (or more) or 100,000 miles
- Appliances = 1 year parts and labor
- Most Electronics = 1 year parts and labor with exceptions on accessories
- Mowers and Tractors = 1-4 years or # hours parts and labor with all kinds of exclusions and limitations.
  (Belts, Seats etc 30 days; Batteries are 30 days prorated to 12 months)

General Motors

Automobile Volume and Complexity Make Quality a Challenge

- 1 vehicle per minute X 16 hours/day = 960 vehicles/day
- 960 vehicles/day X 235 days/year = 225600 vehicles/year
- 225600 vehicles/year X 2000 parts/vehicle = 451,200,000 parts/year
- If only 1:1,000 parts fail then it's 451,000 warranty issues per GM Assembly Plant
- GM's target for MACI is less than 1.0 IPTV
- In order to meet this, MACI's suppliers have to be much less than 1.0 IPTV!

General Motors

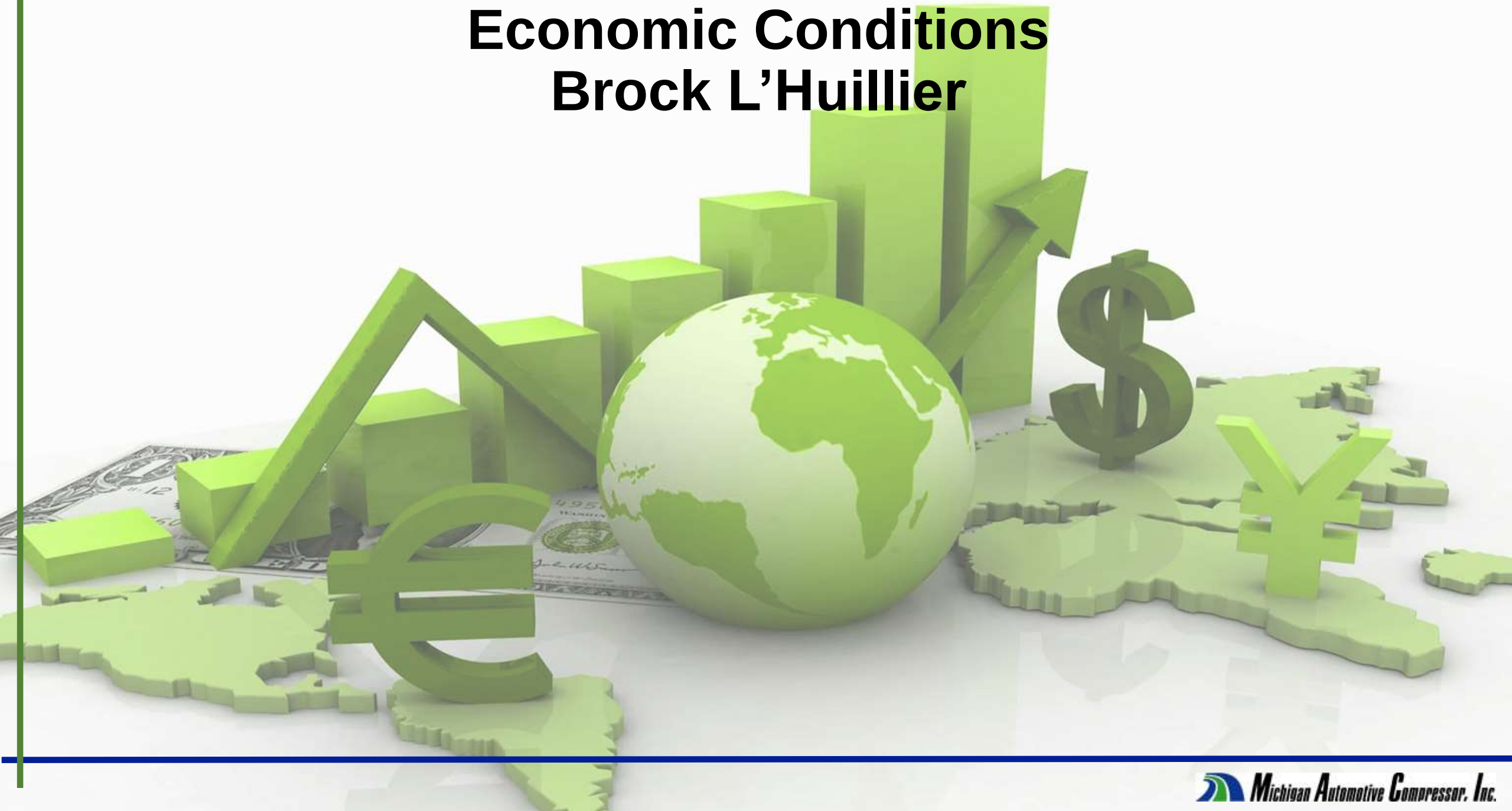
Be Aware of Pass Through Failure Modes

- While no defects are acceptable, those that can pass through your process, MACI's process and worst of all the GM Assembly Plant will in the end create the most collateral and costly damage.

  Eg: Defects that need a thermal cycle to fail

  Eg: Defects that have Safety Implications

Economic Conditions
Brock L'Huillier



Business Planning Topics

Economic Conditions:

- Statistical Indicators
- Light Vehicle Sales & Production Forecast

Business Update:

- North American Market Share
- Sales Volume – technology transition
- Reinvestment

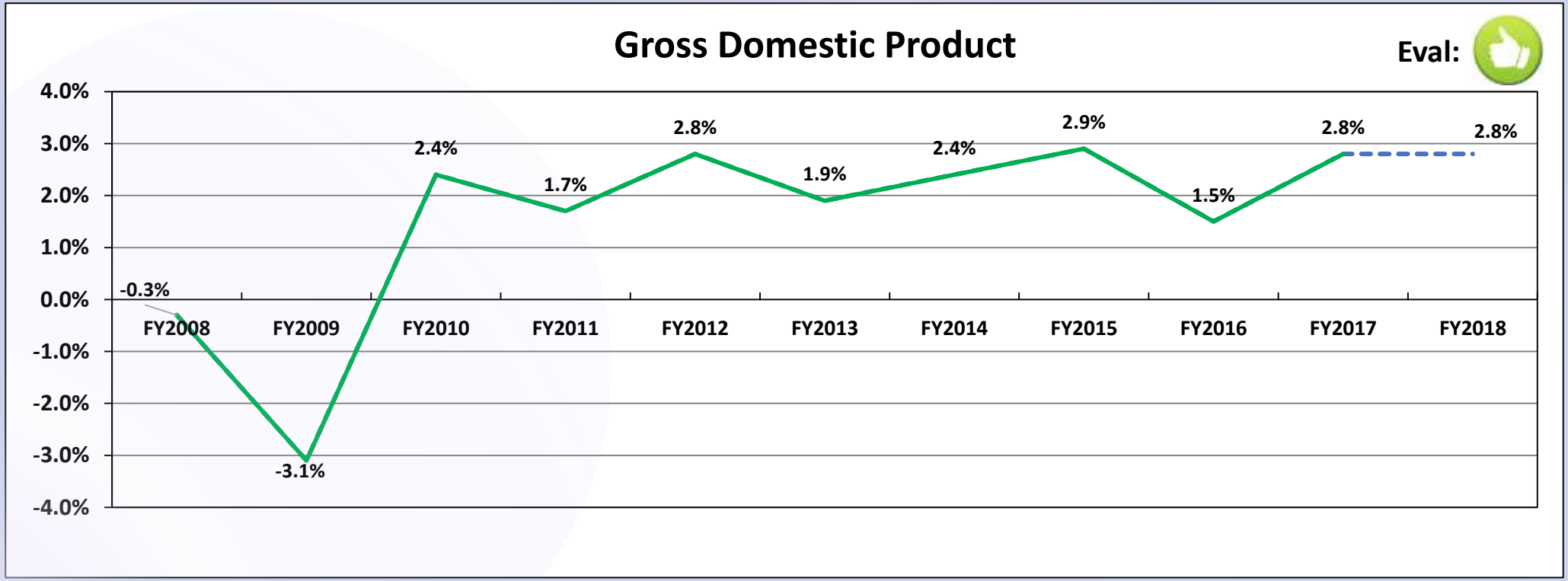
Cost Management:

- Change, Protect, Prosper (CPP)

Building Expansion:

- Product Localization
- Capacity Expansion

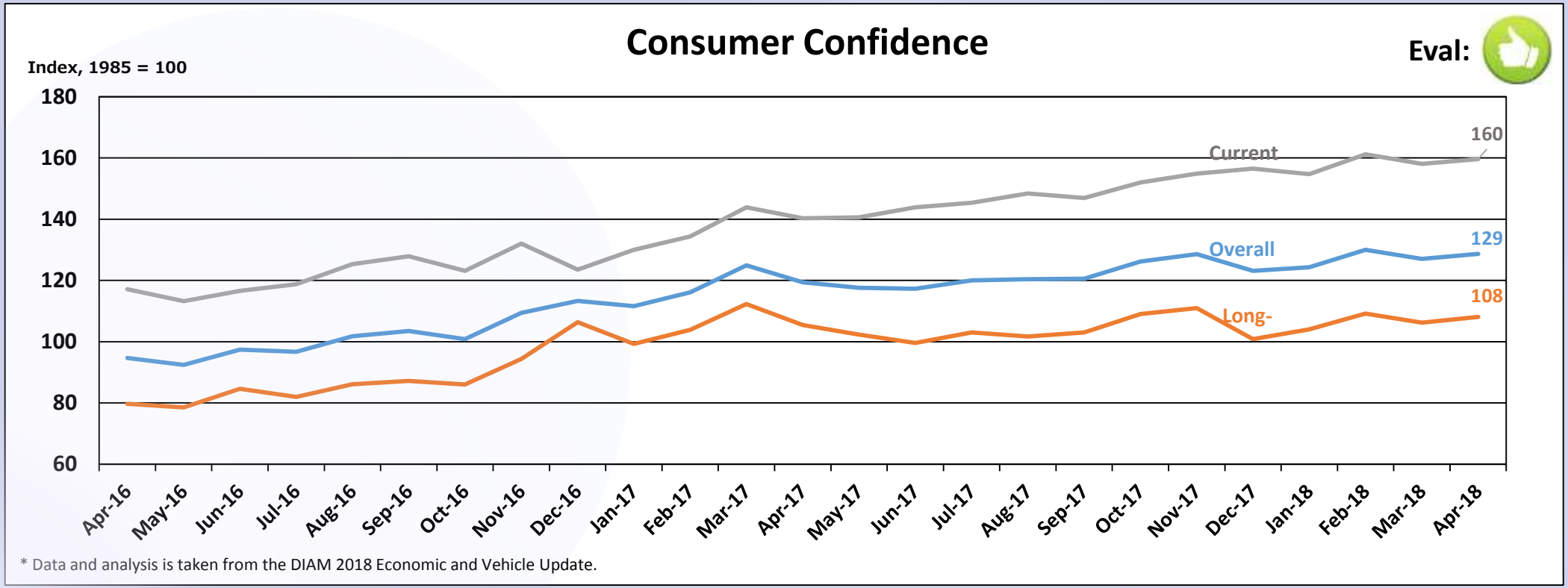
Economic Conditions



FY2018 – For planning purposes, GDP growth is assumed to maintain FY2017 level

- US tax cuts and strong consumer confidence aiding the sustained growth from FY2017
- Actual GDP growth was 2.0% for the 1st quarter and 4.1% in the 2nd quarter of 2018

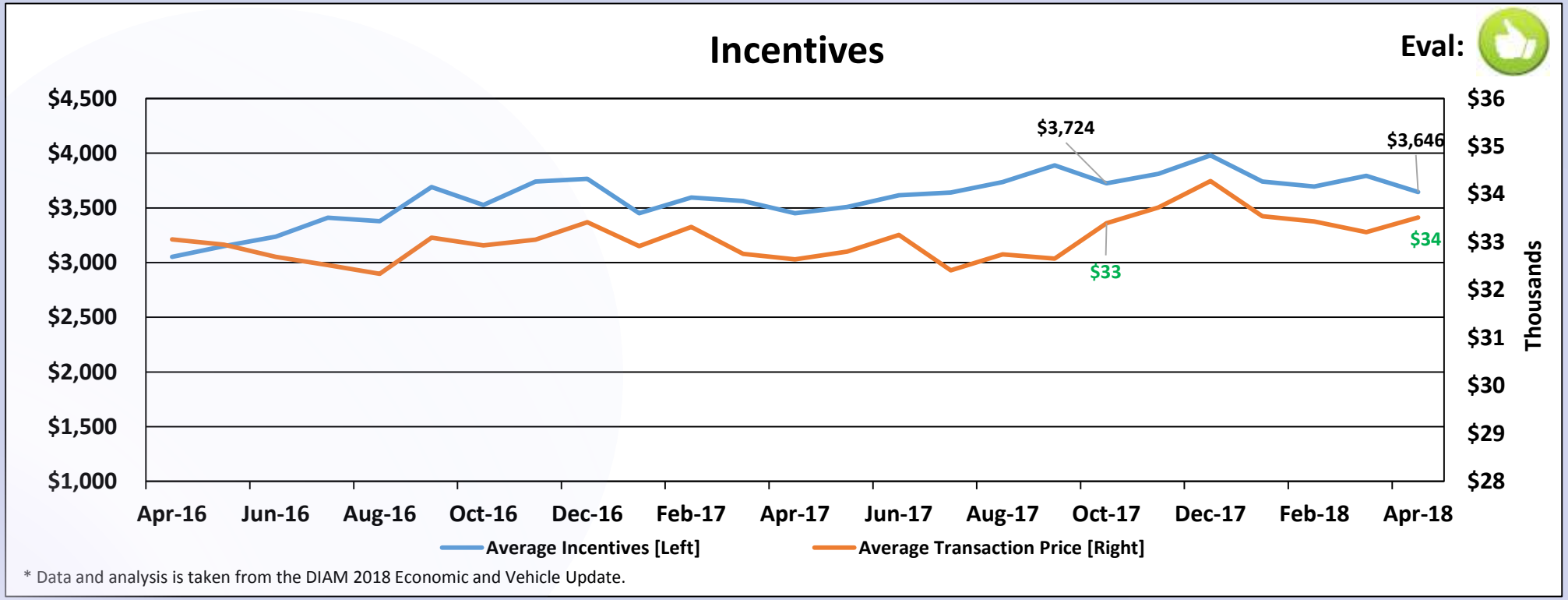
Economic Conditions



FY2018 – Consumer confidence level highest since early 2000's

- Actual results in 2018 have improved by 3 points from annual planning level

Economic Conditions

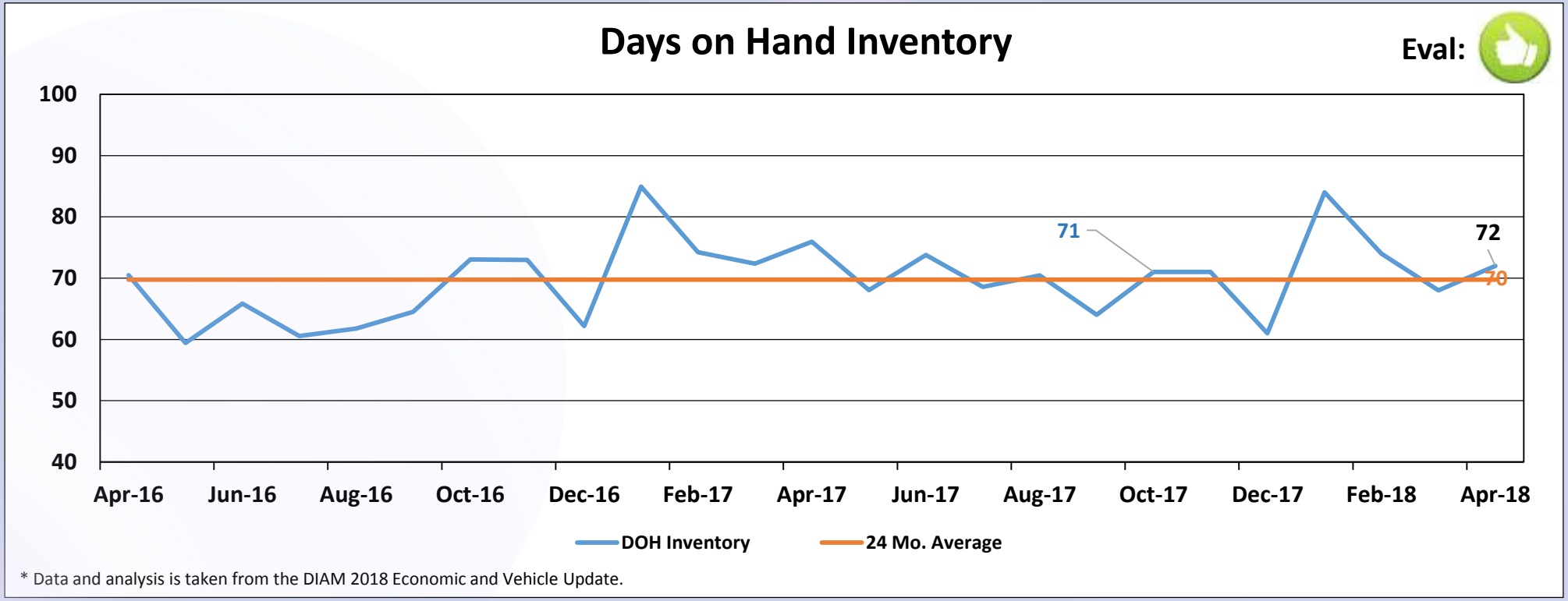


* Data and analysis is taken from the DIAM 2018 Economic and Vehicle Update.

FY2018 – Average transaction Price & Incentives remain elevated, but aligned

- Incentives are up 6% year over year (good for consumers, profit challenging for OE)

Economic Conditions

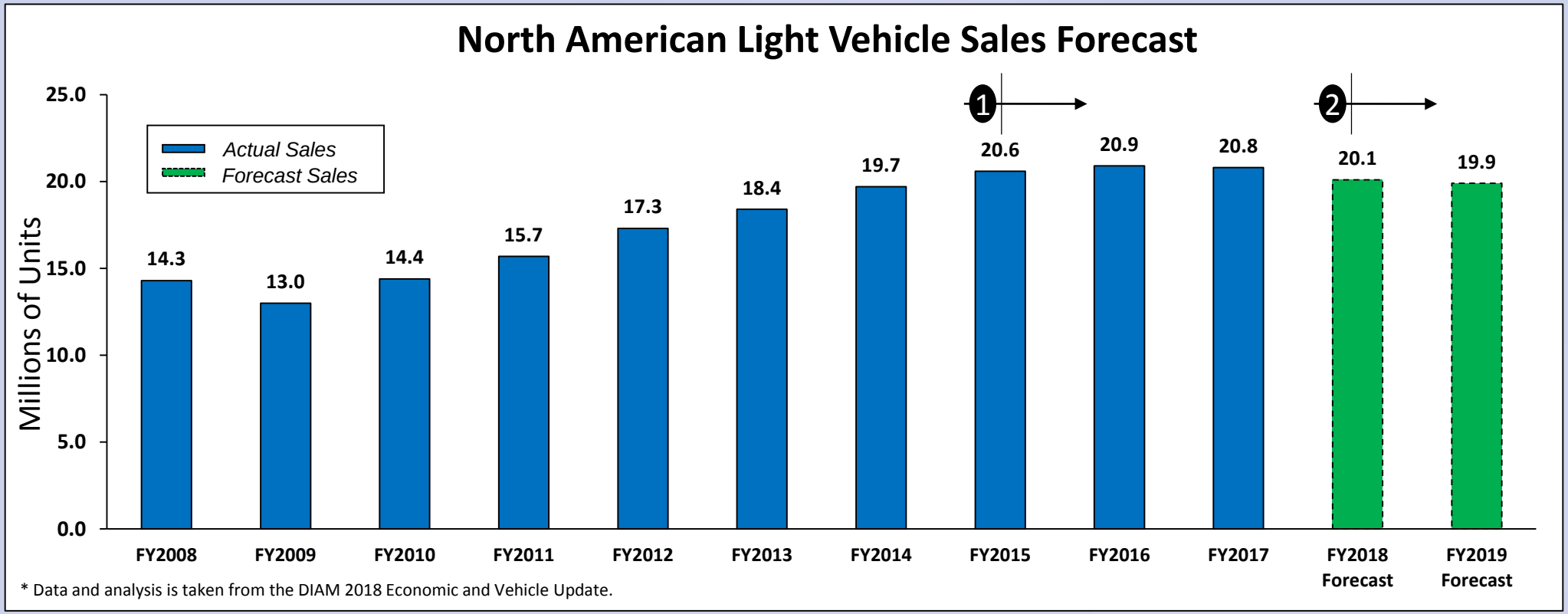


* Data and analysis is taken from the DIAM 2018 Economic and Vehicle Update.

FY2018 – Days-on-Hand discipline has maintained

- Inventory level is healthy at 72 Days-on-Hand

Economic Conditions



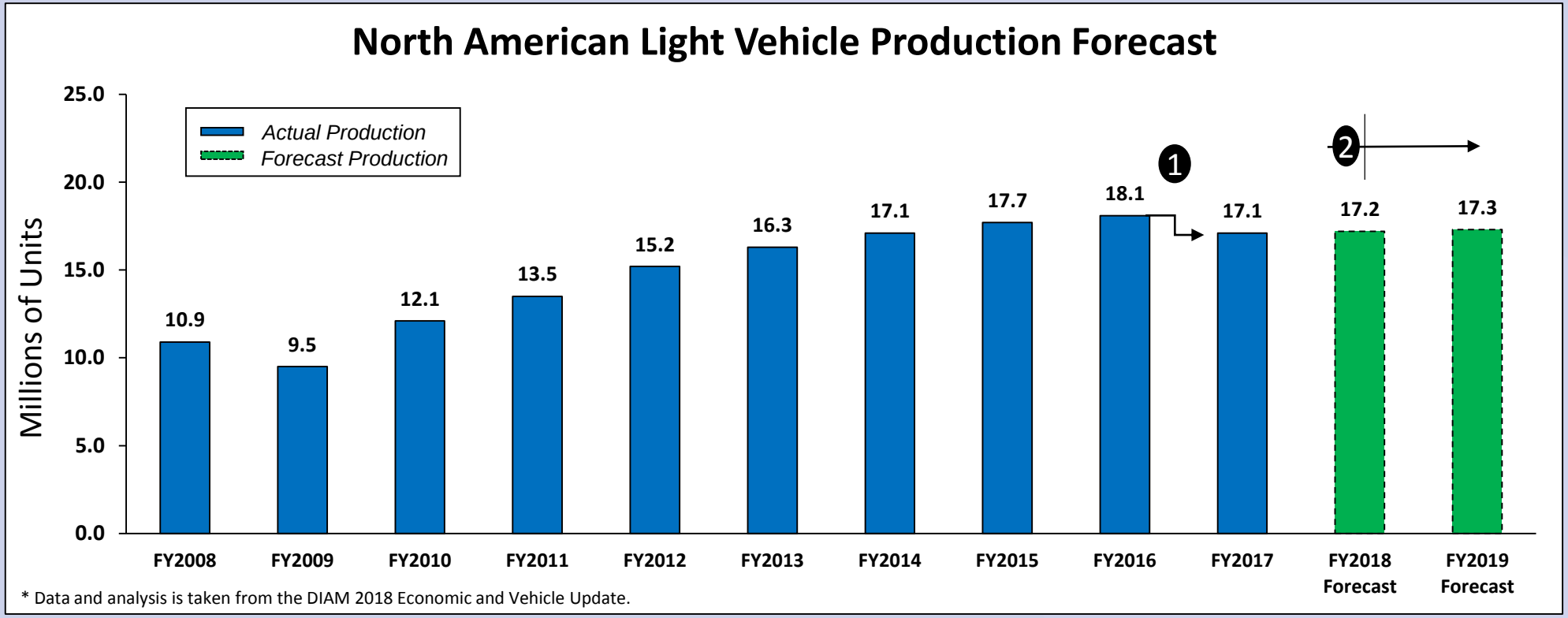
❶ FY2015 – FY2017 – Sales volume driven by OEM incentives (+20M)

- FY2016 – Vehicle replacement cycle at peak

❷ FY2018 – North American vehicle sales expected to decline slightly

- New off-lease vehicles returns putting pressure on new vehicle sales, but comparable sales pricing keeping new vehicle purchases attractive

Economic Conditions



❶ FY2017 – Vehicle production drops for retooling as a reaction to market demand shifting from light vehicles to CUV/SUV/Trucks

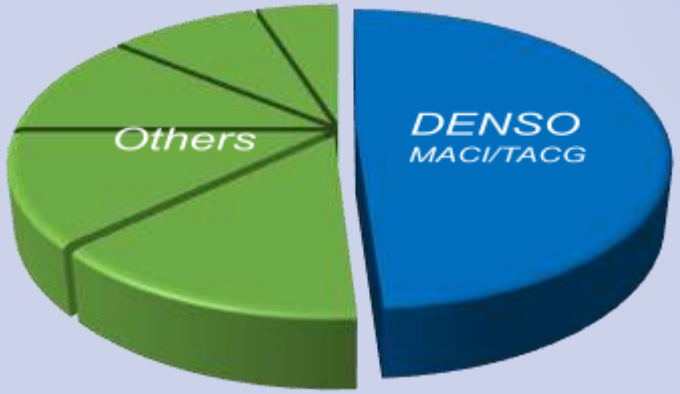
- Demand shifts to this segment are supported by low fuel prices

❷ FY2018 – Production forecast growing steadily after FY2017 due to sustained sales volume, new product launches, inventory replenishment & localization

Business Update

DENSO Compressor Market Share

North America 2008



~6 Total Competitors

North America 2018

~8 Total Competitors

- Added 4% market share over the last decade
- Next closest competitor holds 12% market share

Cost Management

C – *Change* to meet the challenges of our new environment.

P – *Protect* our current business with flexible thinking and quick actions.

P – *Prosper* in the future.

Cost Management

Purpose:

- **Company-wide** cost management activity
  - Align cost reduction targets/results to achieve financial goals of the company
  - Focus to **Per-Unit-Cost Improvement**

Structure:

- Direct – Organized as "**Business Units**" of 4 main processes
  - Led by area Management with respective Quality & Production Engineering, Maintenance, and Production support
- Indirect/SGA – Department controlled
  - Focus to support Direct Business Units and control/reduce overhead costs

Concept:

- **Plan, Do, Check, Act** (PDCA cycle)
  - Plan – Identify areas of improvement & develop a plan to achieve target
  - Do – Implement planned countermeasures
  - Check – Check results against planned effectiveness
  - Act – Standardize and establish controls

Cost Management

FY2018 CPP: Organization Chart

Area	Committee	Category	Item	Element	Leader	Co-leader	Production	Engineering	Quality	Maintenance	Business Planning	Report Week	Report Method
Direct Departments	Diecast Press	Labor	Headcount	Paid, Authorized, Staffing	G. Dods	M. Ames	D. Owen	S. Kawai E. Russell	J. Casey	J. Jones J. Hawkins	B. L'Huillier	Week 4	CPP Committee Meeting
			Overtime	Production, Non-Production									
			Temp	Meet Headcount Plan									
		Expense	Defect	Meet Nenkei Budget GL									
			Repair & Maint (all)										
			All Other										
	Compressor Machining	Labor	Headcount	Paid, Authorized, Staffing	B. Ries	M. Klavon	B. Wright E. Masternak	T. Jansen P. Anderson	J. Casey	T. Mitchell T. McChoneghy	P. Schmidt	Week 3	CPP Committee Meeting
			Overtime	Production, Non-Production									
			Temp	Meet Headcount Plan									
		Expense	Defect	Meet Nenkei Budget GL									
			Repair & Maint (all)										
			All Other										
	Clutch Machining	Labor	Headcount	Paid, Authorized, Staffing	D. Kelly	J. Ludwig	M. Staib C. Gregory	K. Spica S. Fujikawa	J. Houston	F. Gallant B. Osborn	H. Sullivan	Week 4	CPP Committee Meeting
			Overtime	Production, Non-Production									
			Temp	Meet Headcount Plan									
		Expense	Defect	Meet Nenkei Budget GL									
			Repair & Maint (all)										
			All Other										
	Assembly	Labor	Headcount	Paid, Authorized, Staffing	P. Sall	K. Bretes	E. Heie	E. Balde	P. Jones	J. Stone R. Martin	H. Sullivan	Week 4	CPP Committee Meeting
			Overtime	Production, Non-Production									
			Temp	Meet Headcount Plan									
		Expense	Defect	Meet Nenkei Budget GL									
			Repair & Maint (all)										
			All Other										
Stock Adjustment	Spare Parts	Obsolete Parts	Tool Room	Reduce parts obsolescence	H. Curl	S. Sitko	BR, DK, PS, GD	M. Klavon		A. Cielen	B. Manville R. Jester	Week 3	CPP Committee Meeting
		Inventory	Inventory Control	Inventory Reduction									
				Revise OP/OQ									
	Physical Inv.		Inventory Variance	Reduce Physical Inventory Variance	S. Sauter	R. Snyder III	BR, DK, PS, GD				L. Piper	Week 3	
Material		*Direct Material	Marginal Profit	Sourcing	H. Curl	L. Piper					L. Piper	Week 1/4	Board Review
				PPI									
Indirect & SGA		Expense	Controllable Expense	Meeting Nenkei Budget GL	Dept. Management						H. Sullivan	Week 1/4	Board Review
			*Utilities		T. Boertman								

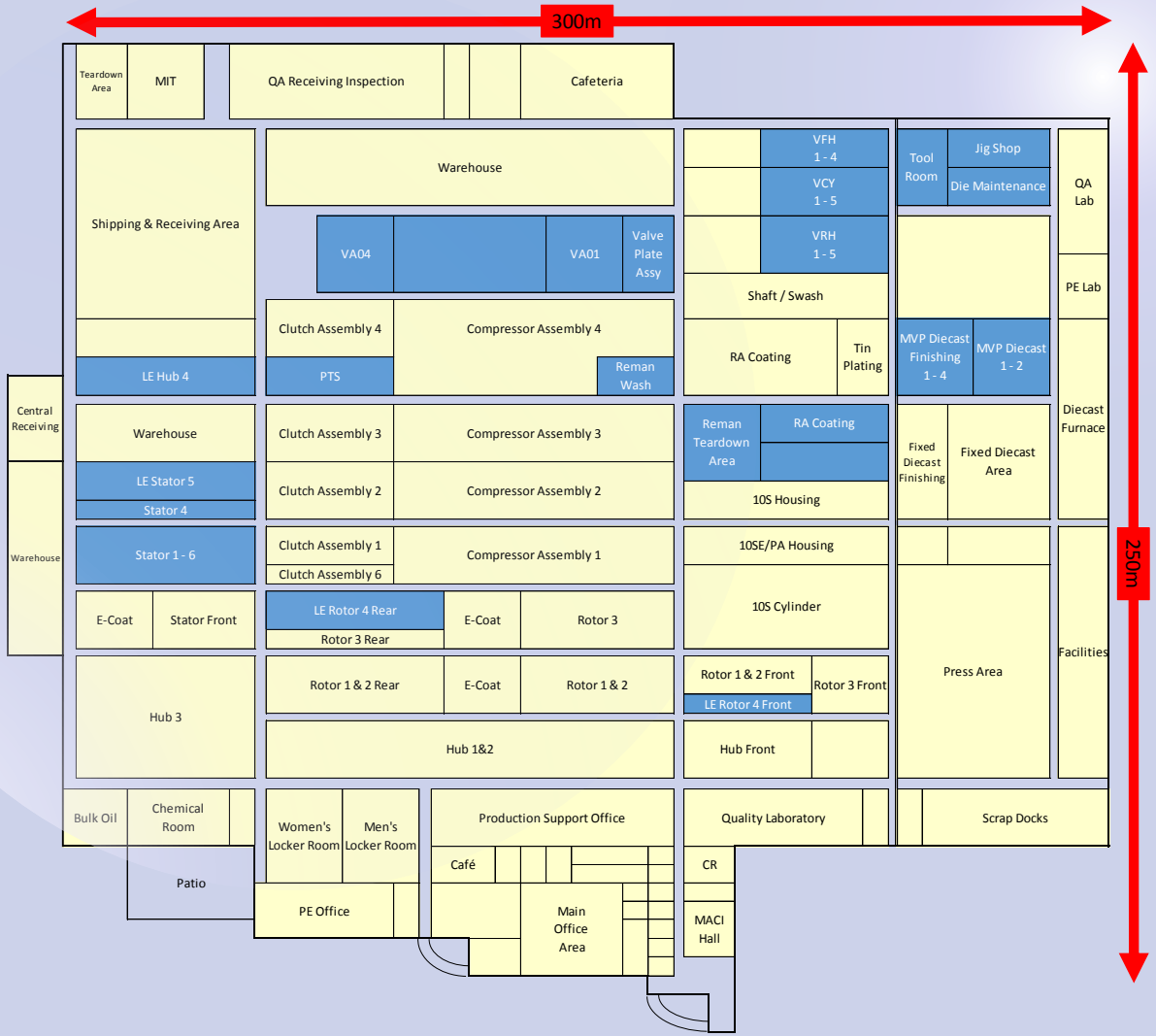
Focus to Per-Unit Cost Reduction

Building Expansion

Pre-Expansion: FY2011

- 787,000 sq. ft.
- 104 Acres
- 4 Fixed Assembly lines
  - 3.8M compressor units/year
- 5 Clutch Assembly lines
  - 4.5M comp w/ clutch units/year

Building Expansion



Phase 1: FY2012

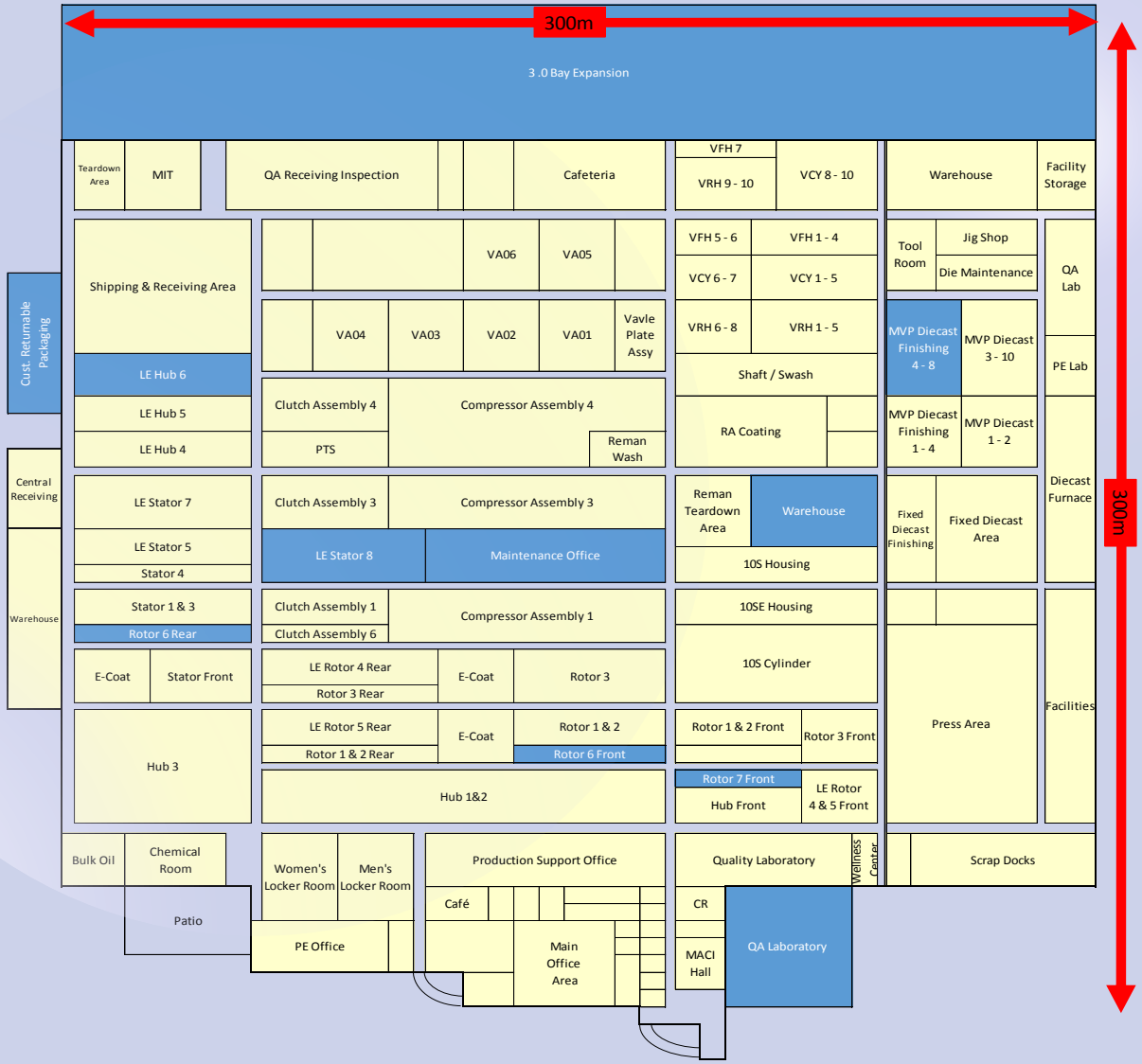
- Building:
  - Clean Room 1
- Machinery:
  - 2 Assembly Cells
  - 14 Compressor Machining Cells
  - 2 Diecast Casting Cells
  - 3 Diecast Finishing Cells
  - 3 Clutch Machining Lines

Building Expansion

Phase 2: FY2013

- Building:
  - 0.5 Bay Expansion
  - Clean Room 2
- Machinery:
  - 4 Assembly Cells
  - 11 Compressor Machining Cells
  - 7 Diecast Casting Cells
  - 3 Clutch Machining Lines

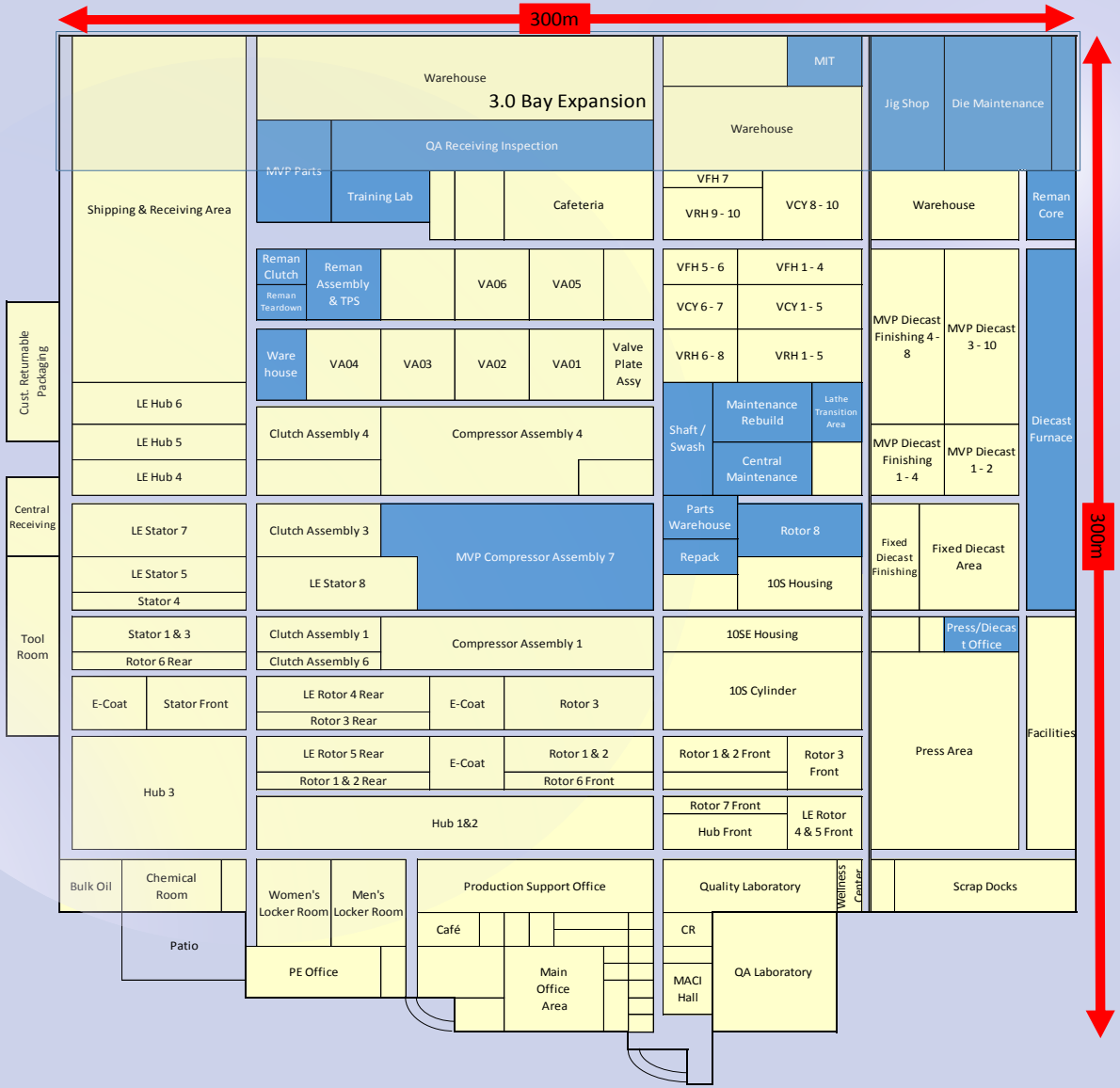
Building Expansion



Phase 3: FY2014 – FY2015

- Building:
  - 3.0 Bay Expansion
  - Customer Returnable Packaging Room
  - Quality Laboratory
- Machinery:
  - 3 Diecast Finishing Cells
  - 4 Clutch Machining Lines

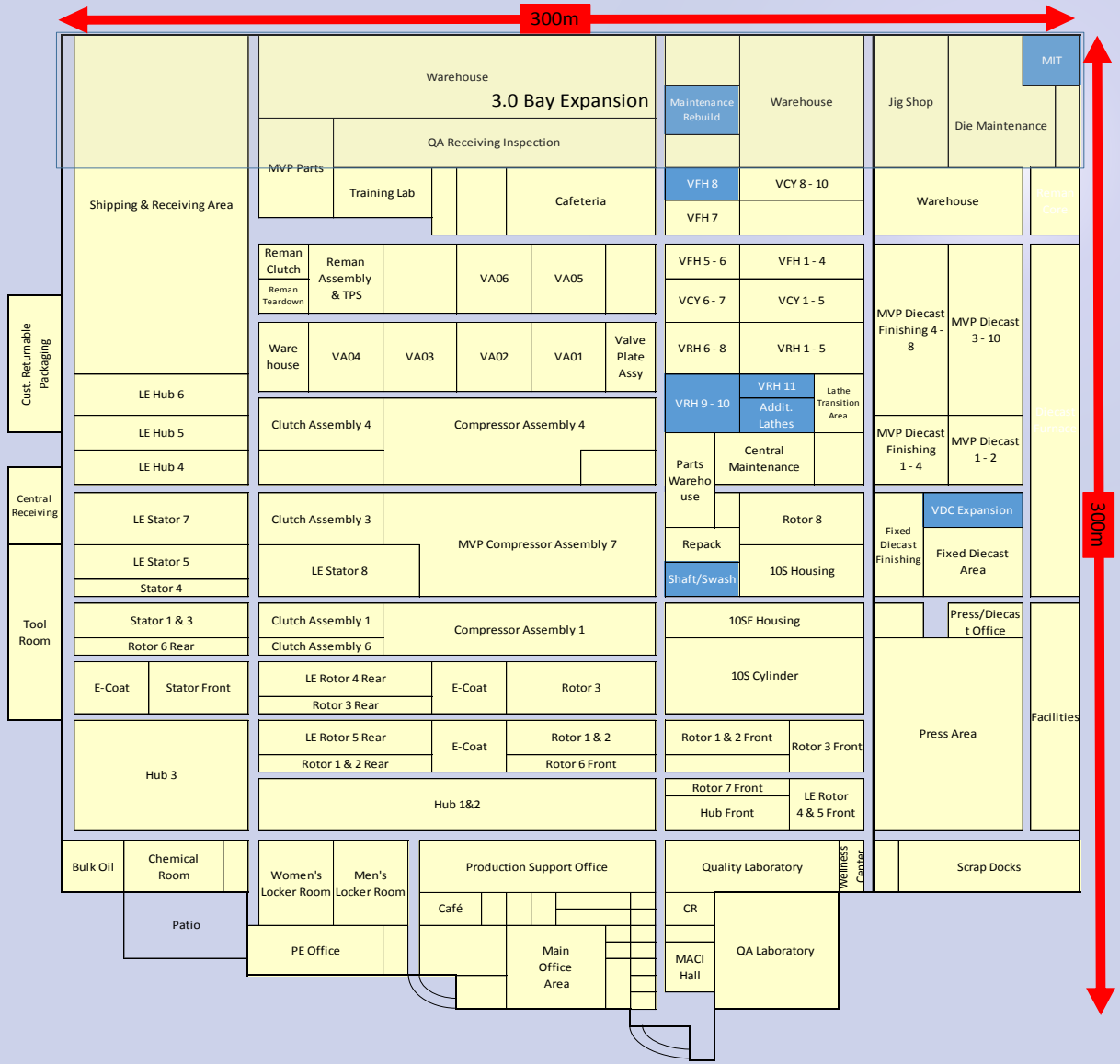
Building Expansion



Phase 4: FY2016 – FY2017

- Building:
  - Clean Room 3
  - Plant Reorganization
- Machinery:
  - 1 Assembly Line
  - 1 Clutch Machining Line

Building Expansion



Phase 5: FY2018

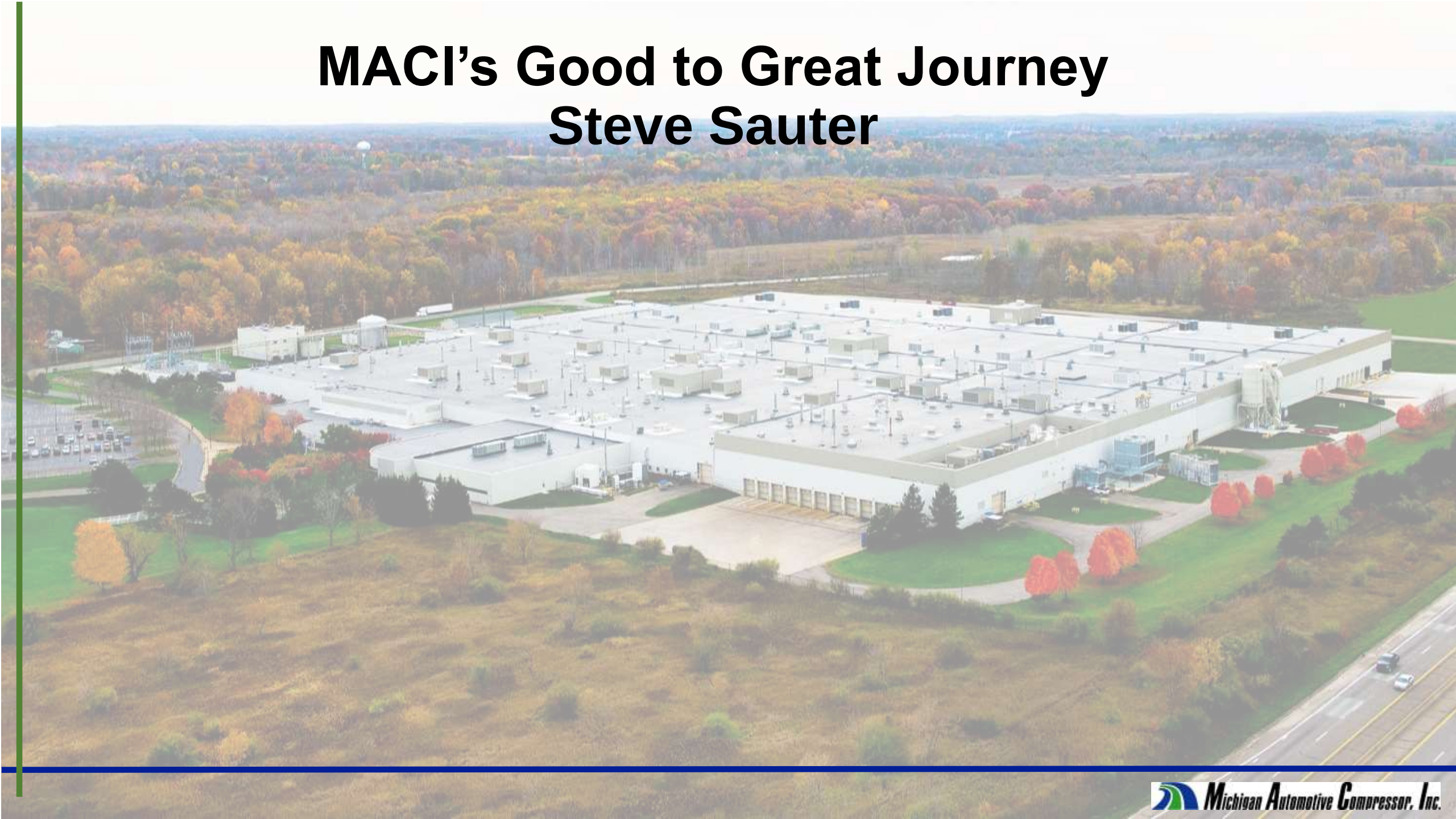
- Machinery:
  - 2 Compressor Machining Cells
  - 1 Diecast Casting Cell
  - Compressor Machining Lathes

Building Expansion

Post-Expansion: FY2018

- 1,000,400 sq. ft.
- 105 Acres
- **52% of floor space has been reinvented for new technology**
- 2 Fixed Assembly lines
  - 1.5M compressor units/year
- 7 Variable Assembly lines
  - 4.0M compressor units/year
- 10 Clutch Assembly lines
  - 6.3M compressor w/ clutch units/year

MACI's Good to Great Journey
Steve Sauter



Michigan Automotive Compressor, Inc.

MACI: GOOD TO GREAT JOURNEY

MACI: Good to Great Journey

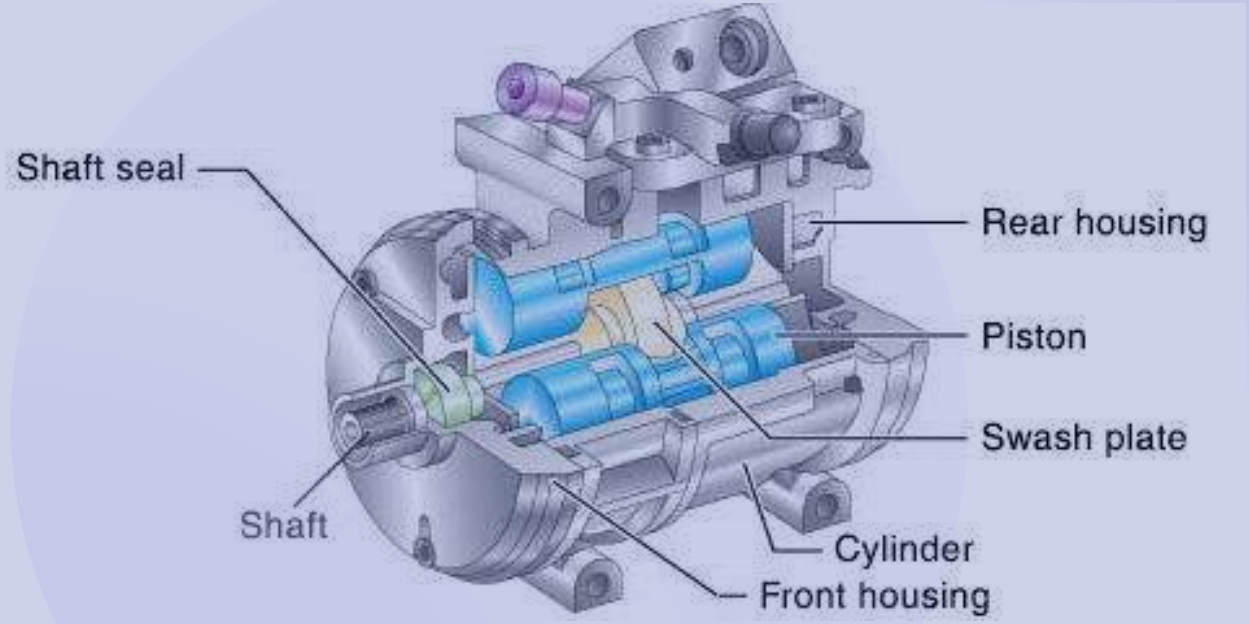
- Transition from Fixed to Variable Compressor
- Key Measurable Review
  - Safety
  - Quality
- Community Support

MACI: Good to Great Journey

FIXED vs VARIABLE

MACI: Good to Great Journey

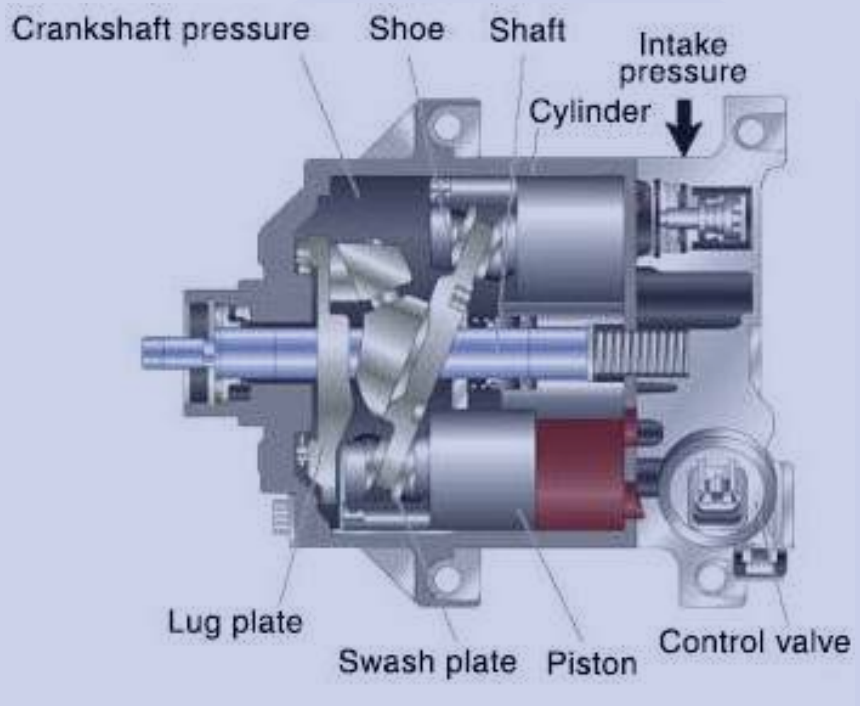
Fixed vs. Variable Compressor Technology:

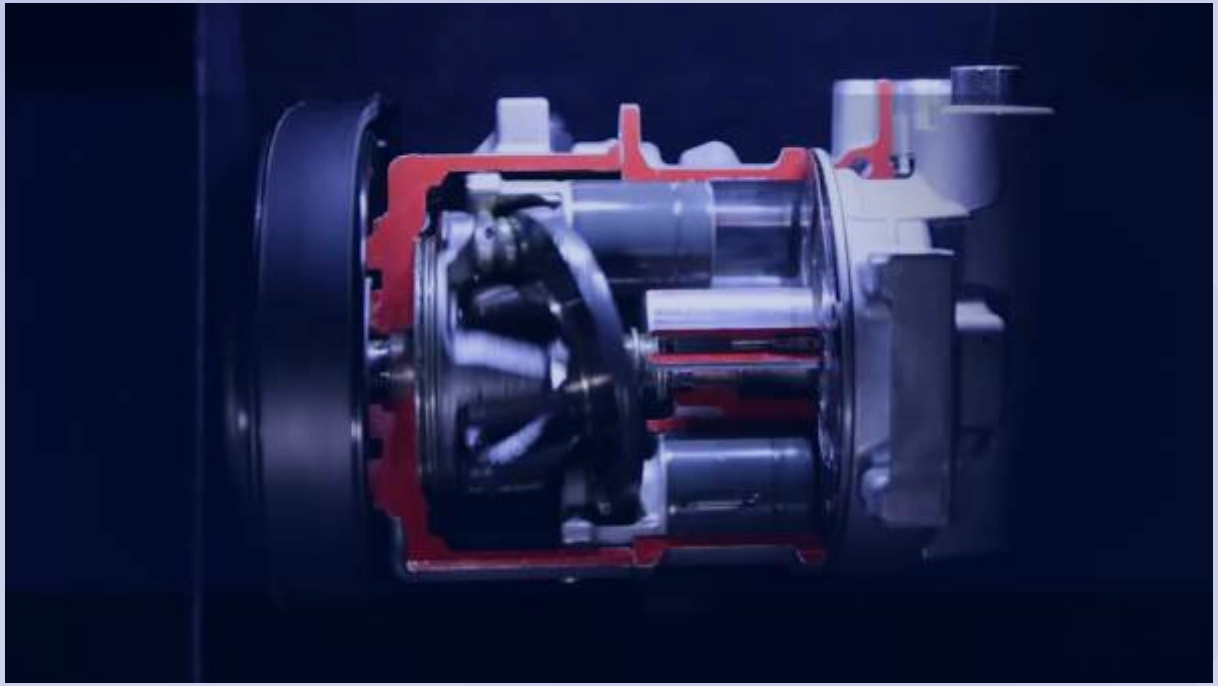


4 piece aluminum body
Fixed swash plate angle
Always “full” power when AC is turned on
On/Off cycle can be harsh

MACI: Good to Great Journey

Fixed vs. Variable Compressor Technology:





3 piece aluminum body
Variable power when AC is turned on
Swash plate angle set by control valve
MPG advantage

MACI: Good to Great Journey

SAFETY

Our Associates Are Our Most Important Asset

MACI: Good to Great Journey

Safety-Incident Rate:

Injury / Illness Comparison by Year: Illness is Bottom Number in Italics

MACI: Good to Great Journey

Safety-Incident Rate:

<u>Countermeasure Activity</u>

Early Intervention and Massotherapy

Safety DOJO and Expanded Safety Training

MACI: Good to Great Journey

Safety-Incident Rate:

<u>Countermeasure Activity</u>

Early Intervention and Massotherapy

Safety DOJO and Expanded Safety Training

Company Wide Stretching Program

MACI: Good to Great Journey

Safety-Incident Rate:

<u>Countermeasure Activity</u>

Early Intervention and Massotherapy

Safety DOJO and Expanded Safety Training

Company Wide Stretching Program

Continuous Safety Communication

Revived Ergonomic Training and Assessment

Safety Culture Review and Enhancement

Separation of Lift Trucks and Associates

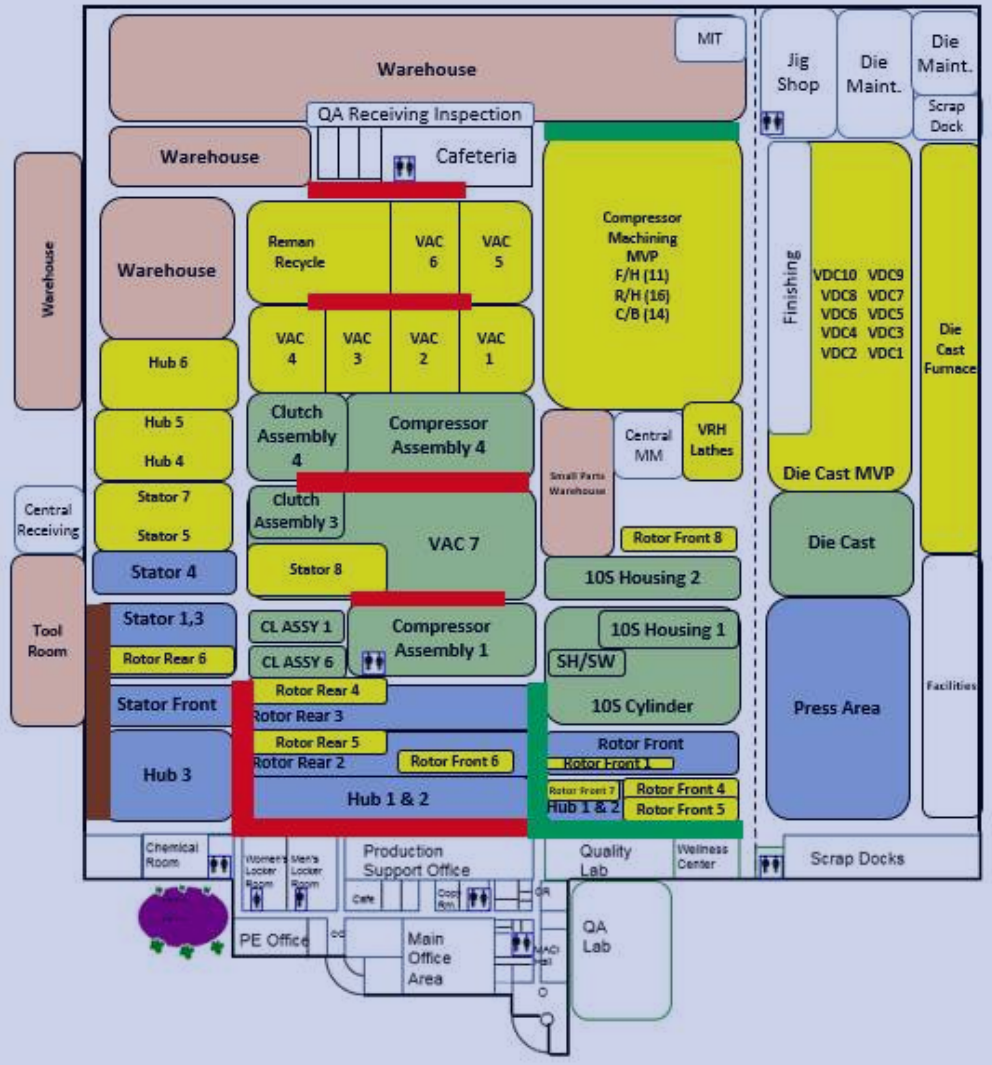
MACI: Good to Great Journey

Safety-Mixed Traffic:

Associates, bicycles, and Lift Trucks all sharing the same aisle.

MACI: Good to Great Journey

Safety-Mixed Traffic:



Pedestrian Only Current

Forklift Only

Pedestrian Only Proposed

MACI began a review of traffic patterns in the plant. Changes were made to product and sub material delivery limiting access to aisles to separate Associate and Lift Truck traffic.

MACI: Good to Great Journey

Safety-Mixed Traffic:

Bollards restrict vehicle access to aisle, ensuring Associates safe travel.

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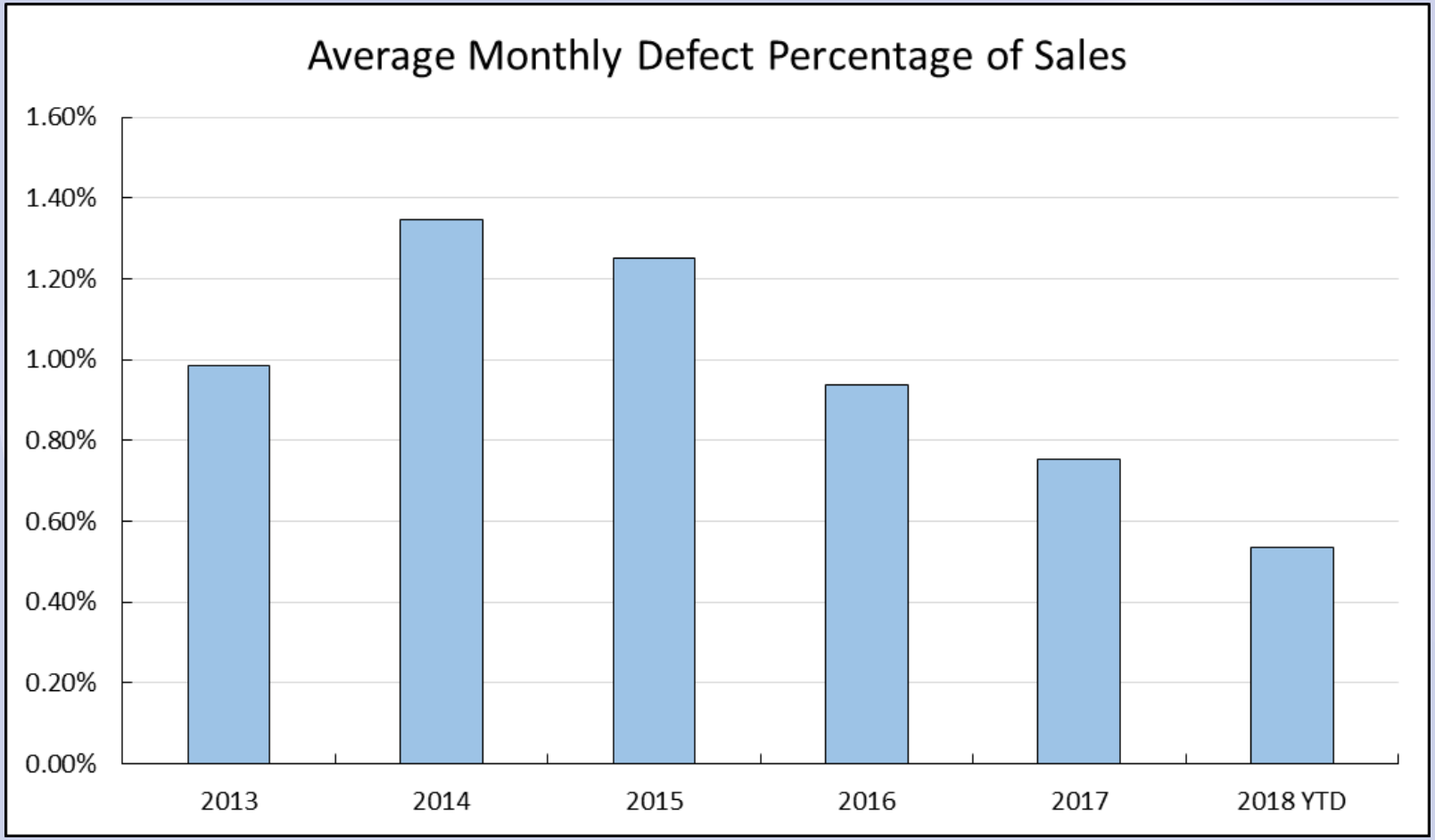
QUALITY

Our First Priority Is The Customer

MACI: Good to Great Journey

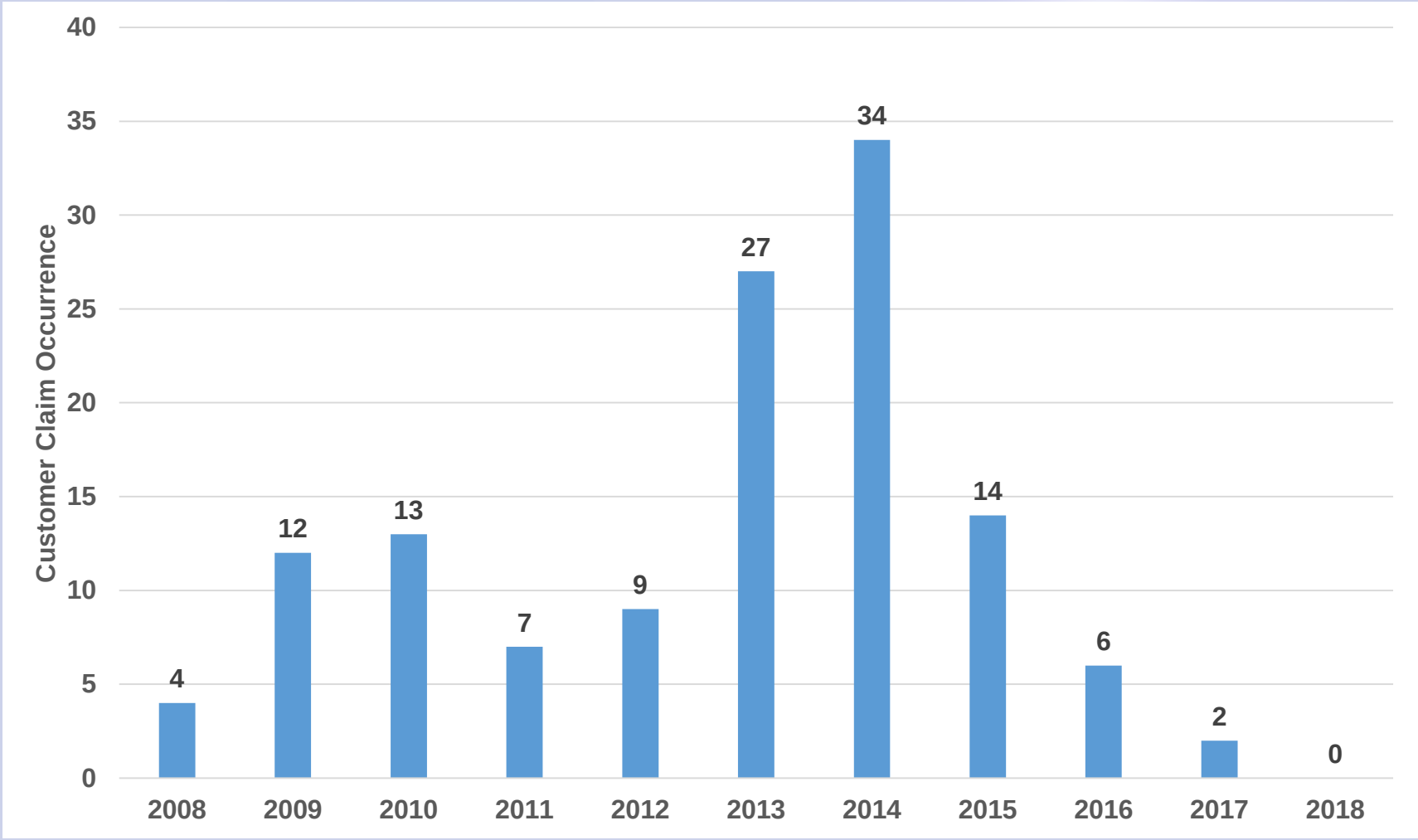
Quality-In Process Defect



Challenged operations to improve in process defect results. Through focused, data directed activity there has been consecutive year over year defect reductions.

MACI: Good to Great Journey

Quality-Customer Claim



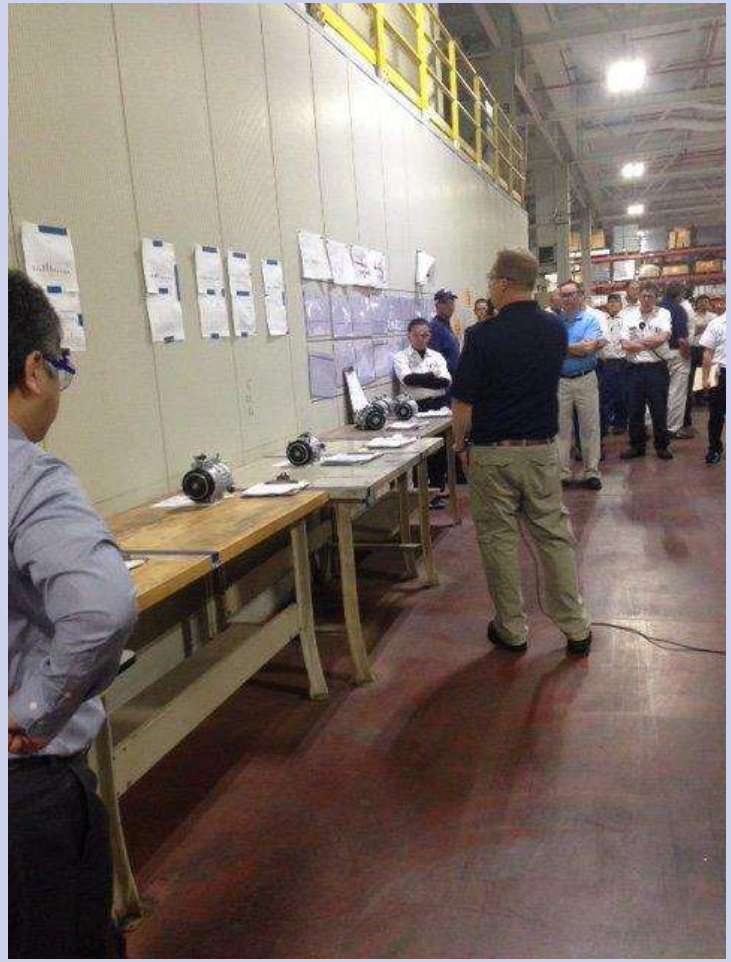
0 mile customer claims followed a similar trend as in process defects with the launch of variable. Countermeasure activity has resulted in the lowest levels of claims in MACI history.

MACI: Good to Great Journey

Quality-Customer Claim

Countermeasure Activity

- Cabbage Patch
- **Group Review**



MACI: Good to Great Journey

Quality-Customer Claim

Countermeasure Activity

- Cabbage Patch
- Group Review
- **Standardized Work Focus**

Line # VAC 1			Cycle Time	Standardized Work Chart		If monitor is not on or wrong part information shown, STOP line and call Offline or Above
Process # 120-Control Valve Assembly						
Steps		Work Process (What)		Key Points (How)		Process Key Points
Process Work	1	Move Compressor to Control Valve Jig.		Use both hands and carefully position correctly in the jig.	A	
	2	Retrieve Control Valve and insert into Compressor.		Confirm the type. Insert in to the compressor. Do not touch the or ring. Do not damage the cap.	B	
	3	Push Jig in, Press Control Valve, Pull Jig ou				

Standardized Work Training Sheet

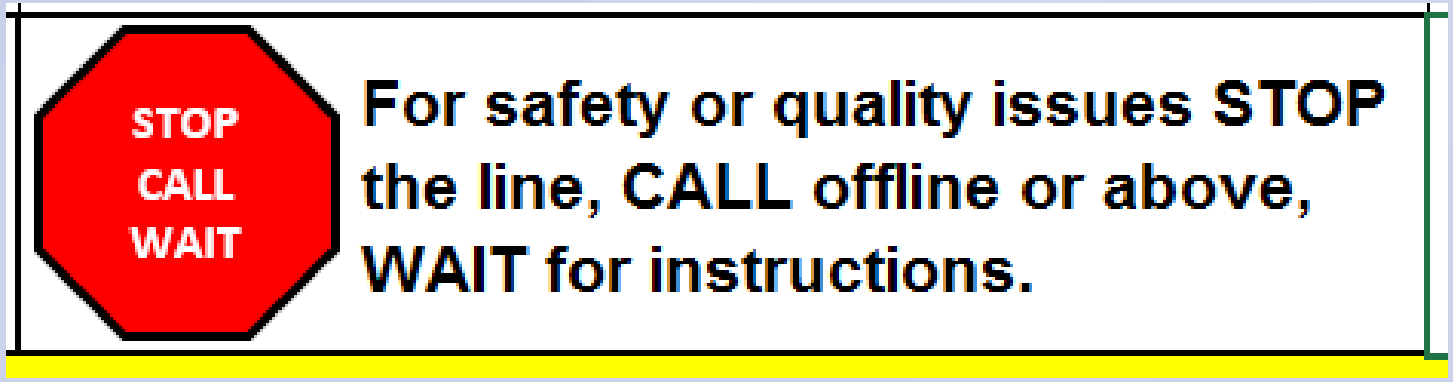
Line # VAC 1			Process #		
No.	Work Process (What)	Key Points (How)	Quality Points		Reasons (Why)
1	Move Compressor to Control Valve Jig.	Use both hands and carefully position correctly in the jig.			To move the compressor from the conveyor to the jig with no damage.
2	Retrieve Control Valve and insert into Compressor.	Confirm the type. Insert in to the compressor. Do not touch the or ring. Do not damage the cap.			Wrong control valve will cause quality issues for the customer.

MACI: Good to Great Journey

Quality-Customer Claim

Countermeasure Activity

- Cabbage Patch
- Group Review
- Standardized Work Focus
- Improved Early Stage Control
- **Stop/Call/Wait Reinforced**



MACI: Good to Great Journey

Quality-Customer Claim

Countermeasure Activity

- Cabbage Patch
- Group Review
- Standardized Work Focus
- Improved Early Stage Control
- Stop/Call/Wait Reinforced
- Simulation Area for Training
- **NG Part Handling Improvement**

VMC - Training Sheet

Scrap Part Marking Procedure

No.	Picture	Process Flow	Key Points
1		All parts that are in process scrap are to be marked with a red "X" and associate initials. Mark the part in an area that is easy to see.	This is done to help reduce the chance of parts that are known to be NG accidentally being reintroduced to the process.
2			

MACI: Good to Great Journey

Quality-Customer Claim

Countermeasure Activity

- Cabbage Patch
- Group Review
- Standardized Work Focus
- Improved Early Stage Control
- Stop/Call/Wait Reinforced
- Simulation Area for Training
- NG Part Handling Improvement
- **Machine Fault Key Inspection Points**
- Containment Improvement

YELLOW CARD

Line	VAC 7
Process #	43
Process Name	Shoe Clearance - 4
Station #	Shuttle Pickup

QUALITY CHECKING POINTS WHEN THE ERROR OCCUR

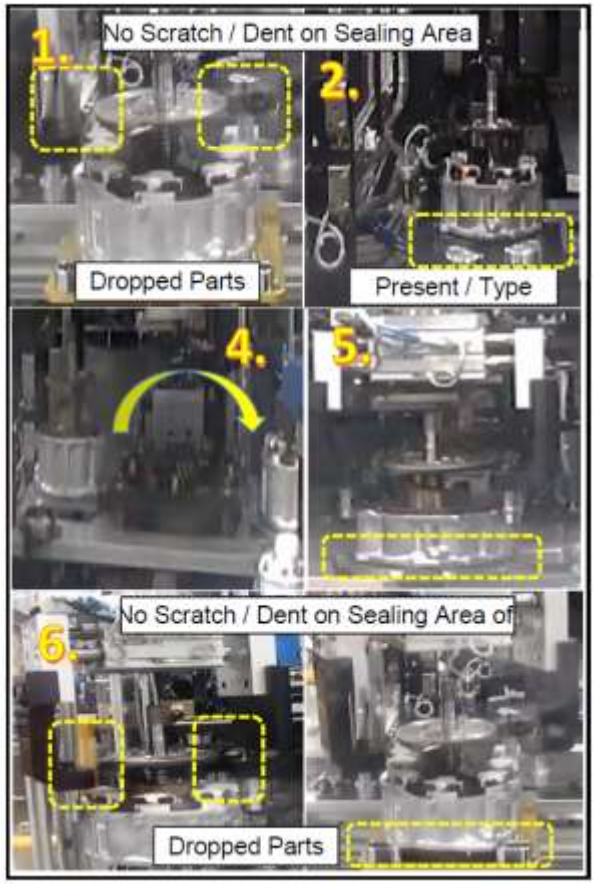
	Process Steps	Quality Check Point	Reason - Why Check
1	Shuttle Cylinder Pickup	Dropped Part - Shifted	Online - Possible Leak NG
2	Drop Off Cylinder - Staging Jig	Confirm no scratch/dent on sealing area of cylinder	Customer - Abnormal Nosie - Seized
3	Cylinder Type	Present and Type	Online - Machine Fault, Possible Dropped Part Customer - Compressor Seized
4	Index	Confirm no scratch/dent on sealing area of cylinder	
5	Pickup Cylinder	Foreign Material	
6	Dropoff Cylinder	Confirm no scratch/dent on sealing area of cylinder	
		Dropped Part - Shifted	

Lessons Learned

If Visual Defect Found **MUST** Scrap

CONFIRM NEXT PART THROUGH THIS PROCESS

YELLOW CARD



MACI: Good to Great Journey

Quality-Simulation Area for Training

MACI developed and built 9 off line simulation stations to train Associates.

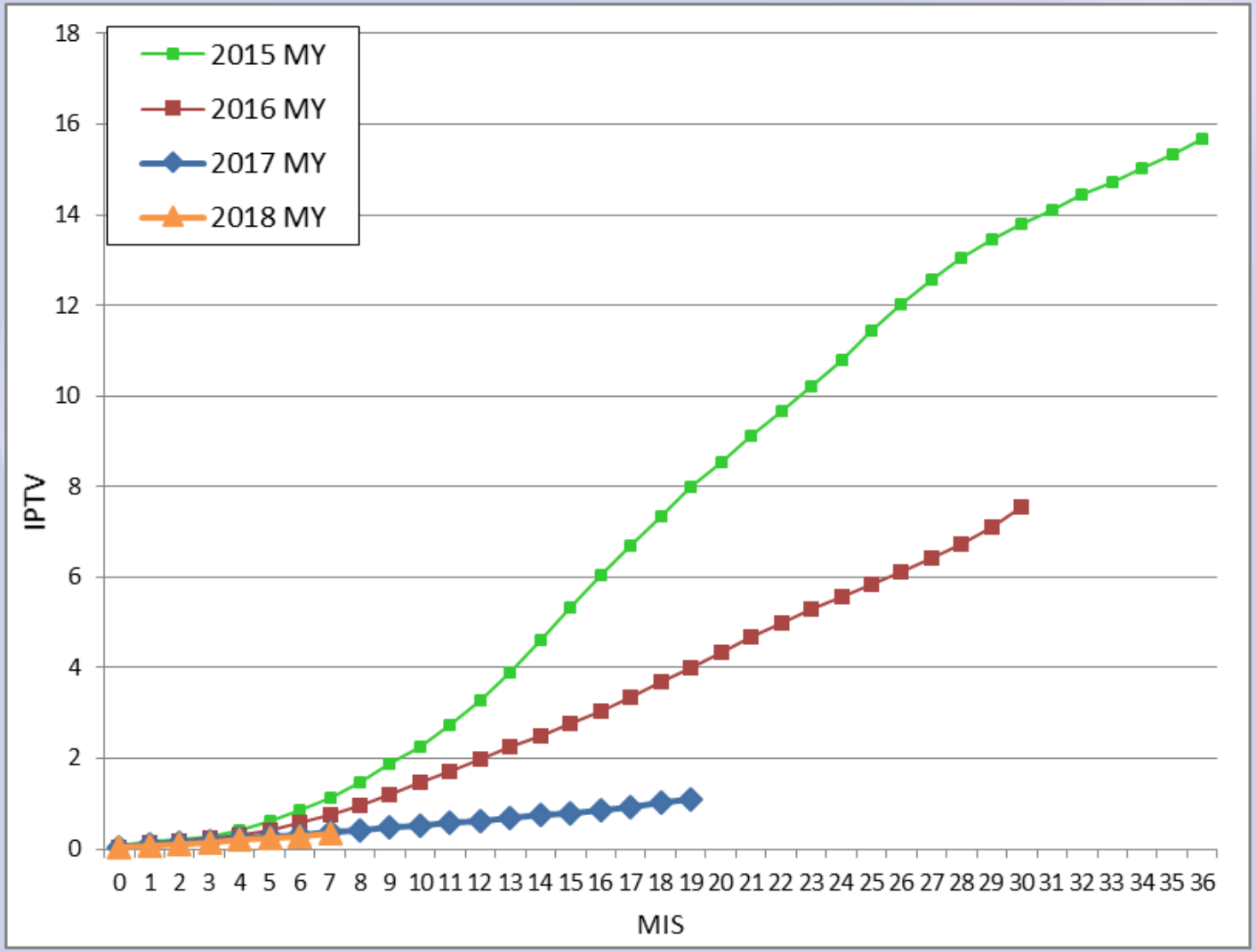
These training simulators cover the main manual assembly processes.

Simulators give feedback for total cycle time as well as a break down of each job task.

Benefits include improved productivity, reduced dropped parts, and enforcement of standardized work.

MACI: Good to Great Journey

Quality-Warranty Claim



MACI responsibility for warranty extends 3 years. Current warranty data shows year over year improvement and no design or manufacturing related issues. Supplier part quality is critical for MACI to keep warranty as a competitive differentiator.

MACI: Good to Great Journey

Quality-Customer Awards and Milestones

2010	75 Million Sales Units
	GM Global Supplier of the Year
	Ford World Excellence Gold Award
2014	Ford World Excellence Silver Award
2015	25th Anniversary
	100 Million Sales Units
	GM Customer Care & Aftersales On Time Shipping Award
2016	Corporate Citizen of the Year
	DTNA Masters of Quality Award
2017	IATF 16949 Certification
	Ford World Excellence Gold Award

MACI: Good to Great Journey

COMMUNITY SUPPORT

Our Company Is Committed To Being A Responsible Citizen

MACI: Good to Great Journey

Community Support

- FIRST Robotics – Governor's Task Force
- Jackson Area Manufacturers Association (JAMA) – Board of Directors
- Baker College – Board of Regents
- United Way – Board Member and Campaign Chair
- Enterprise Group
- Annual support of Youth Education and Environmental Activities

Training
Tom Huscio

Good-Pre 2014

New Hire Training

Associate

Orientation
13 X 1.5 hour sessions
Taught by area subject matter expert

General MACI policies and procedures
Benefits
Safety-3hrs

✚

On the Job Training
Gauging
Defect training
Quality check sheets
Introduction to work processes

Temporary

Orientation
1 x 2 hour session
Taught by Staffing Company Staff

General MACI/Staffing comp. policies
General Safety~20 minutes

✚

On the Job Training
Intro to quality
Defects
Standardized work

Regulatory Training

Production Control

Facilities

Safety

All records kept by HR

Development Training

Classes budgeted for and scheduled by each department as needed

Computer Training
Example: Excel

Technical Training
Example: Denso Robot

Other Training
Example: Blue Print Reading

All classes held in MACI Hall/Meeting Rooms

Held at outside vendor location

Training Department Created July 2014

Safety Dojo

New Hire Orientation Room

Computer Lab

Technical Training Room

Green=Change Points

Great

New Hire Training

Associate

Orientation

1 X 40 hour week vs.19.5 hours previously

Taught by Training Dept. & HR

- Safety-8hrs
- Quality check sheets
- Gauging
- Defect training
- Introduction to work processes
- General MACI policies and procedures
- Benefits

✚

On the Job Training

Temporary

Orientation

1 X 8 hour day vs 2 hours previously

Taught by Training Dept.

- Safety-2hrs
- Intro to quality
- Defects
- Standardized work
- 5S
- General MACI/Staffing Comp. Policies

✚

On the Job Training

Regulatory Training

Training Department

All records kept by Training Department

Development Training

Classes developed in house and given by Training Department Staff

Computer Training

Excel Levels 1-4, PowerPoint 1 & 2

Technical Training

Denso Robot, PLC, Fanuc, Vision System
Robo Drill, Vision System & more

Other Training

Blue Print Reading, GD & T, Problem Solving
Quality Control Circle & more

Held at MACI

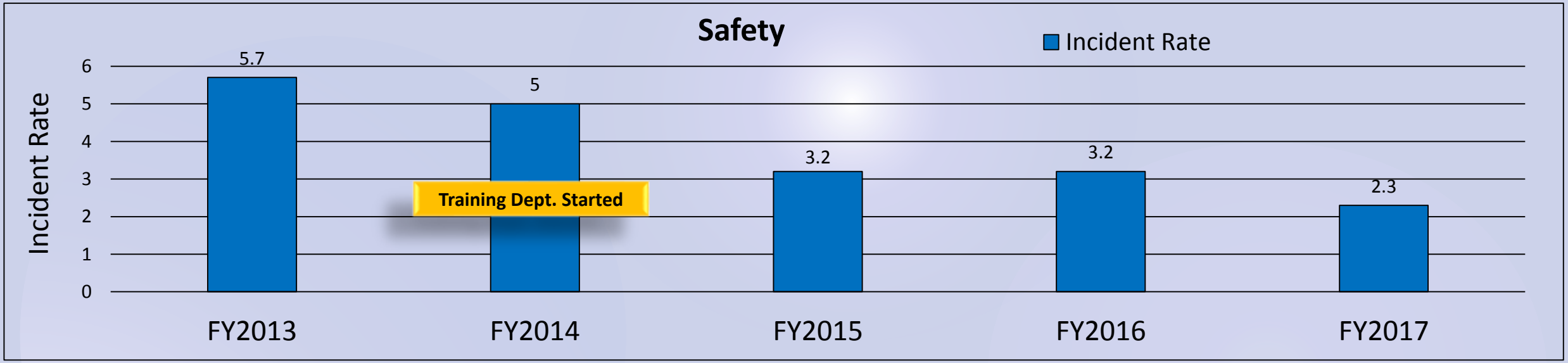
Classes budgeted for and scheduled by each department as needed

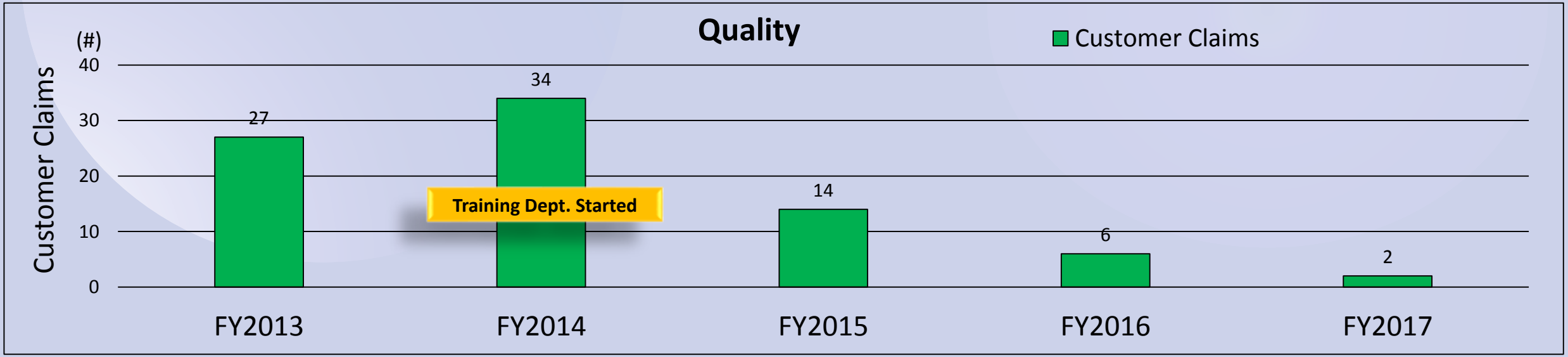
Check: Should this training be developed and given in house?

Held at outside vendor location

All classes held in dedicated training space

Safety and Quality Results



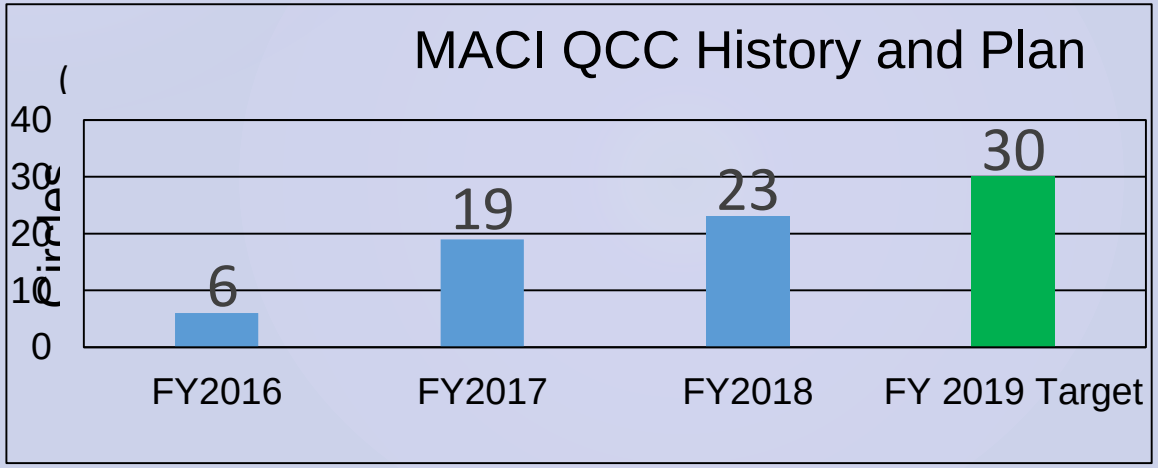


Quality Control Circle(QCC)

What is QCC?

- A small Group of 3-10 associates that meet on a regular basis to tackle work related problems.
- Associate through Team Leader Level from floor and office associates.
- Use an 8 step problem solving process.
- Main goal of the activity is associate skill development.

8 Steps of QCC
Step 1-Organize the Circle
Step 2-Theme Selection
Step 3-Define the Situation
Step 4-Analyze Cause
Step 5-Examine and Implement Countermeasures
Step 6-Check Results
Step 7-Standardize and Establish Control
Step 8-Reflections and Future Plan



- 23 Circles presented at MACI internal competition on August 7-8.
- 138 total Associates participated in 2018-with representation from ~90% of all MACI Departments
- Rotor Rulers II-1st place in FY 2017 and 2nd place in 2018

2018 MACI Quality Control Circle Team

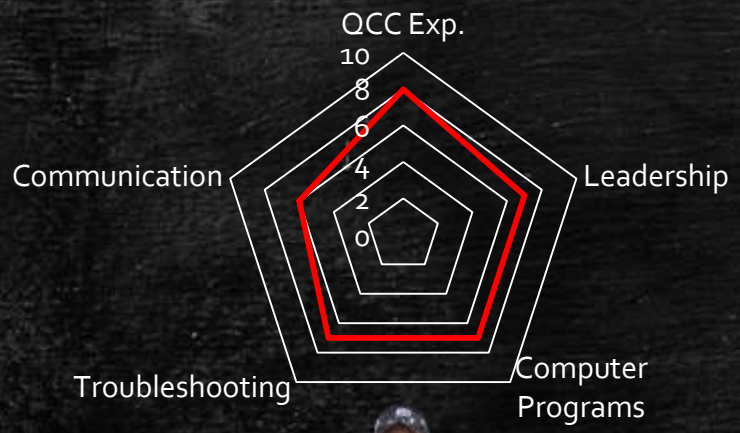
ROTOR RULERS

2017 QCC Award Winner

RADAR CHARTS

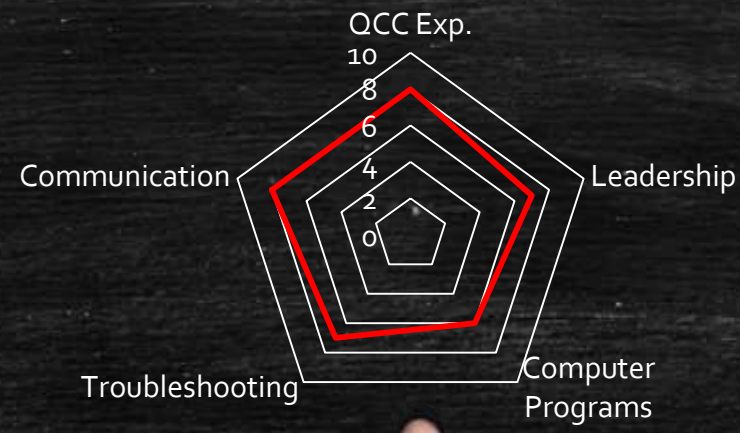
Team Leader

Scott



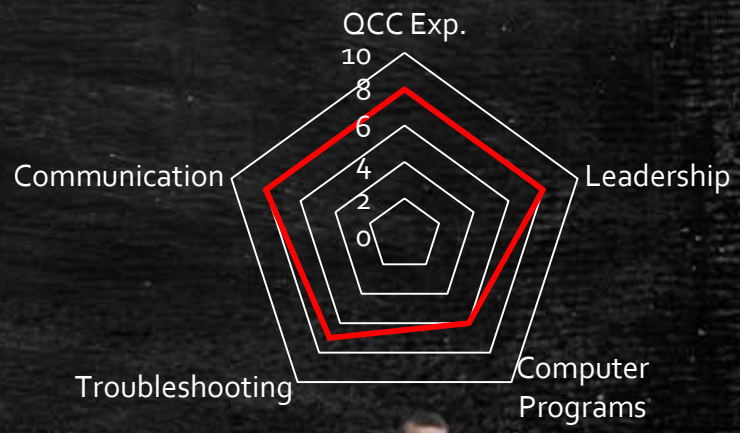
Asst. Team Leader

Adam



Statistician

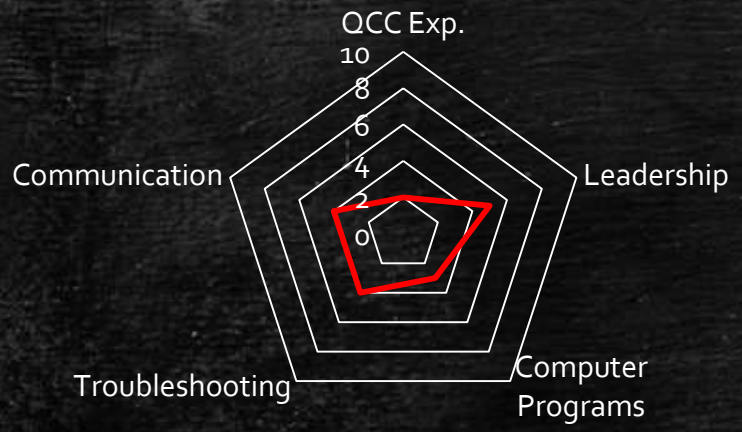
Kirk



RADAR CHARTS

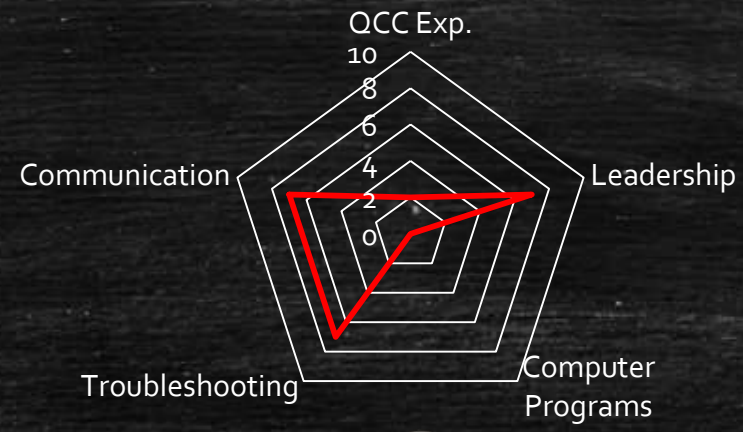
Investigator

Chase



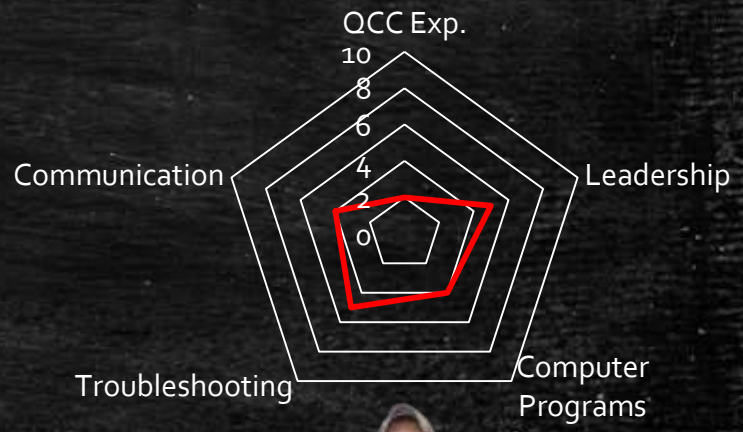
Investigator

Kryscie

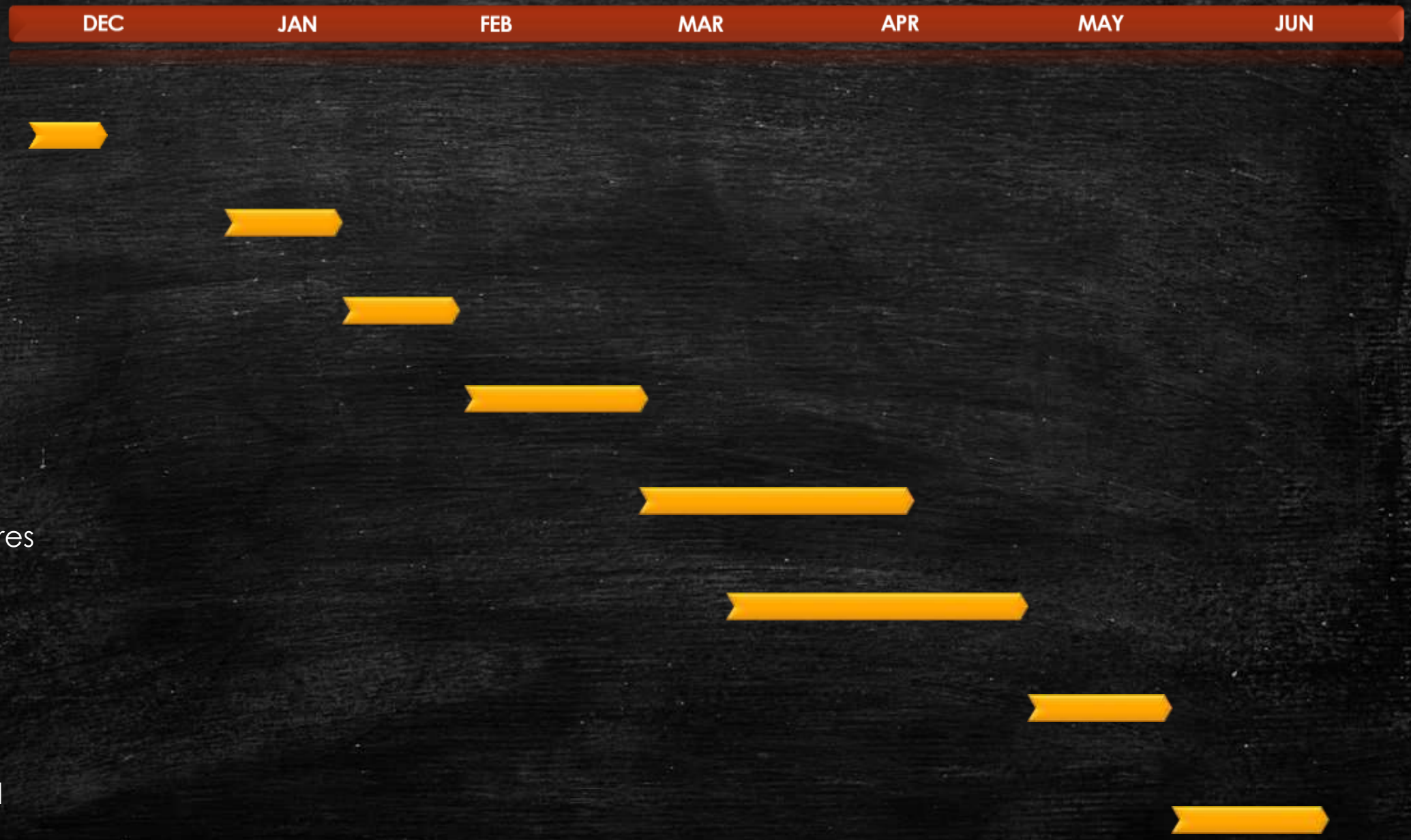


Investigator

Tyler



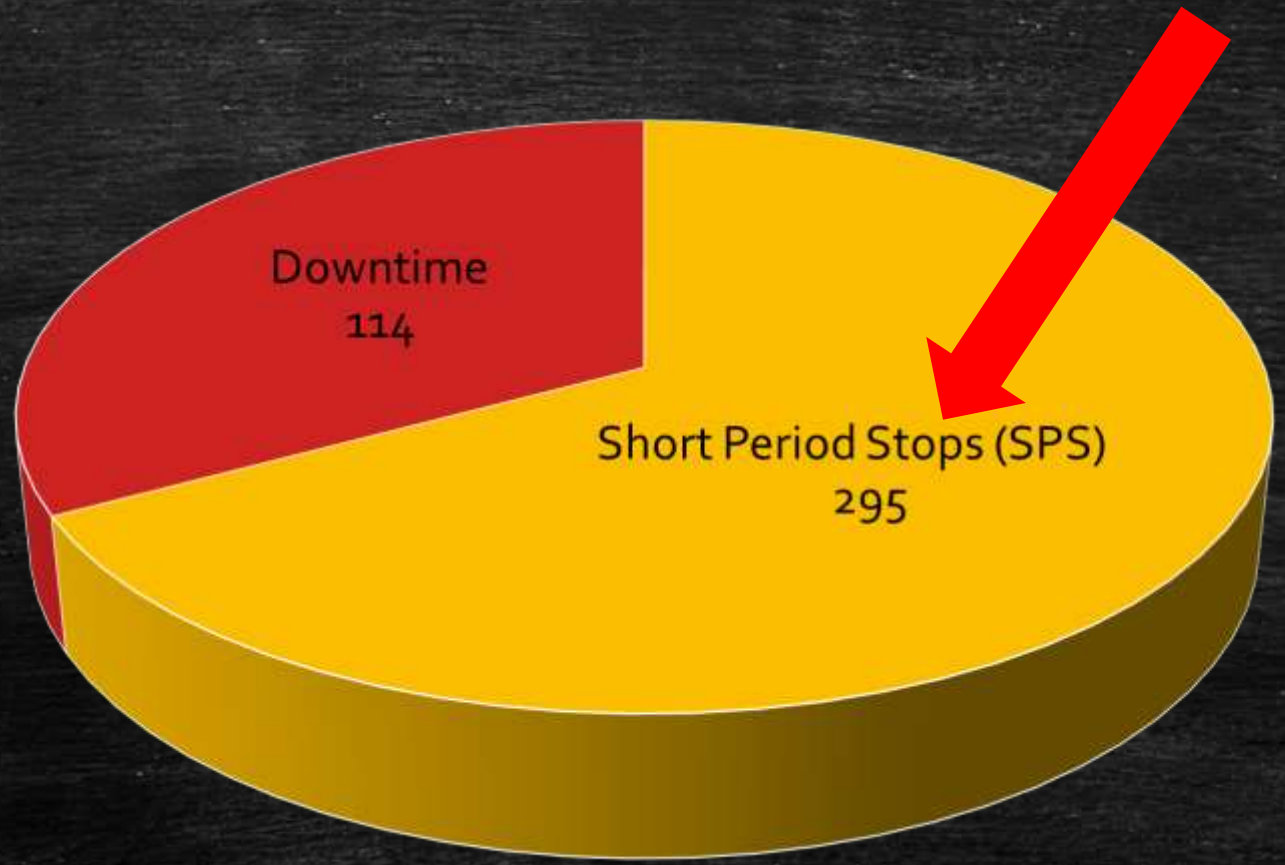
GANTT CHART


DEC
JAN
FEB
MAR
APR
MAY
JUN
Organize The Circle
Theme Selection
Define The Situation
Analyze The Cause
Examine and Implement Countermeasures
Check Results
Standardize and Establish Control
Reflections and Future Plans

GENCHII GENBUTSU

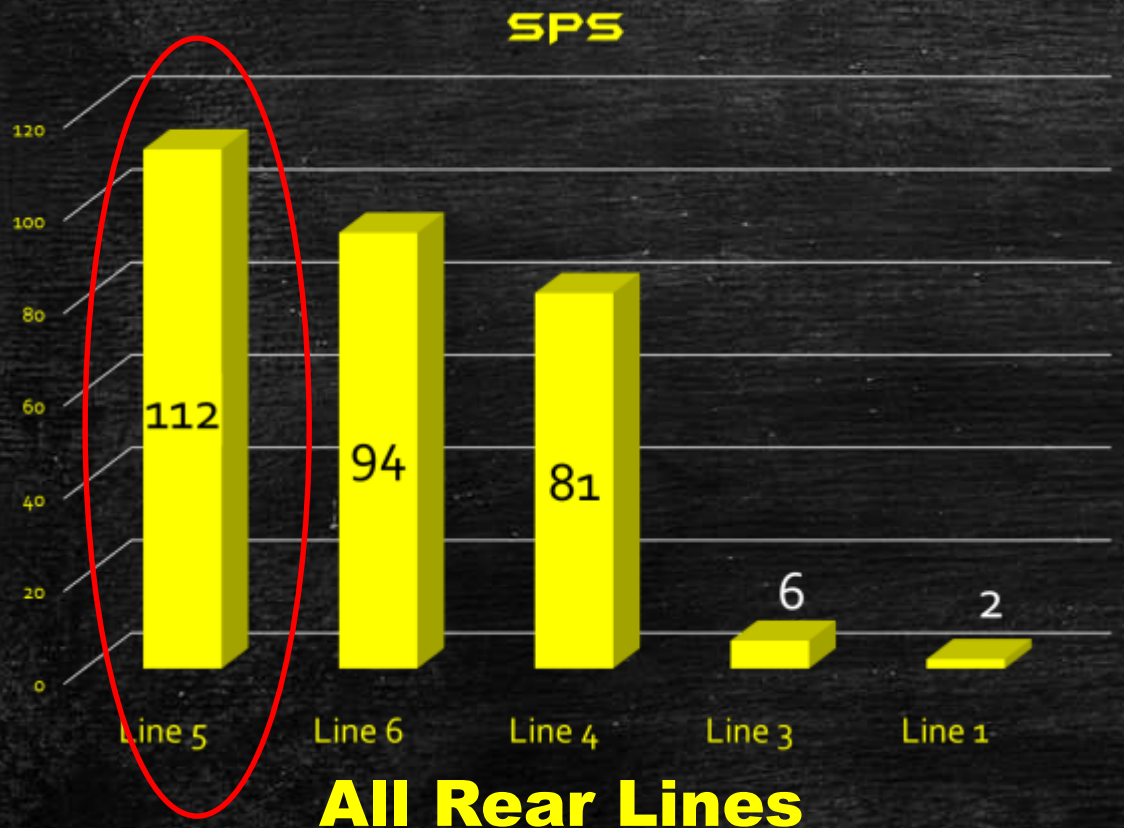
GO AND SEE

DOWNTIME VS SHORT PERIOD STOPS

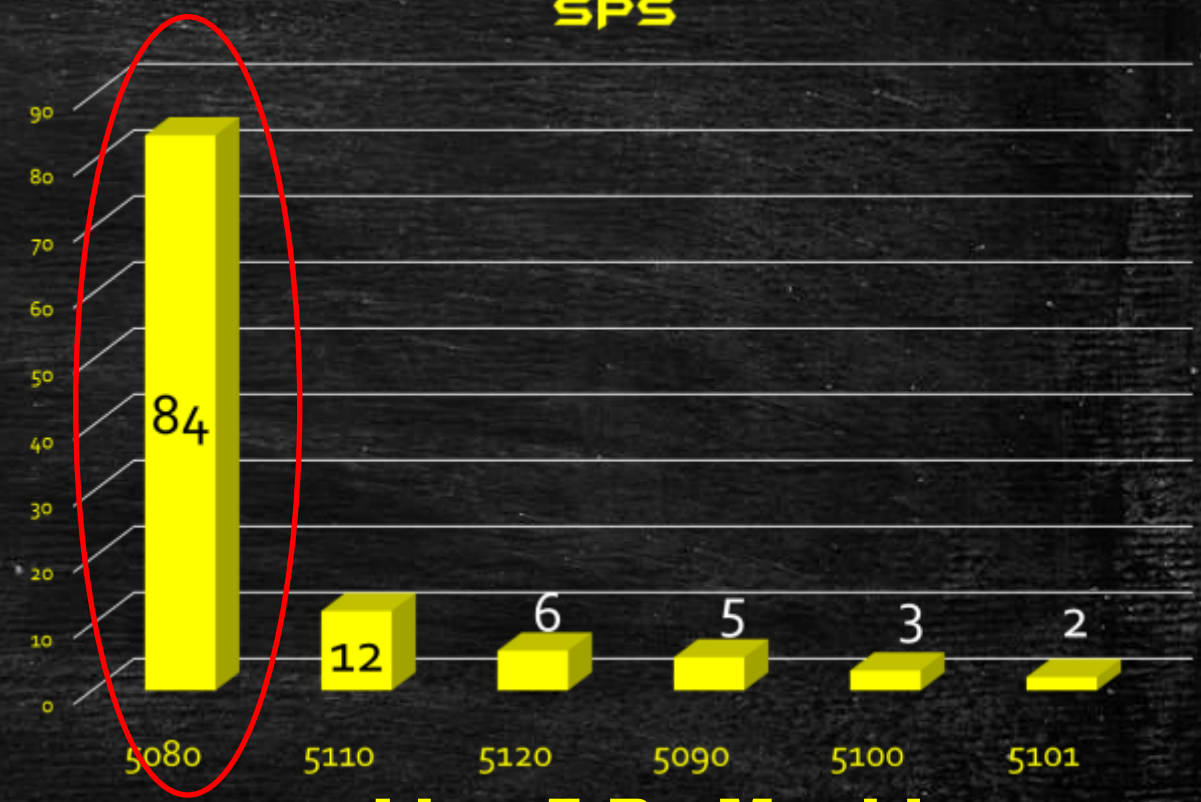


Oct-Dec 2017
Number of Sps/Downtime Occurrences

SHORT PERIOD STOPS



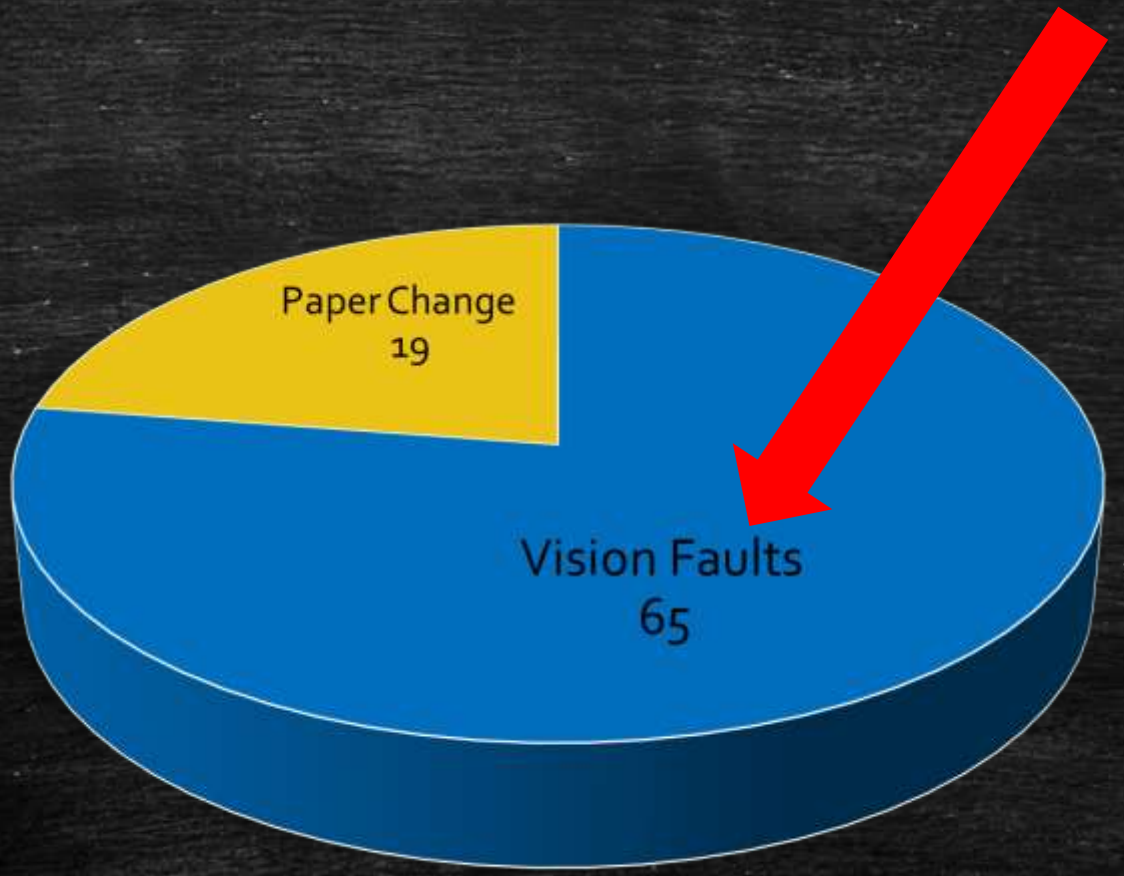
All Rear Lines



Line 5 By Machine

Oct-Dec 2017
Number of SPS Occurrences

SHORT PERIOD STOPS

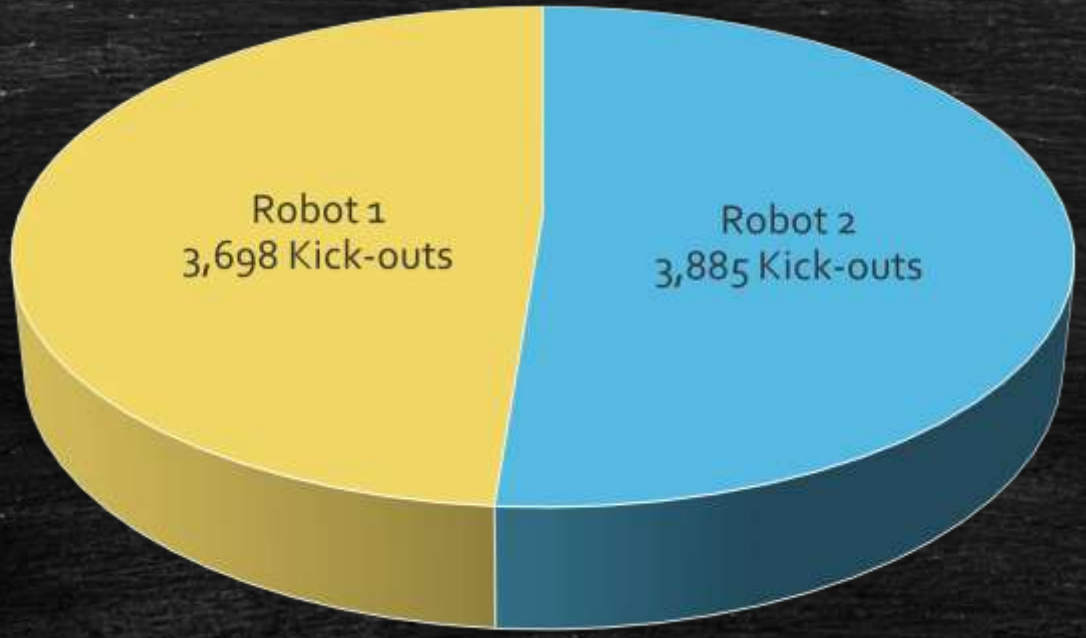


Line 5 5080

Oct-Dec 2017
Number of SPS Occurrences

VISION KICK-OUTS

Vision Kick-Outs Cause Vision Faults



7,583 Kick-outs
130 per day average

Number Of Vision Kick-Outs For Line 5 Blue Shift Oct-Dec 2017

MACRO TO MICRO

Too many short period stops

Rear line 5 has the most short period stops

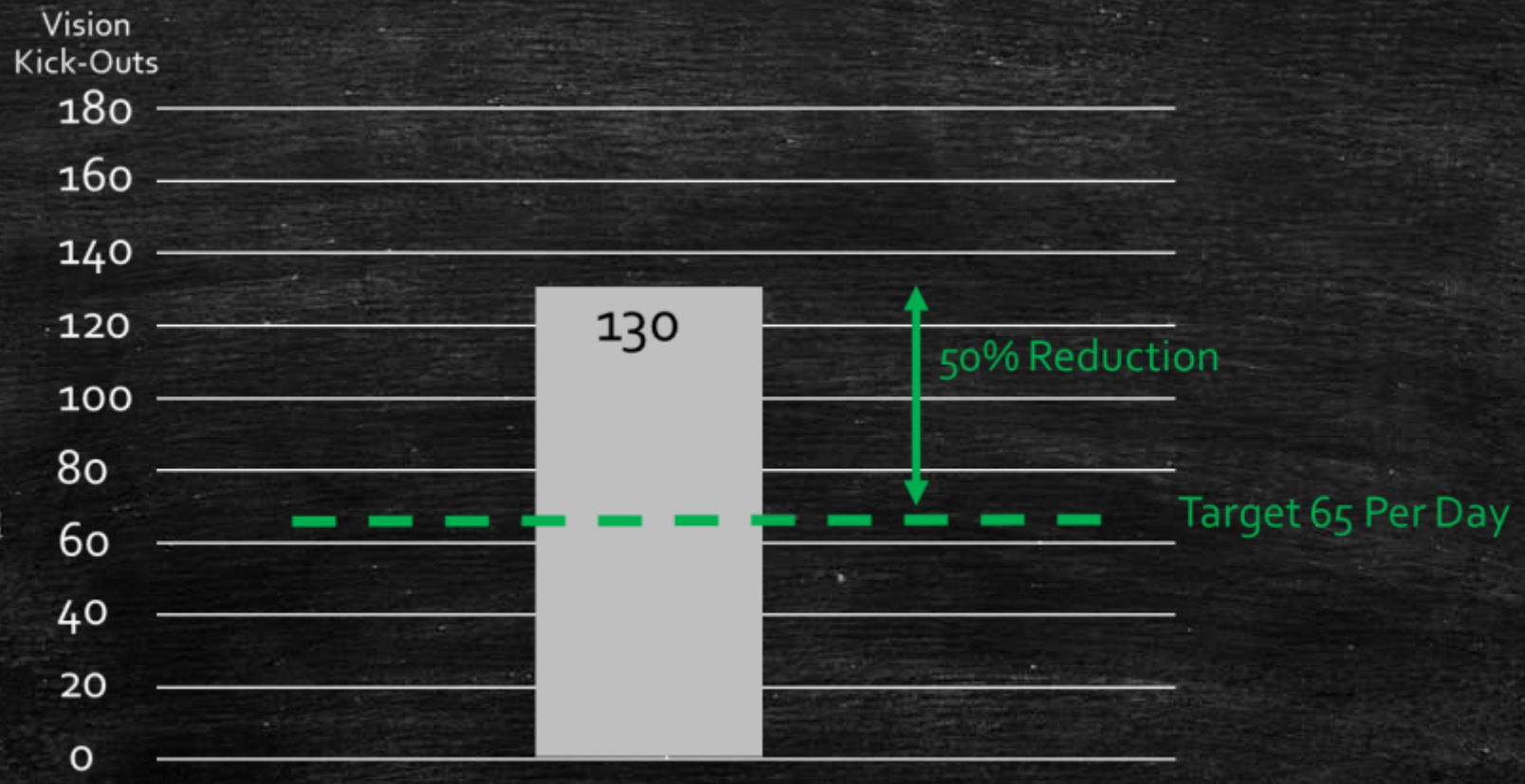
RO-5080 has the most short period stops on line 5

Vision faults are the highest cause of short period stops

Vision kick-outs cause vision faults

Theme = reduce vision kick-outs on RO-5080

REAR ROTOR LINE 5



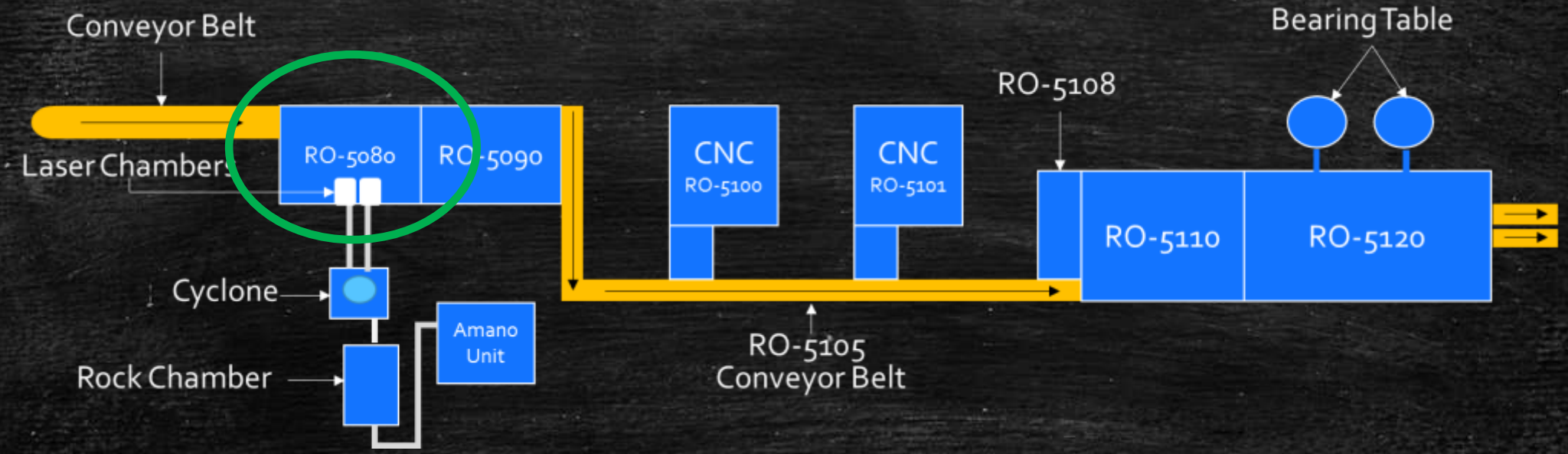
TARGET: 50% Reduction of Vision Kick-Outs by May 1st

REAR ROTOR LINE 5

ROTOR

Finished rotor on a MACI compressor

REAR ROTOR LINE 5



REAR ROTOR LINE 5

Rotor At The Beginning
Of Our Process

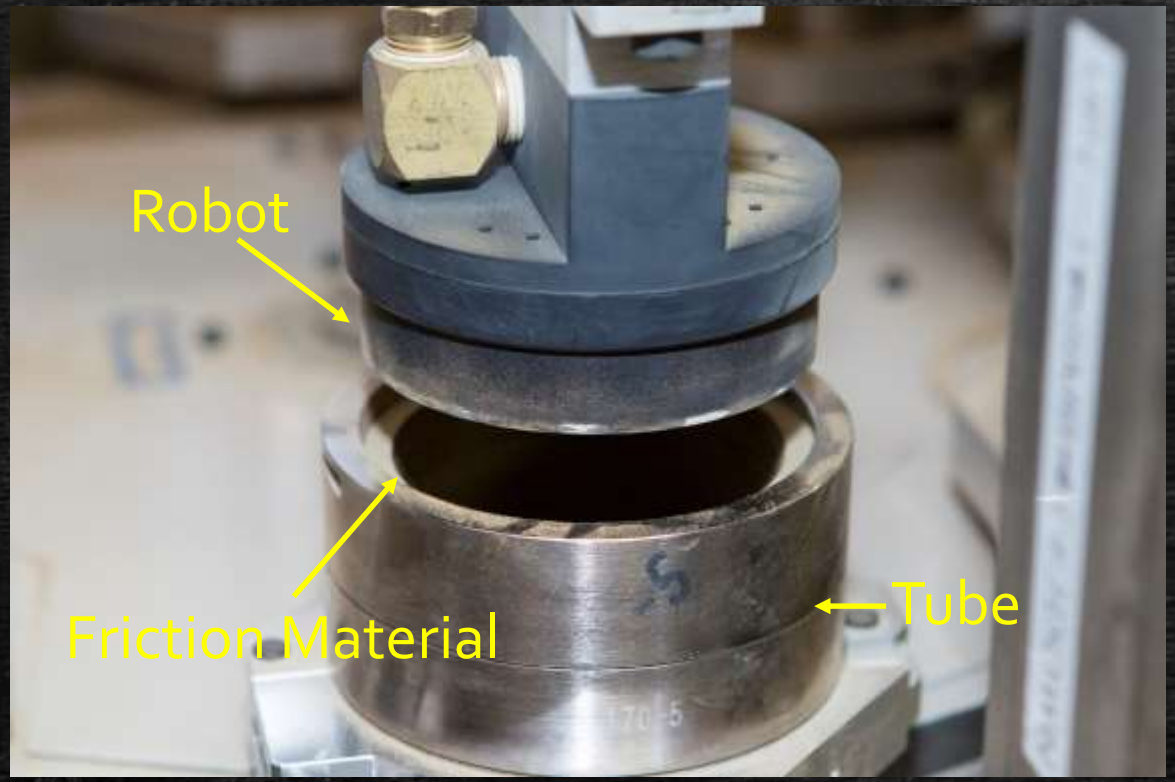
REAR ROTOR LINE 5

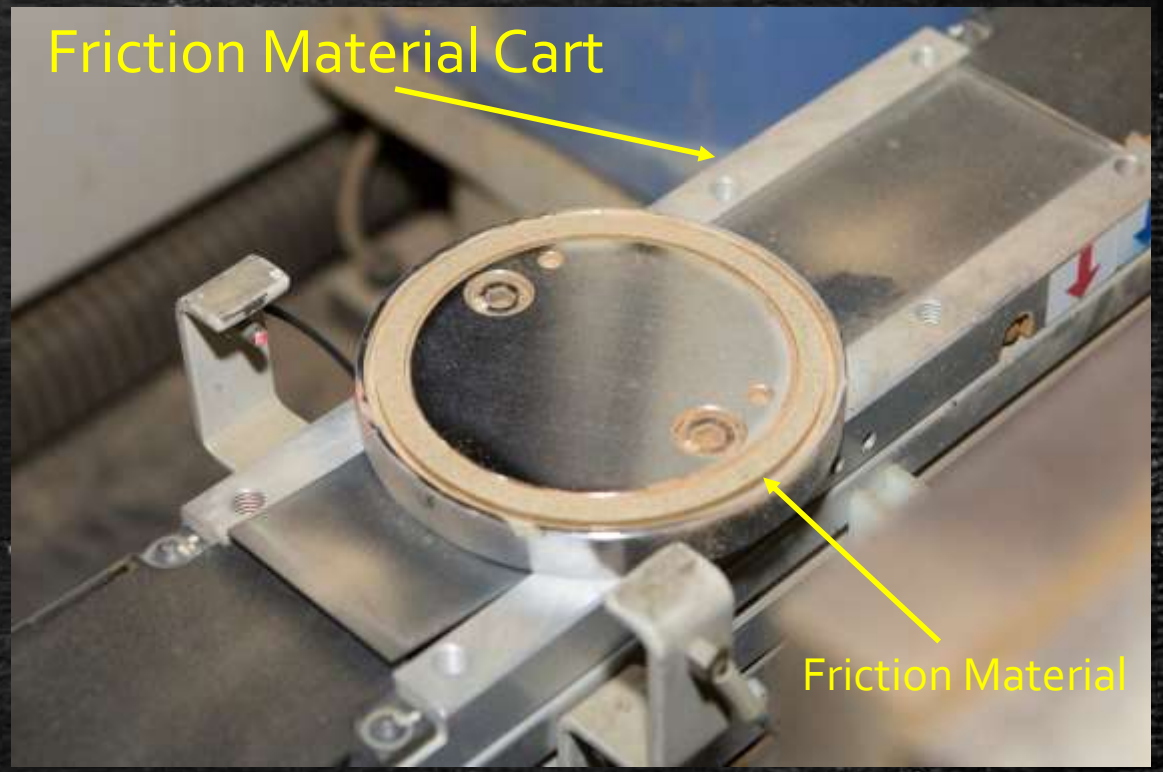
Associate loads Friction Material into Tube chamber

REAR ROTOR LINE 5

Associate loads rotor on the conveyor belt

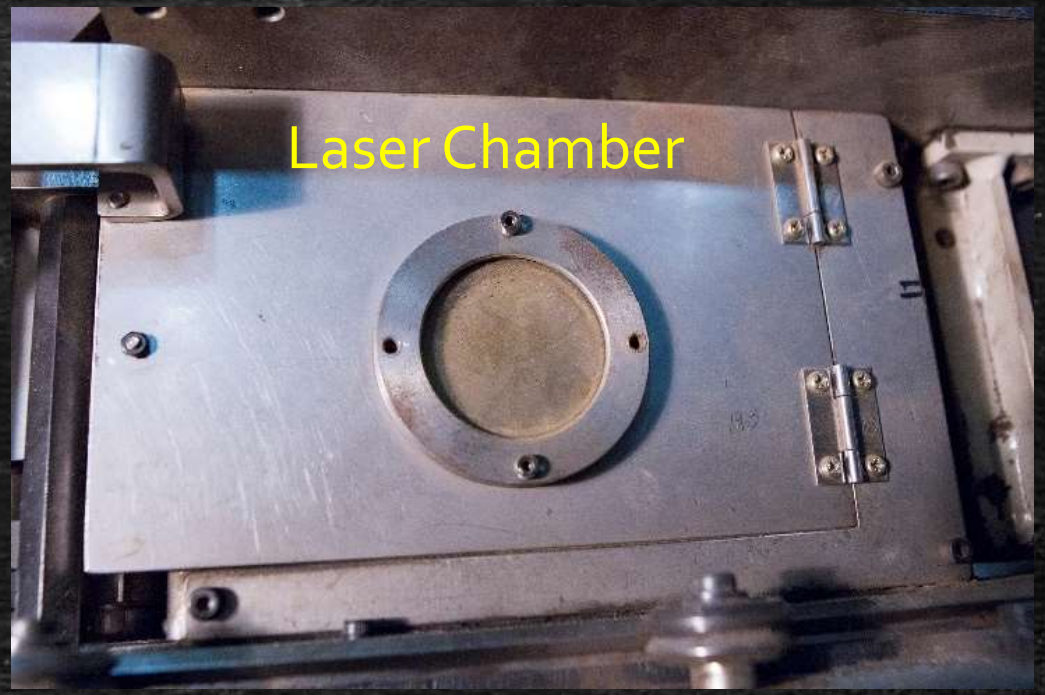
REAR ROTOR LINE 5





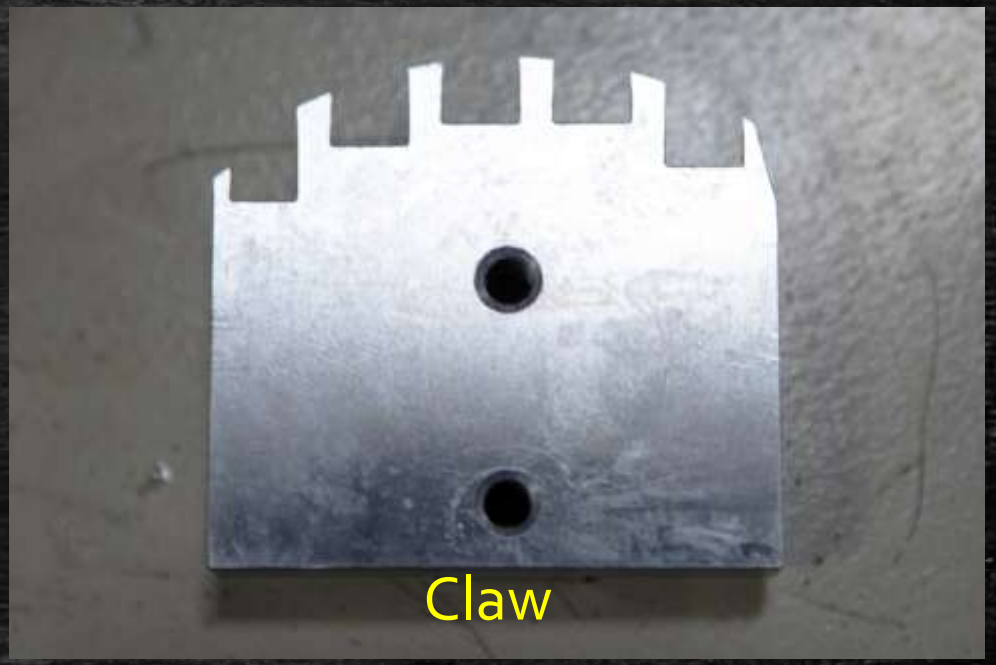
A Robot picks friction material from the tube and loads it on the friction material cart

REAR ROTOR LINE 5



One of two robots will then pick the friction material off the cart and take it into a laser chamber to apply permacel tape to the friction material.

REAR ROTOR LINE 5



While inside the laser chamber, the laser cuts the permacel tape into four pieces and a claw is used to pull the cut pieces into position on the friction material while the robot head rotates.

REAR ROTOR LINE 5

After the permacel tape is applied, the robot then takes the friction material to the vision camera to be determined if the permacel tape is applied properly.

REAR ROTOR LINE 5

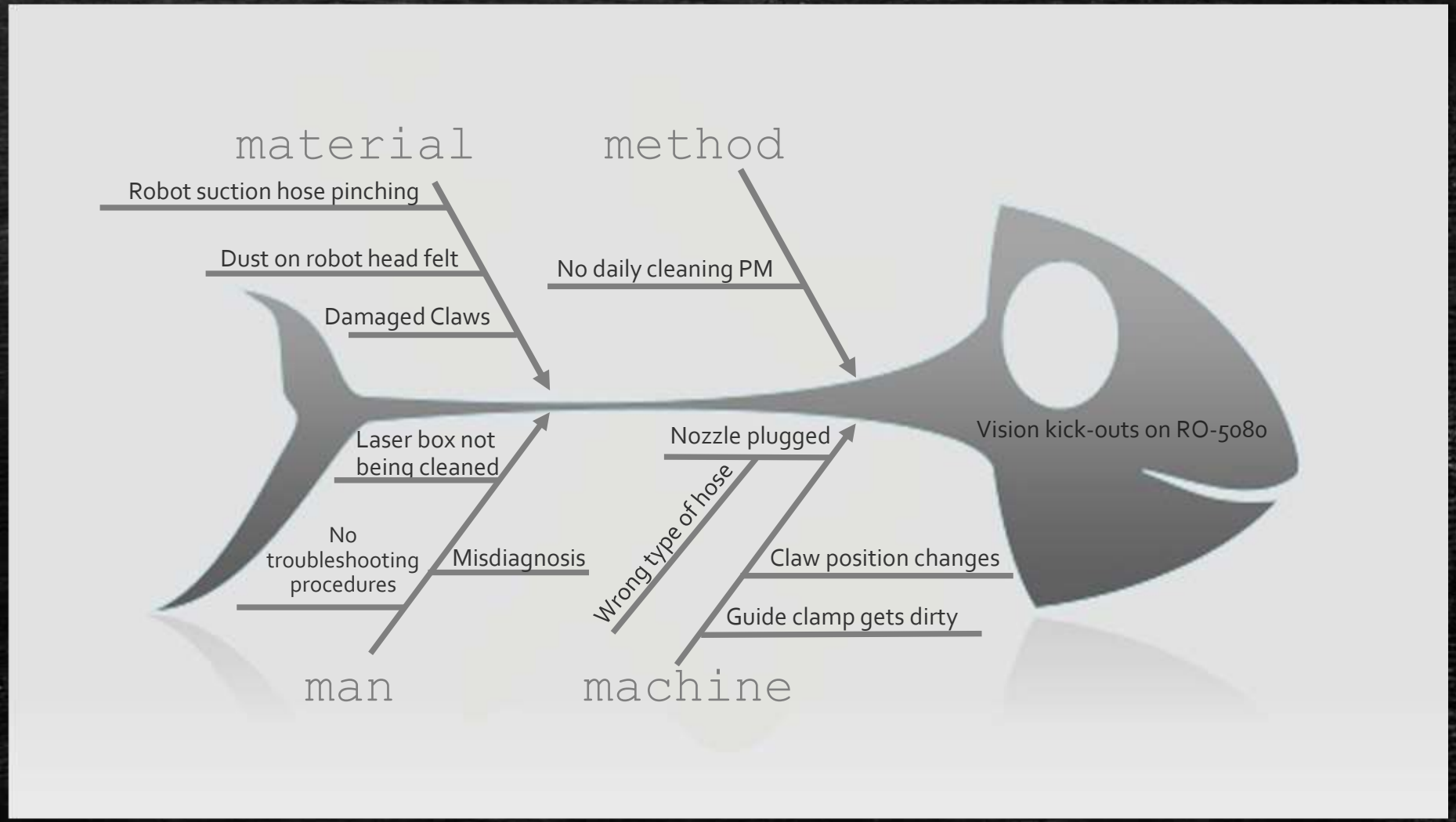
A good vision reading after being checked by the camera.

A rotor after the friction material is applied to it.

REAR ROTOR LINE 5

A NG vision reading after being checked by the vision camera.

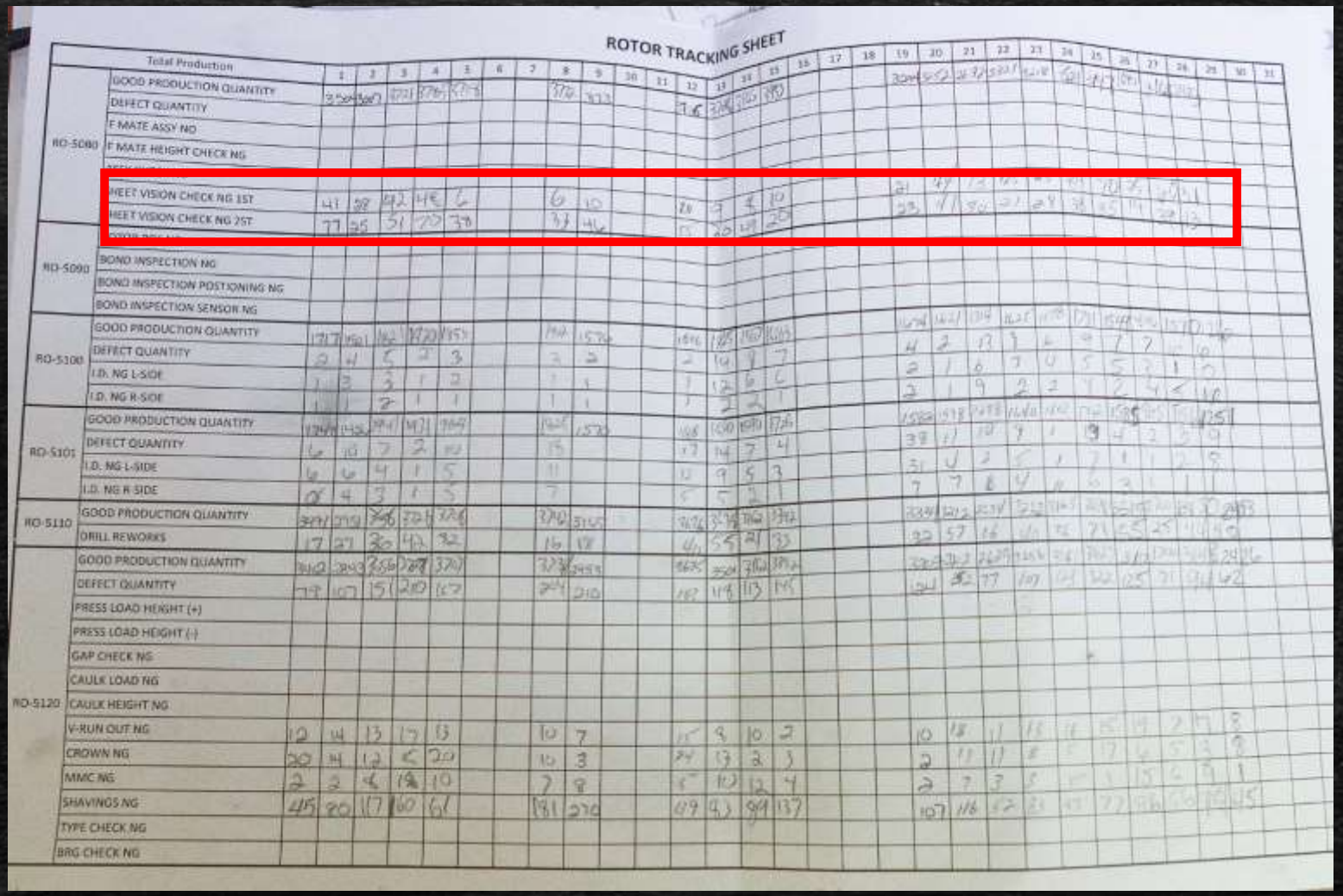
FISHBONE


material
method
Robot suction hose pinching
Dust on robot head felt
Damaged Claws
No daily cleaning PM
Laser box not being cleaned
No troubleshooting procedures
Misdiagnosis
Nozzle plugged
Wrong type of hose
Claw position changes
Guide clamp gets dirty
Vision kick-outs on RO-5080
man
machine

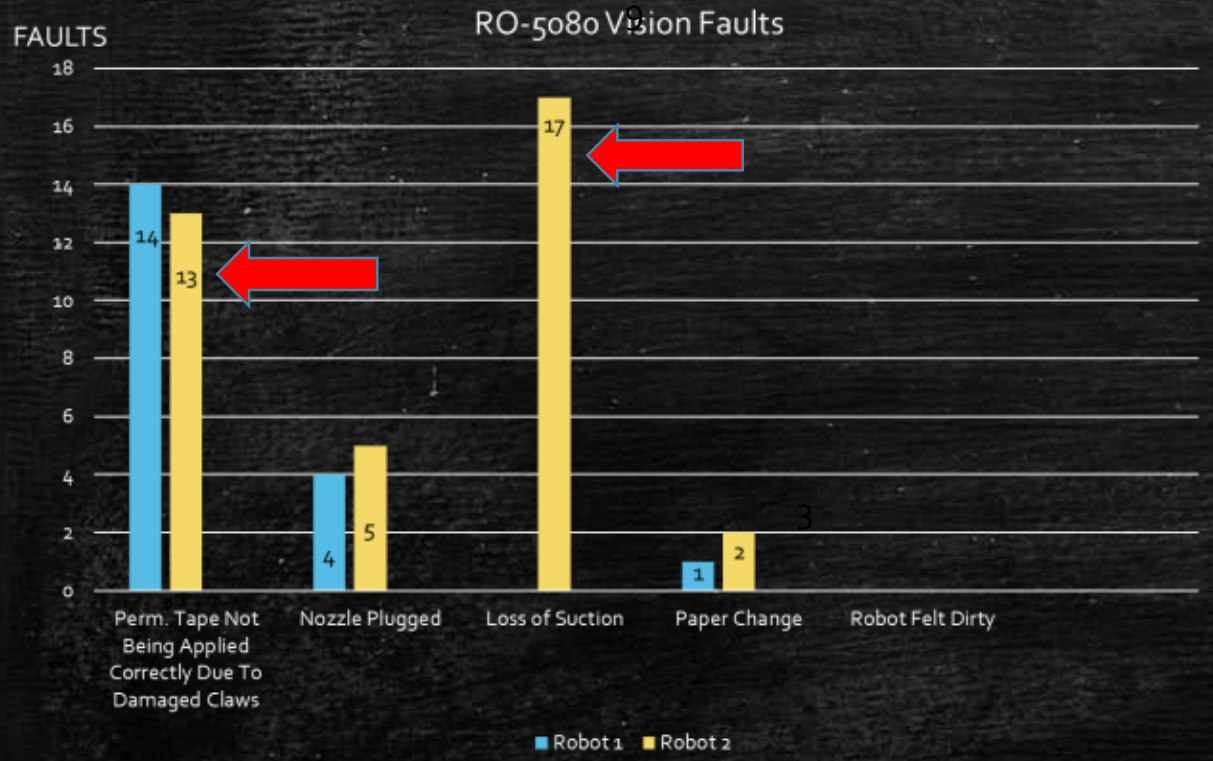
Plan

DATA COLLECTION

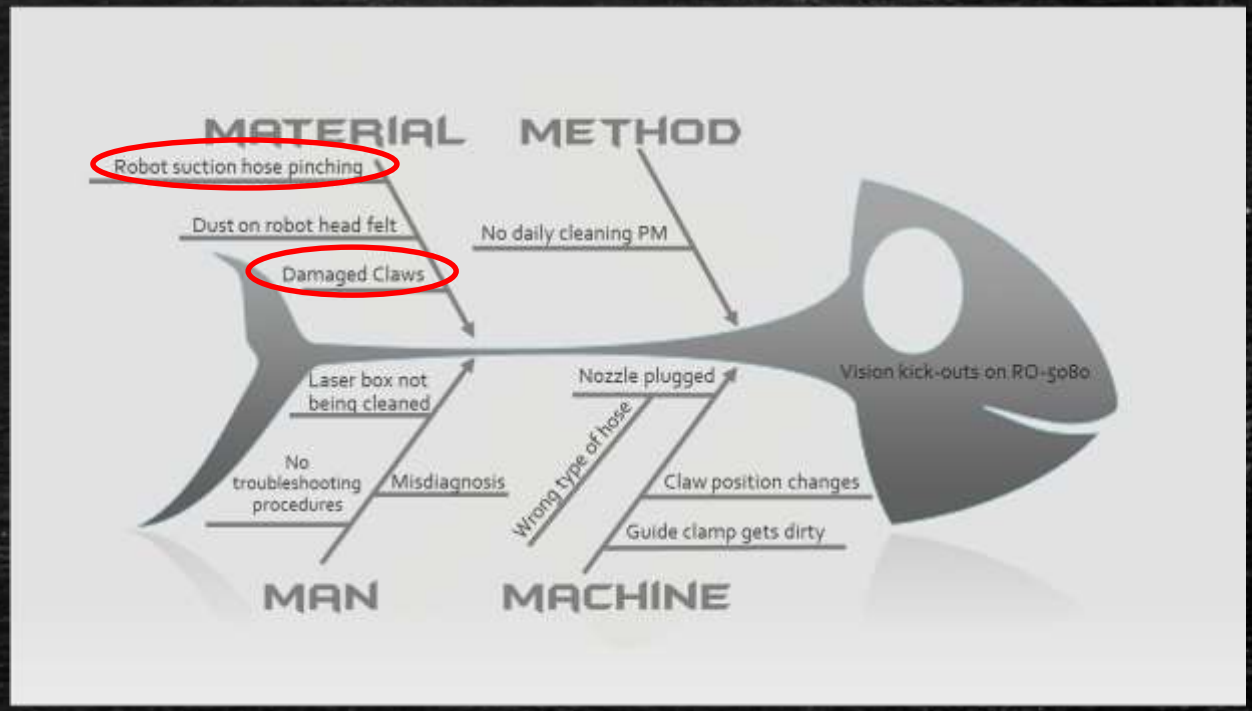
DATA COLLECTION



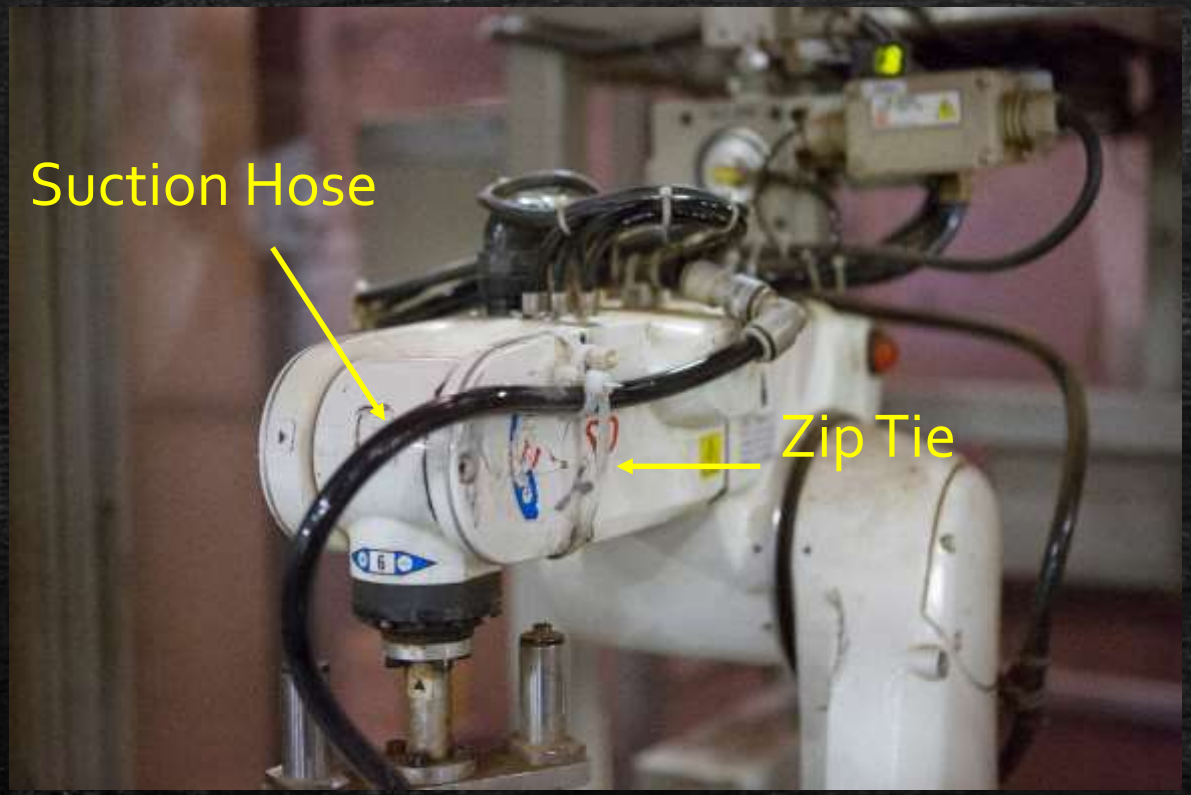
DATA COLLECTION

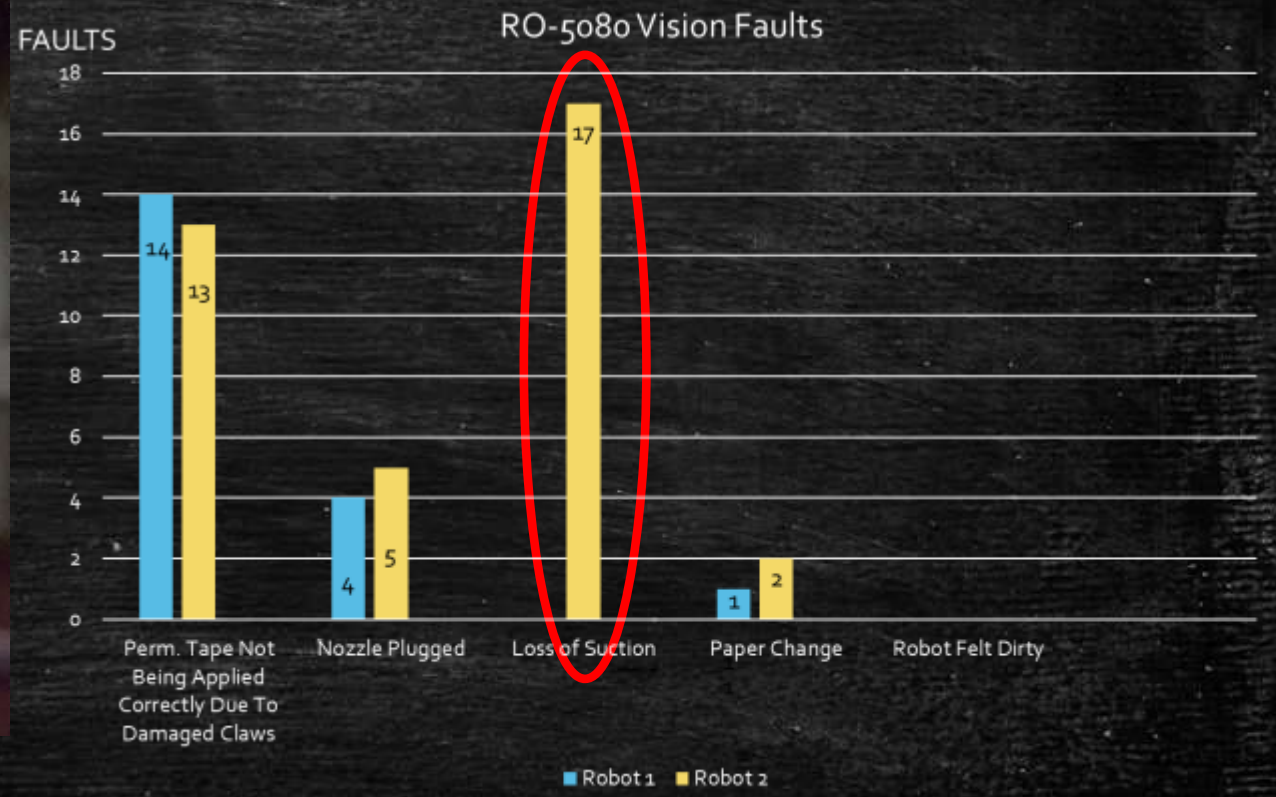


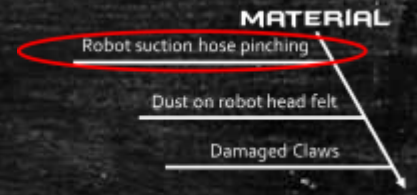
Jan 3rd – Jan 12th



ROOT CAUSE



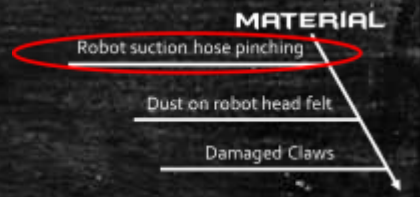




The suction hose on robot two is pinching causing a loss of suction that keeps the friction material in place.

Plan

5 WHY



VISION KICKOUTS ON RO-5080

WHY

FRICTION MATERIAL NOT STAYING ATTACHED TO THE ROBOT HEAD

WHY

ROBOT LOSING SUCTION THAT KEEPS THE FRICTION MATERIAL ATTACHED TO THE ROBOT HEAD

WHY

ROBOT SUCTION HOSE PINCHING

WHY

HOSE ISN'T ATTACHED TO THE ROBOT PROPERLY

WHY

THERE IS NO PERMANENT ATTACHMENT TO ATTACH THE HOSE TO THE ROBOT

ROOT CAUSE A

COUNTERMEASURES

Implemented January 12th

Countermeasure Ideas	Price	Lead Time For Test	Longevity	Effectiveness	Initial Score	Priority
Hose clip screwed into the robot permanently	●	●	▲	▲	16	1
More Rigid Hose that won't pinch.	✖	●	▲	▲	11	2

● = 5

▲ = 3

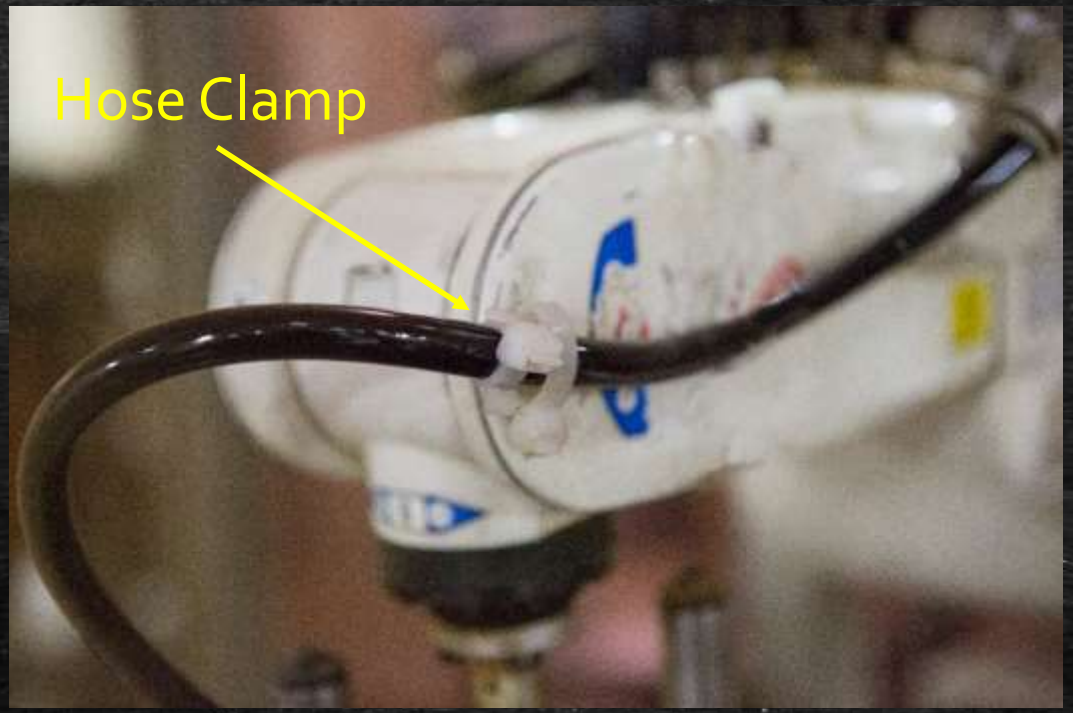
✖ = 0

Root Cause A

There is no permanent attachment to attach the hose to the robot

IMPLEMENTATION

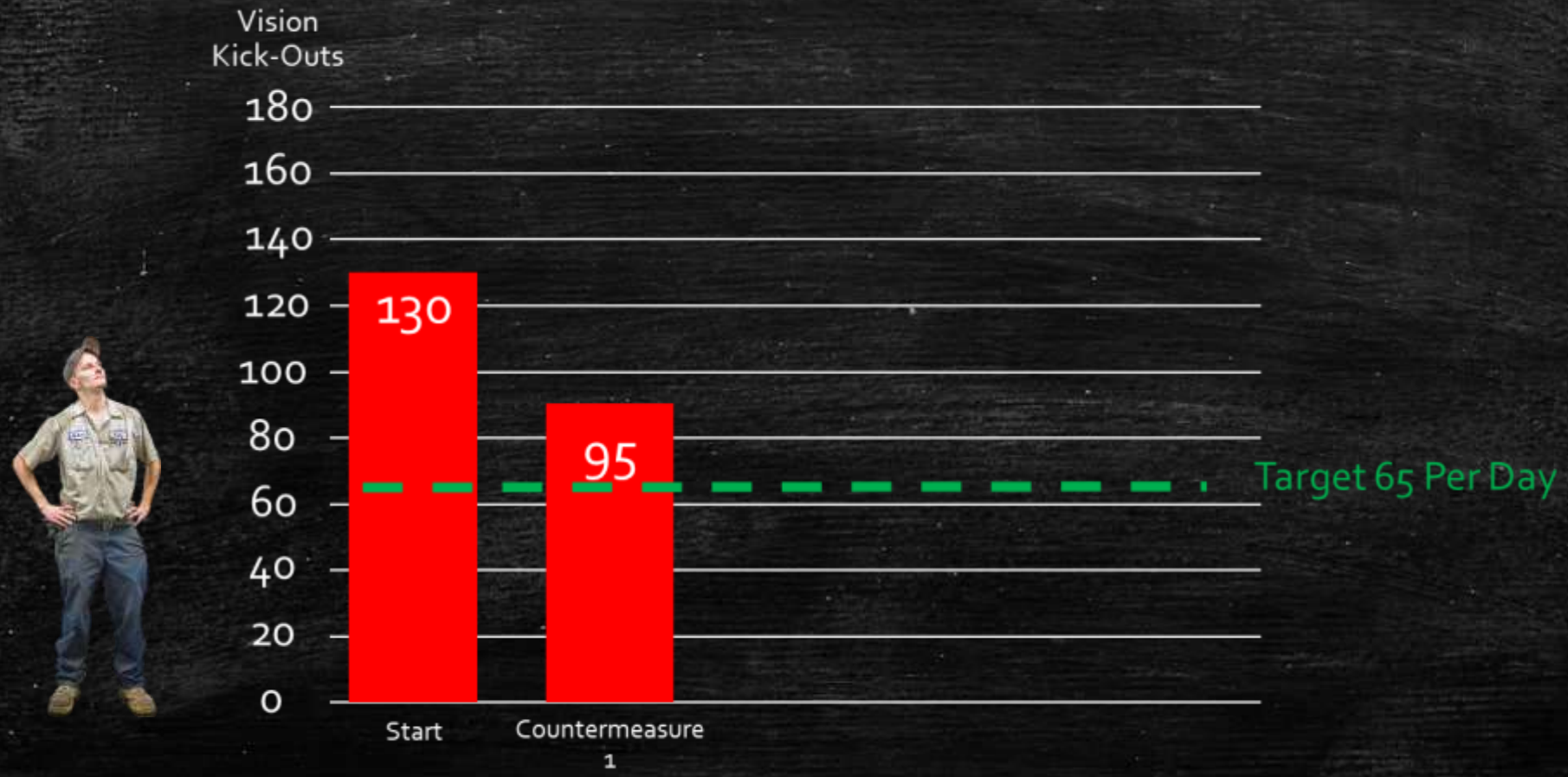
Countermeasure 1 For Root Cause A

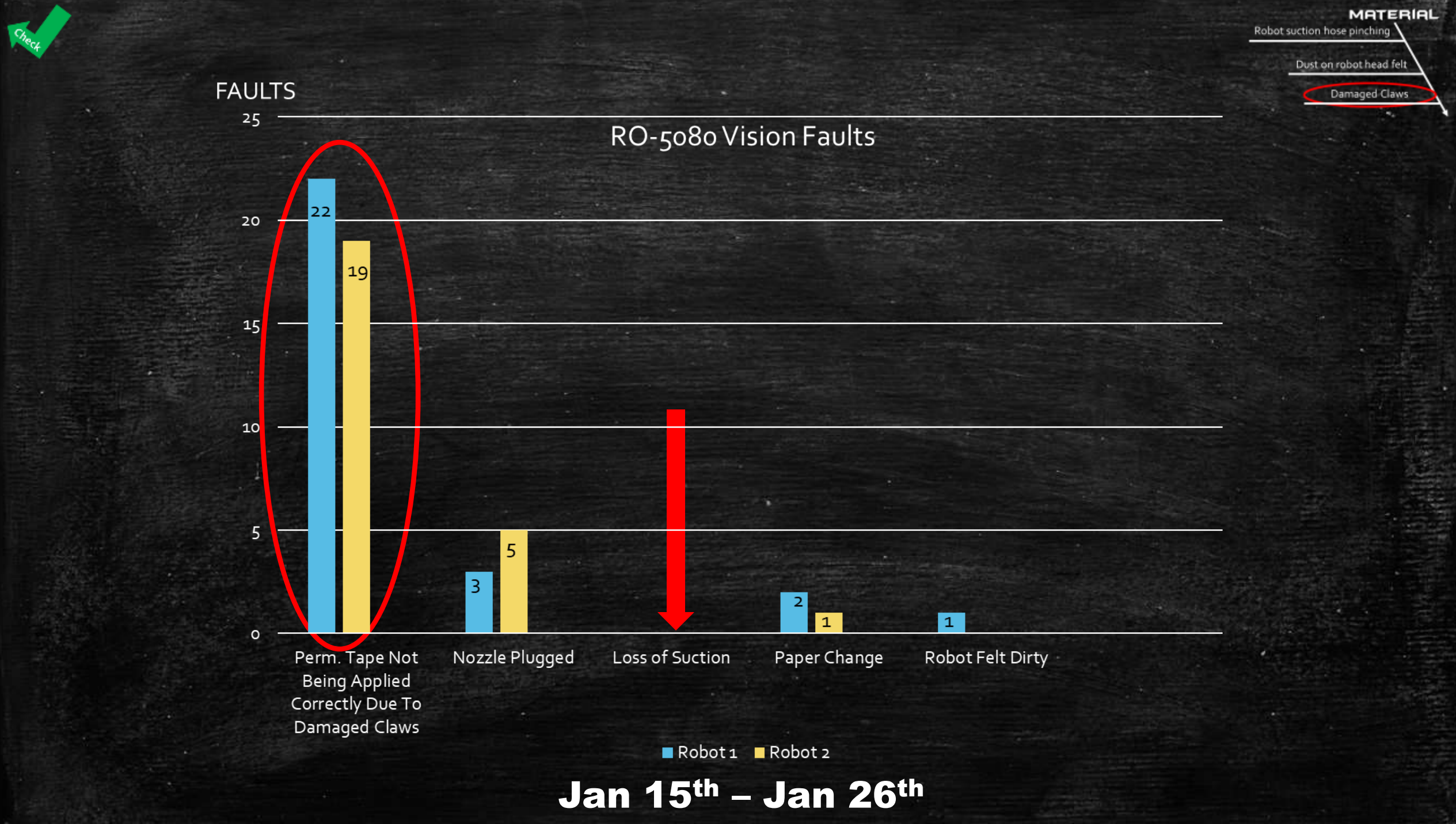


WHY	WHAT	WHEN	WHERE	WHO	HOW
Problem	Countermeasure	Due Date	Machine	P.I.C.	Implementation
There is no permanent attachment to attach the hose to the robot	Add Permanent Hose Clamp	Jan 11th	RO-5080 Robot 2	Scott	Attach hose clamp permanently to robot 2

RESULTS

Root Cause A
Countermeasure 1
Jan 15th – Jan 26th




Check
MATERIAL
Robot suction hose pinching
Dust on robot head felt
Damaged Claws
FAULTS
RO-5080 Vision Faults
25
20
15
10
5
0
22
19
3
5
2
1
1
Perm. Tape Not Being Applied Correctly Due To Damaged Claws
Nozzle Plugged
Loss of Suction
Paper Change
Robot Felt Dirty
Robot 1
Robot 2
Jan 15th – Jan 26th

ROOT CAUSE

MATERIAL
Robot suction hose pinching
Dust on robot head felt
Damaged Claws

Claws aren't being cleaned properly. Associates use a grinding stone, wire brushes and sandpaper to clean claws which damages the claw.

Plan

5 WHY

MATERIAL
Robot suction hose pinching
Dust on robot head felt
Damaged Claws

VISION KICKOUTS ON RO-5080

WHY

PERMACEL TAPE IS NOT BEING APPLIED CORRECTLY TO THE FRICTION MATERIAL

WHY

THE CLAW ISN'T GRABBING THE PERMACEL TAPE CORRECTLY

WHY

THE FINGERS ON THE CLAWS ARE GETTING WORN DOWN, BENT, OR GROOVES FORMING ON THE CLAWS ALLOWING LASER DUST TO BUILD UP FASTER ON THE CLAWS

WHY

TOOLS BEING USED TO CLEAN CLAWS ARE DAMAGING THE CLAWS

WHY

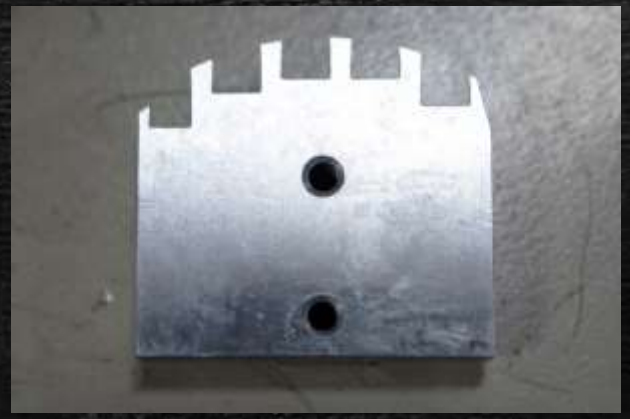
THERE ARE NO OTHER TOOLS OR METHODS TO CLEAN THE CLAWS

ROOT CAUSE B

COUNTERMEASURES

Instead of using grinding stone and wire brushes to clean the claws, we can let the claws sit in a cleaning solution overnight and clean with a toothbrush the next day

Implemented February 9th



Countermeasure Ideas	Price	Lead Time For Test	Longevity	Effectiveness	Initial Score	Priority
Soak Claws in Water	●	●	▲	✖	13	3
Soak Claws in Alcohol	●	●	▲	✖	13	2
Soak Claws in Acetone	●	●	▲	▲	16	1

● = 5

▲ = 3

✖ = 0

Root Cause B

There are no other tools or methods to clean the claws

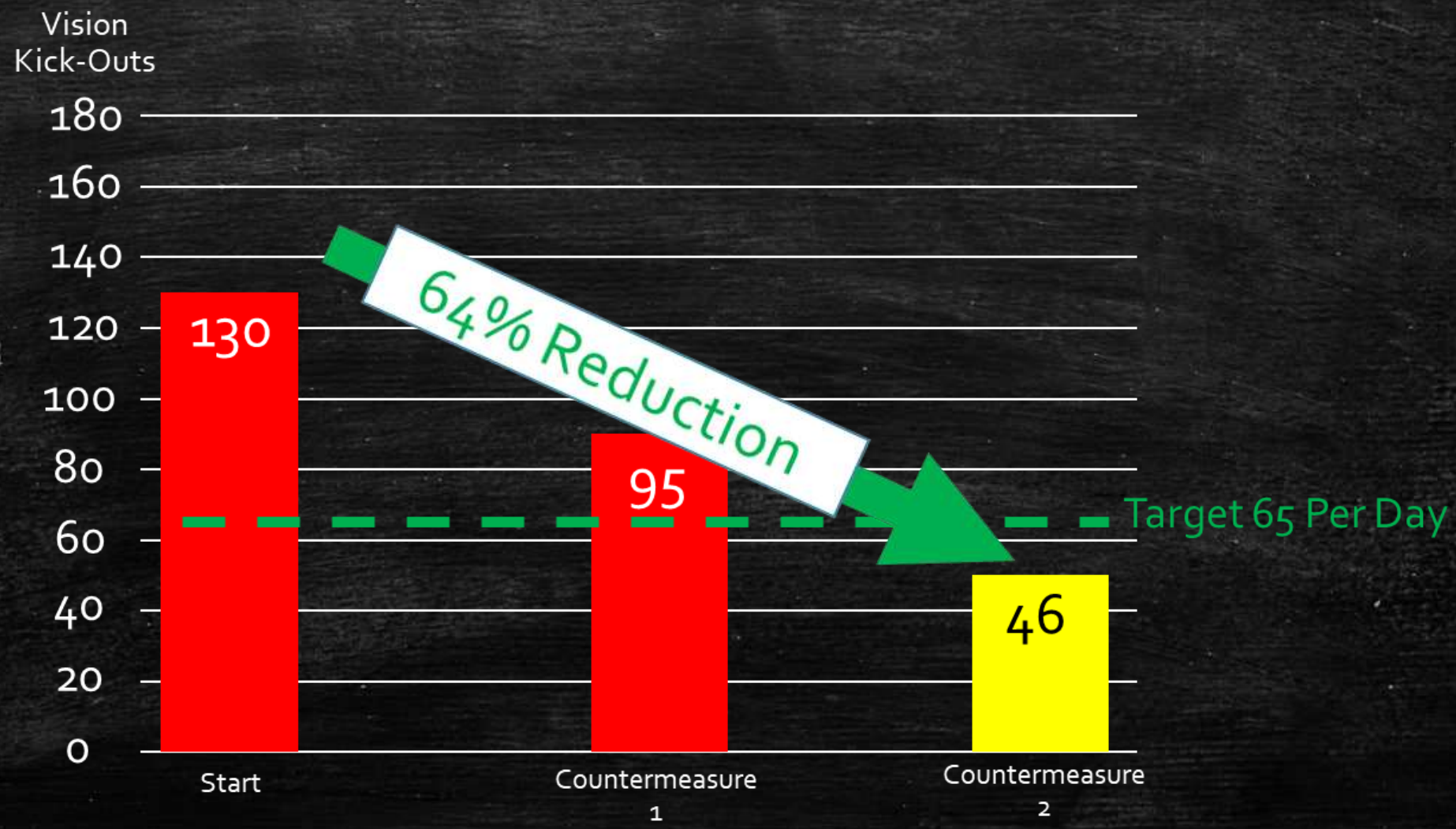
IMPLEMENTATION

Countermeasure 2 For Root Cause B

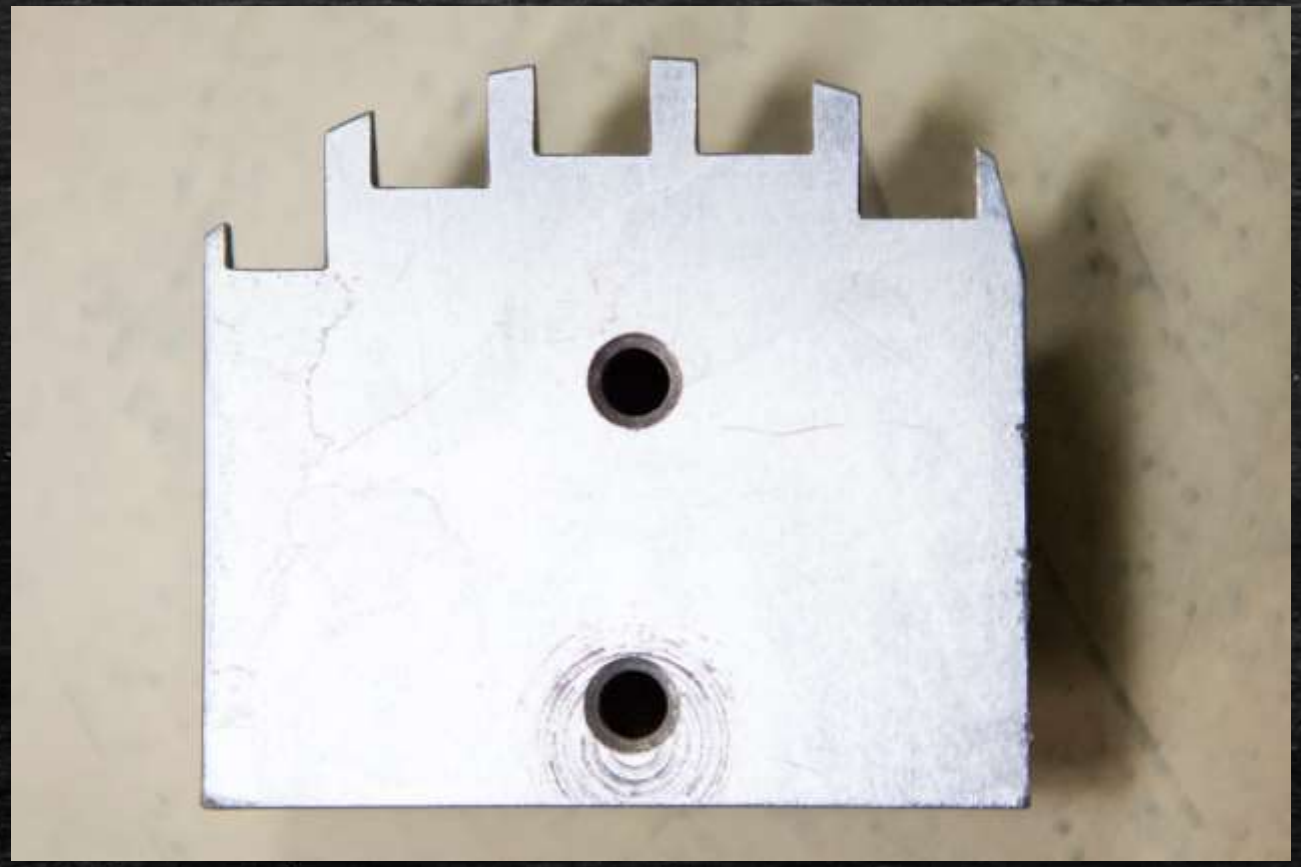
WHY	WHAT	WHEN	WHERE	WHO	HOW
Problem	Countermeasure	Due Date	Machine	P.I.C.	Implementation
There are no other tools or methods available to clean the claws	Find better way to clean claws	Feb 9th	RO-5080	Kryscie	For Claws

RESULTS

Feb 12th – Feb 23rd



RESULTS



Claw After Three Months Using New Cleaning Method

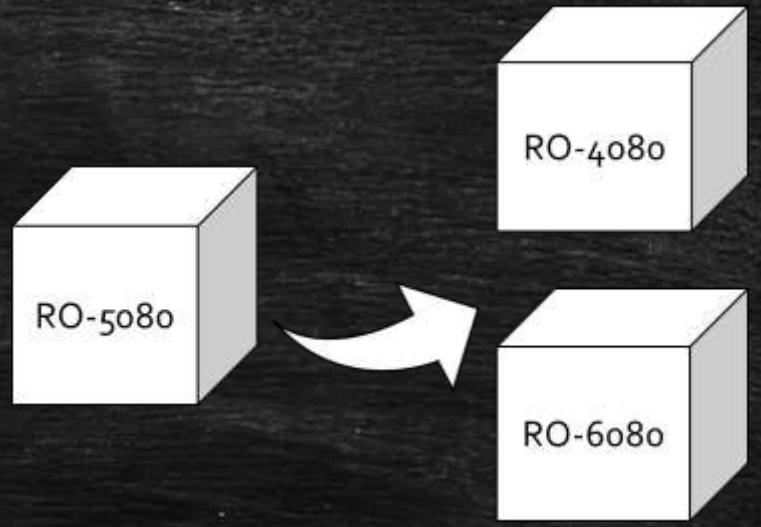
TRAINING PROCEDURE

RO5 - 080 Training Sheet

RO-5080 Laser Box/Claw Clean-Up Procedure

No.	Picture	Process Flow	Key Points
1		Open the door to one of the laser boxes on the backside of the machine.	Always use your life tag.
2		Use a allen wrench to remove the claw.	
3		Use a soft bristled toothbrush to clean the clamp and bolts.	Never use a wire brush, honing stone, sandpaper, grinder or any abrasive tool as it can cause damage.
4		Remove the vacuum hose and nozzle.	
5		Use acetone and soft toothbrush to clean out the vacuum nozzle.	Never use a wire brush, honing stone, sandpaper, grinder or any abrasive tool as it can cause damage.
6		Remove the claws from the acetone cleaner.	

CROSS LINE

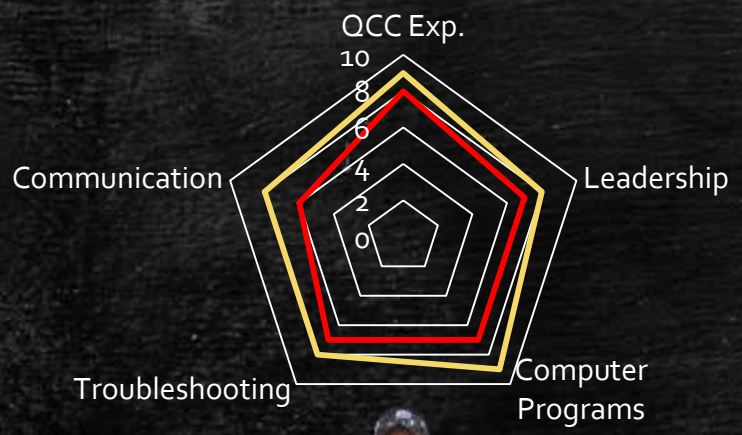


Tangible/Intangible Benefits

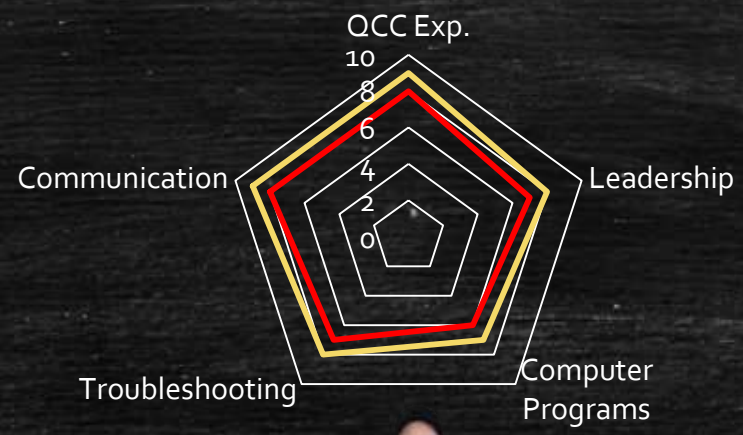
1. Claws last longer saving money on buying new claws
2. Associates don't have to shutdown RO-5080/6080/4080 to clean claws as often.
3. Had a new cart made for the new cleaning tools improving 5s.

RADAR CHARTS

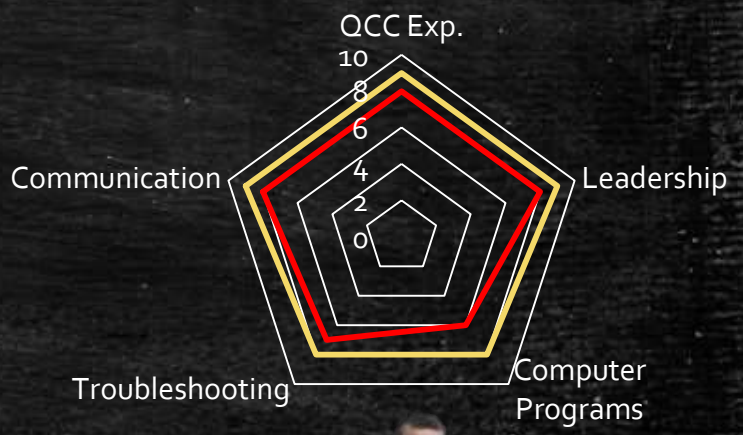
Scott



Adam

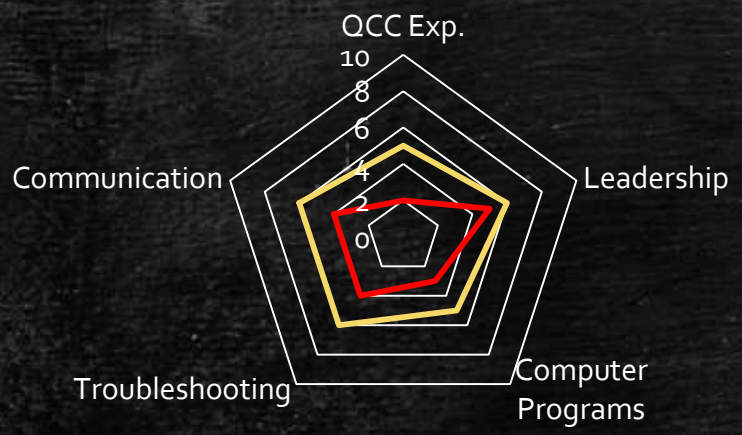


Kirk

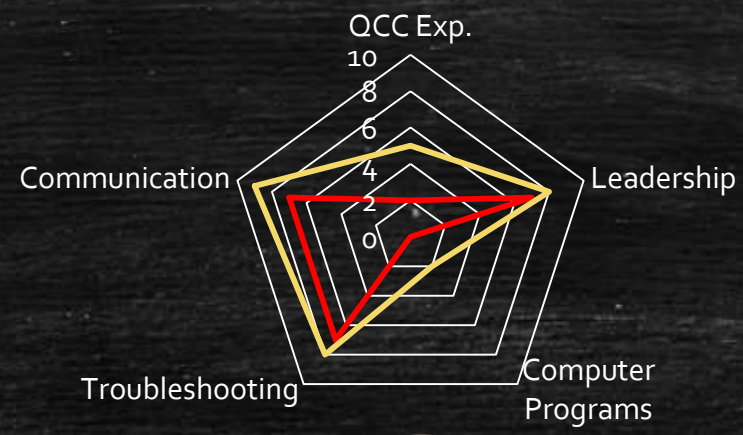


RADAR CHARTS

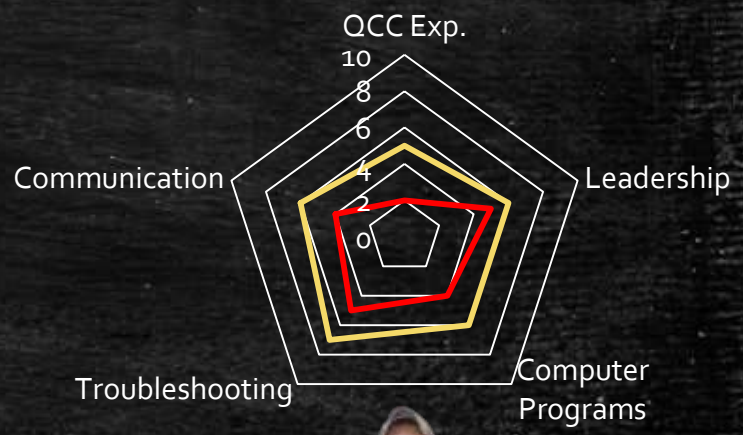
Chase



Kryscie

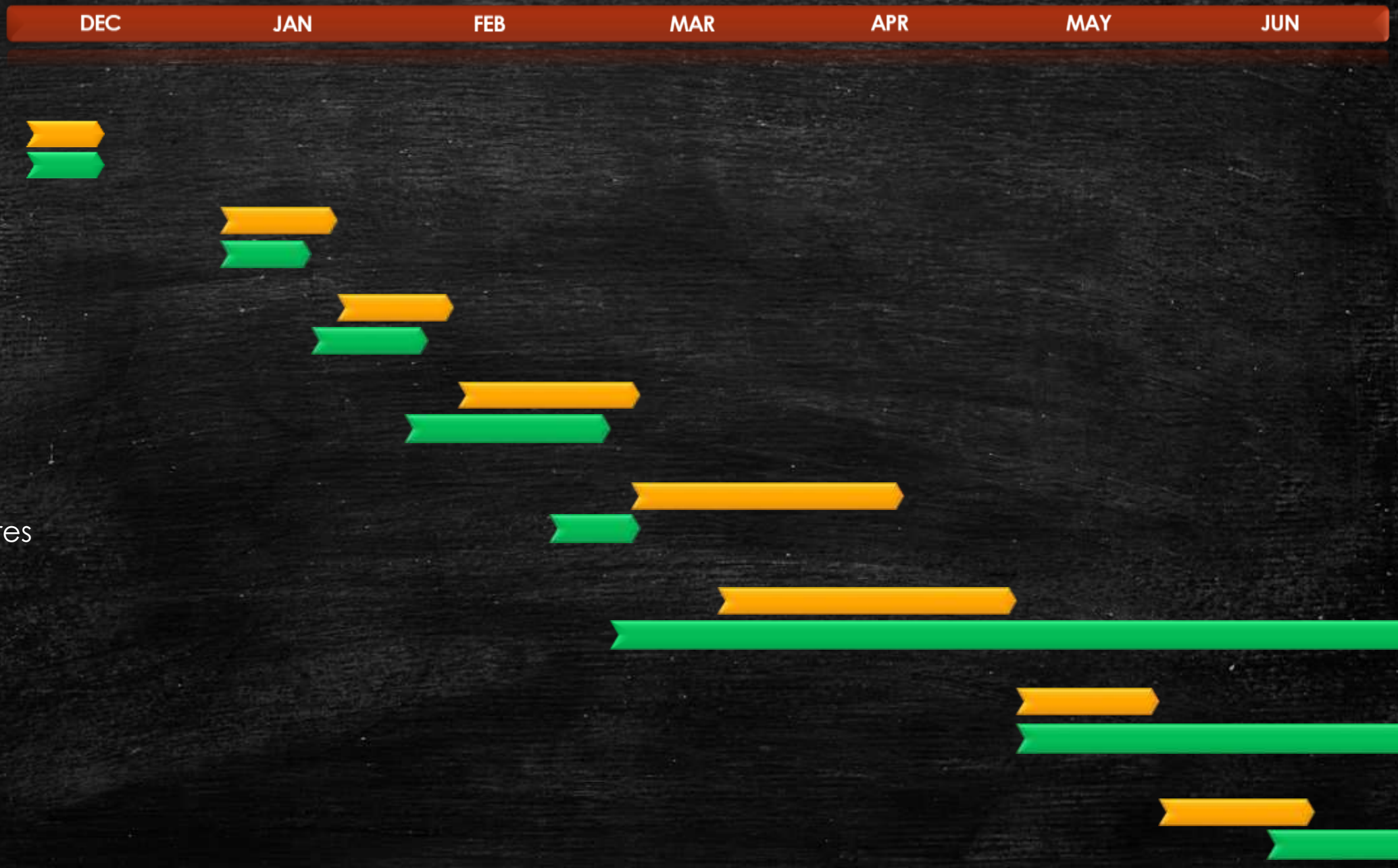


Tyler



GANTT CHART

PLANNED
ACTUAL



The End

Quality
Alice Schneider

QA - Good to Great - Together

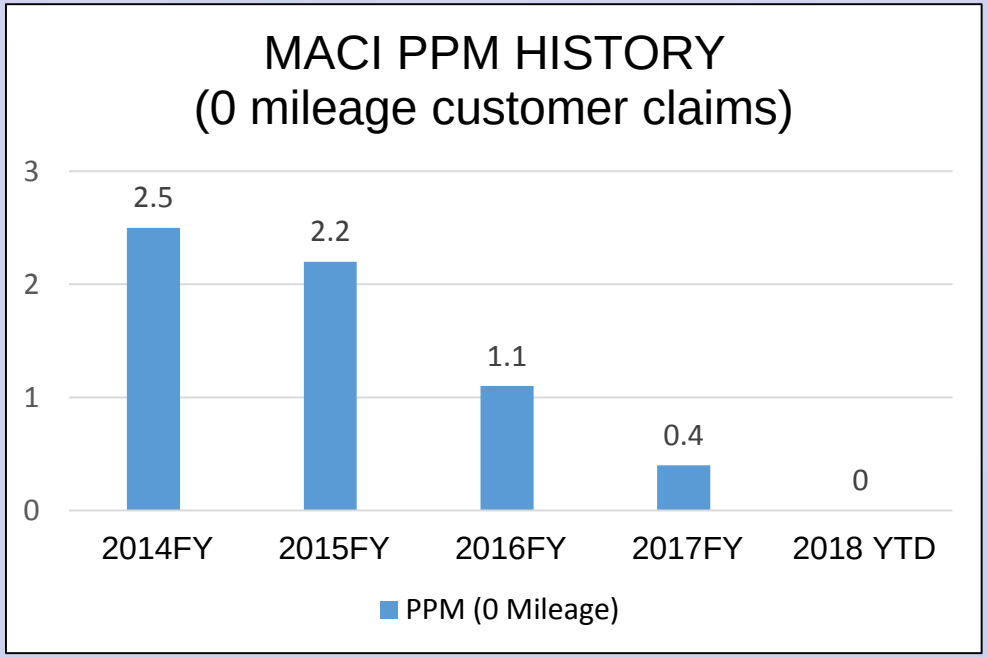
Partnership in Success

Thank you for your support on a daily basis to deliver quality parts to MACI.

MACI has improved our 0 mileage PPM with our customers over the last 5 years.

That success is based in large part on

- The quality of your product
- Your commitment to identifying and counter measuring the root cause of an issue
- A good working relationship between us to resolve problems
- Effective containment to protect our end customer when problems do occur



QA - Good to Great - Together

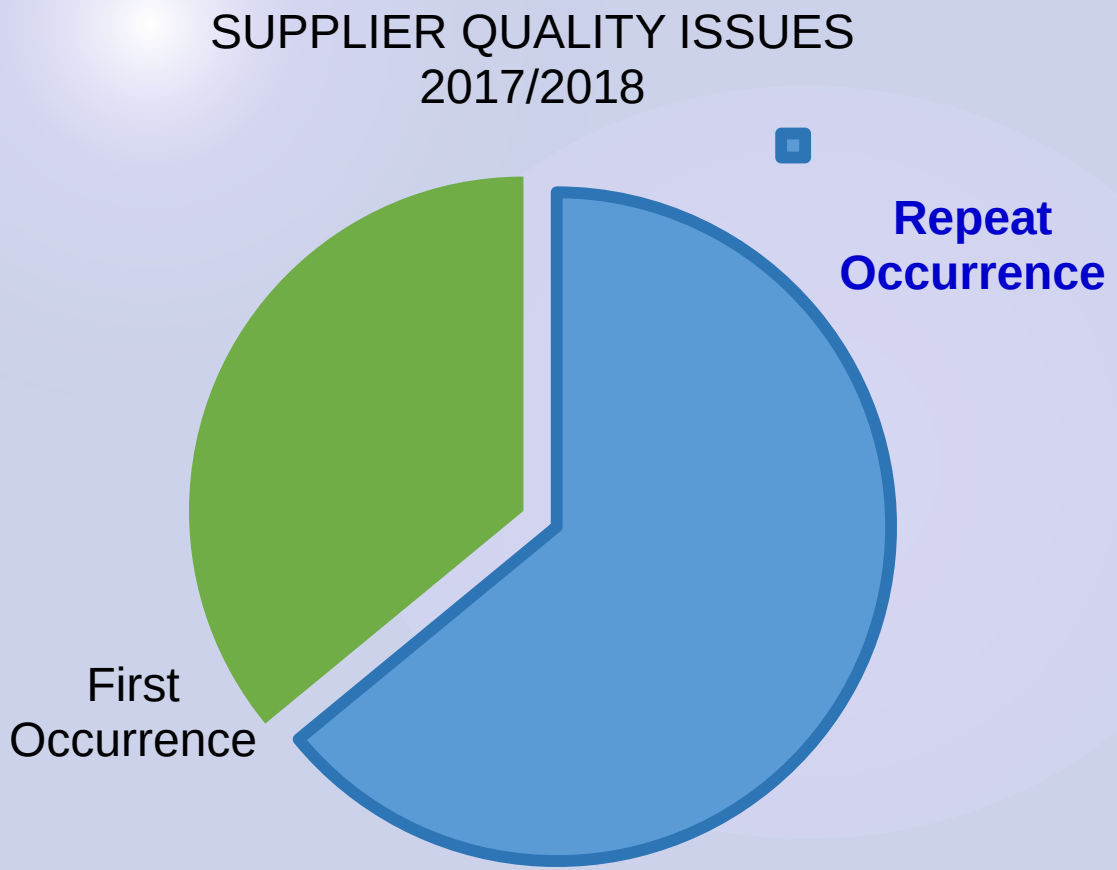
Eliminating Repeat Occurrences

Strong Root Cause Analysis and Countermeasure Activity

- Occurrence & Detection
- Abnormal work process/flow
- Visual Inspection improvements
- Training effectiveness and verification

Cross Line Action

Containment



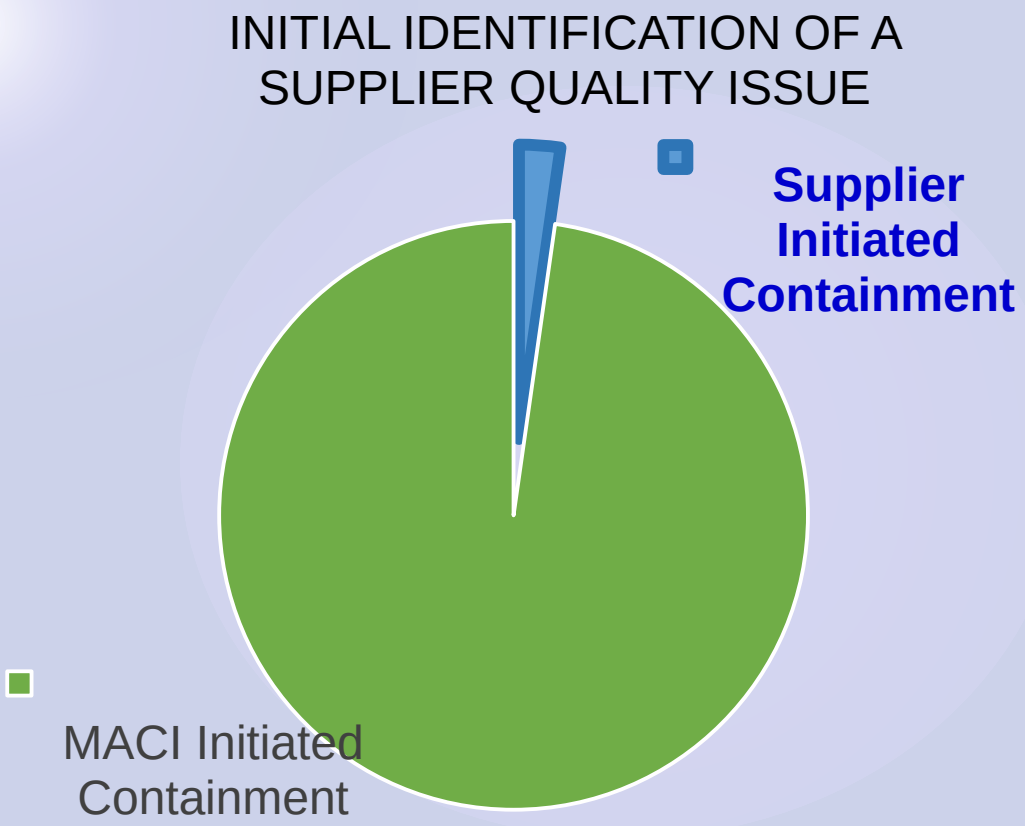
QA - Good to Great - Together

Effective Containment

We want to work closely with you and be notified when you believe there has been a containment issue at your facility.

We greatly appreciate our suppliers that notify and work with us when there are possible containment issues in order to capture suspect product upon receipt at MACI.

When a supplier quality issue is found at MACI, please evaluate your internal containment process as part of your analysis and reflection for improvement.



QA - Good to Great - Together

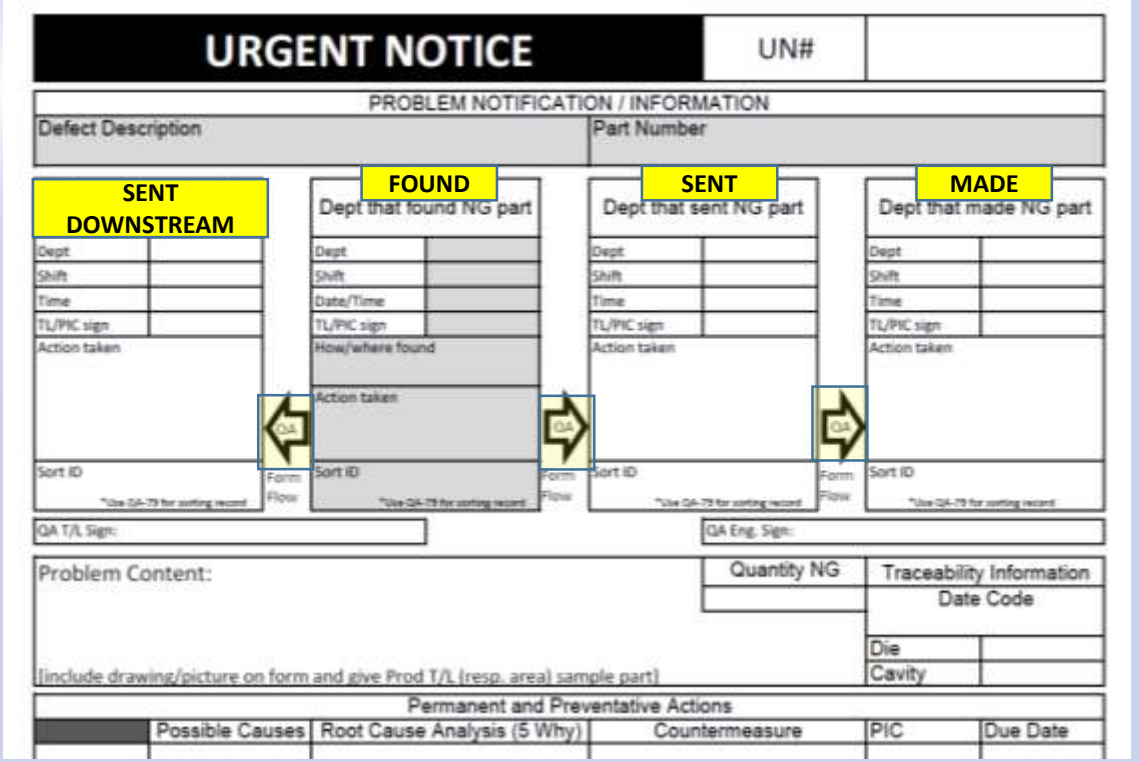
Effective Containment

Example of containment standardization countermeasure that MACI initiated in our process

- Communication / Urgent Notice improvement

Confirm and document notification to all upstream and downstream processes to initiate immediate containment.

This document improvement was developed by our night shift Quality Team and cross lined between shifts.



URGENT NOTICE | UN#

PROBLEM NOTIFICATION / INFORMATION

Defect Description | Part Number

SENT DOWNSTREAM | FOUND | SENT | MADE

Dept that found NG part | Dept that sent NG part | Dept that made NG part

Dept | Shift | Time | T/L/PIC sign | Action taken | Sort ID

Dept | Shift | Date/Time | T/L/PIC sign | How/where found | Action taken | Sort ID

Dept | Shift | Time | T/L/PIC sign | Action taken | Sort ID

Dept | Shift | Time | T/L/PIC sign | Action taken | Sort ID

QA | Form Flow | QA | Form Flow | QA | Form Flow

QA T/L Sign: | QA Eng. Sign:

Problem Content: | Quantity NG | Traceability Information | Date Code | Die | Cavity

[include drawing/picture on form and give Prod T/L (resp. area) sample part]

Permanent and Preventative Actions

	Possible Causes	Root Cause Analysis (5 Why)	Countermeasure	PIC	Due Date

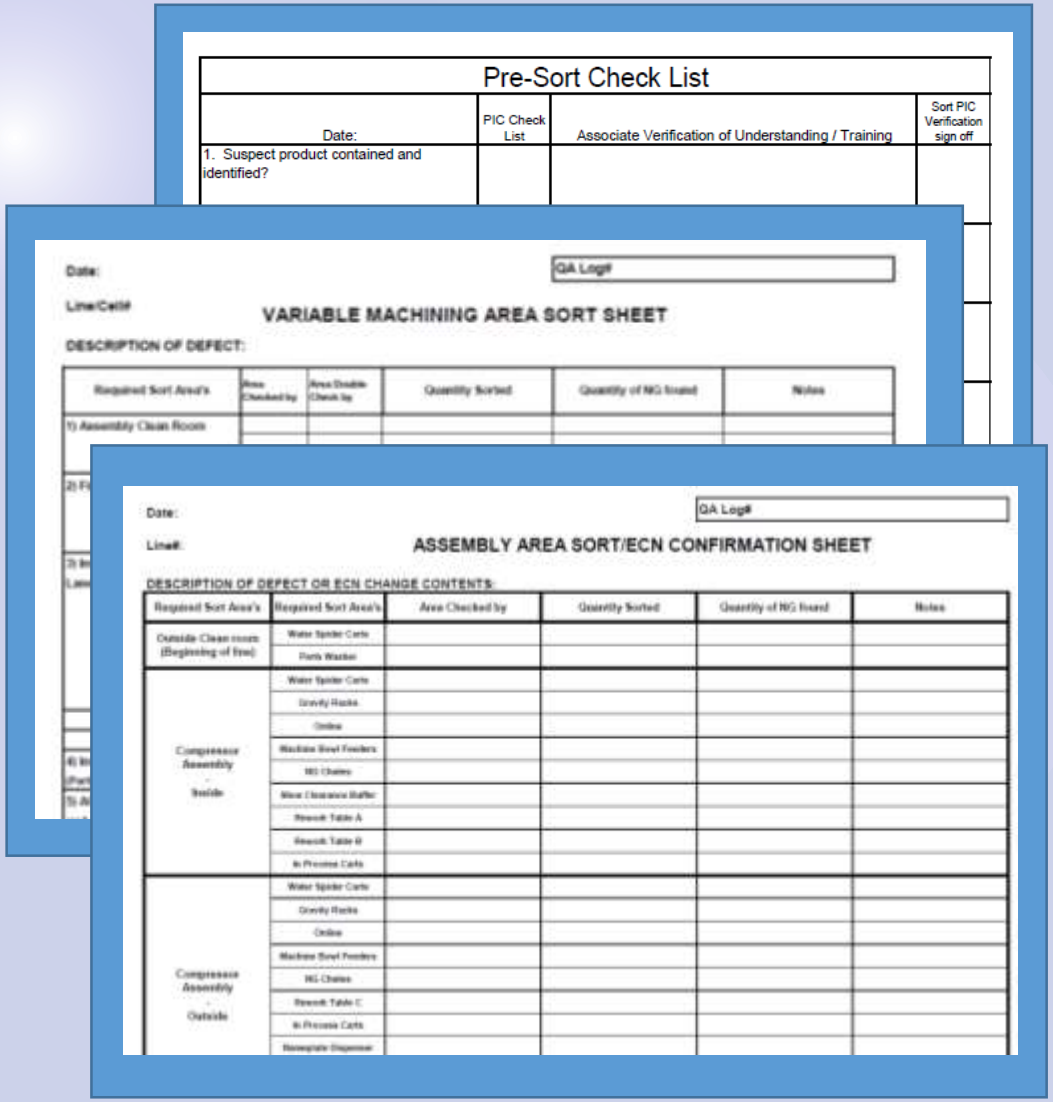
QA - Good to Great - Together

Effective Containment

Example of containment standardization countermeasure that MACI initiated in our process

- Internal sorting standardization

(Ensuring that all potential locations of WIP are contained)



QA - Good to Great - Together

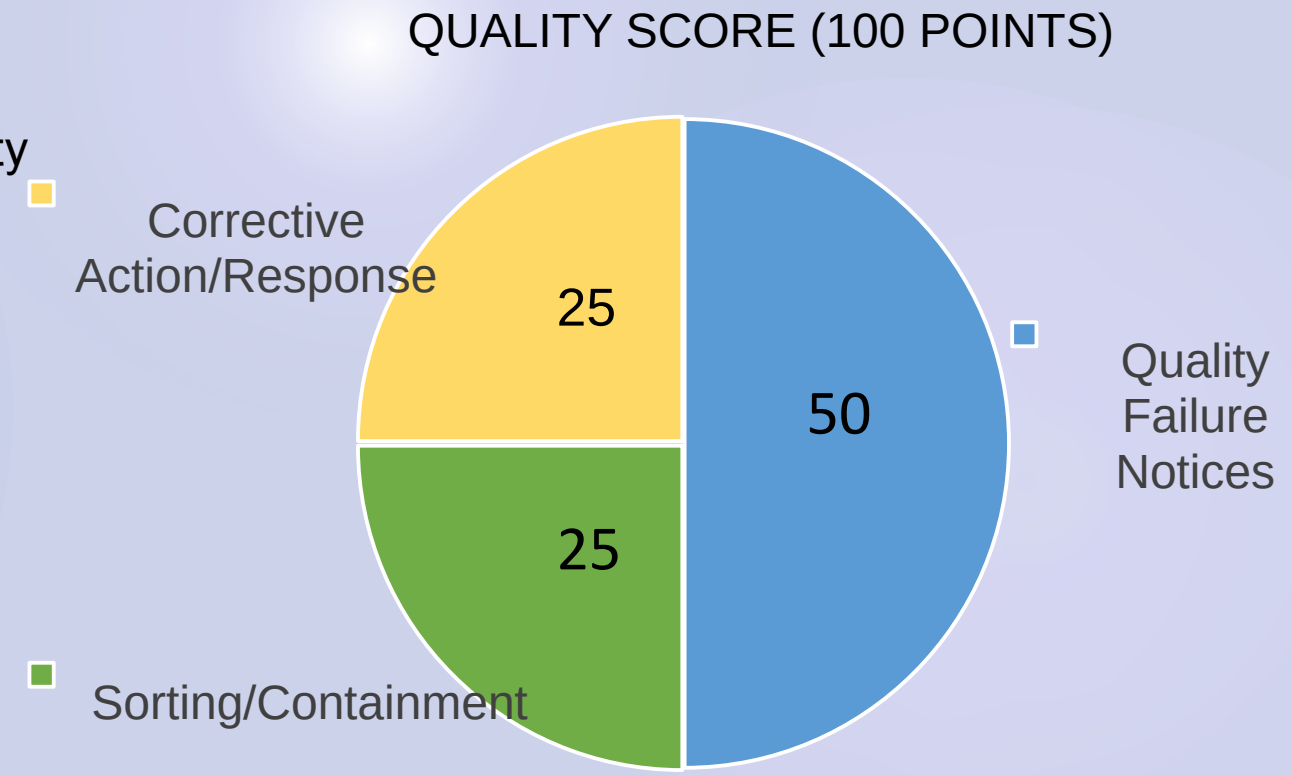
MACI Quality Scoring Review

MACI's Component Supplier Quality Score is based on 100 points

Quality Failure Notices

Corrective Action/Response

Sorting/Containment



QA - Good to Great - Together

MACI Quality Scoring Review

Zero Point Conditions:

A rating of zero (0/100 points) will be given for any supplier related problem that places MACI on special status with our customers, causes a recall with our customers, or creates a customer disruption at their receiving plant, including yard holds and stop ships.

1. Quality Failure Notice Guideline: (50 of 100 points)

	Customer Satisfaction Dealer Returns Field Actions Warranty Returns/Claims Customer Claims	Risk Evaluation High Rank (defect could affect compressor function- cannot detect during MACI assembly process)	Risk Evaluation Medium Rank
First Occurrence	-40 points	-30 points	-10 points
Repeat Occurrence	-50 points	-50 points	-20 points

- **MACI has changed the scoring emphasis over the last several years to reflect the importance of ensuring customer satisfaction and preventing repeat occurrences.**

- Stronger emphasis on failures that cause warranty or zero mileage failure at the end customer

- Stronger emphasis on repeat occurrences

QA - Good to Great - Together

MACI Quality Scoring Review

2. Sorting/Containment Guideline: (25 of 100 points)

	Finished Goods Warehouse Sorting Required	Component Sorting Required
First Occurrence	-15 points	-10points
Repeat Occurrence	-25 points	-20 points

3. Service Rating Guideline: (25 of 100 points)

A. Corrective Action (10 Points)

B. Response to Defects (10 Points)

C. Continuous Improvement (5 Points)

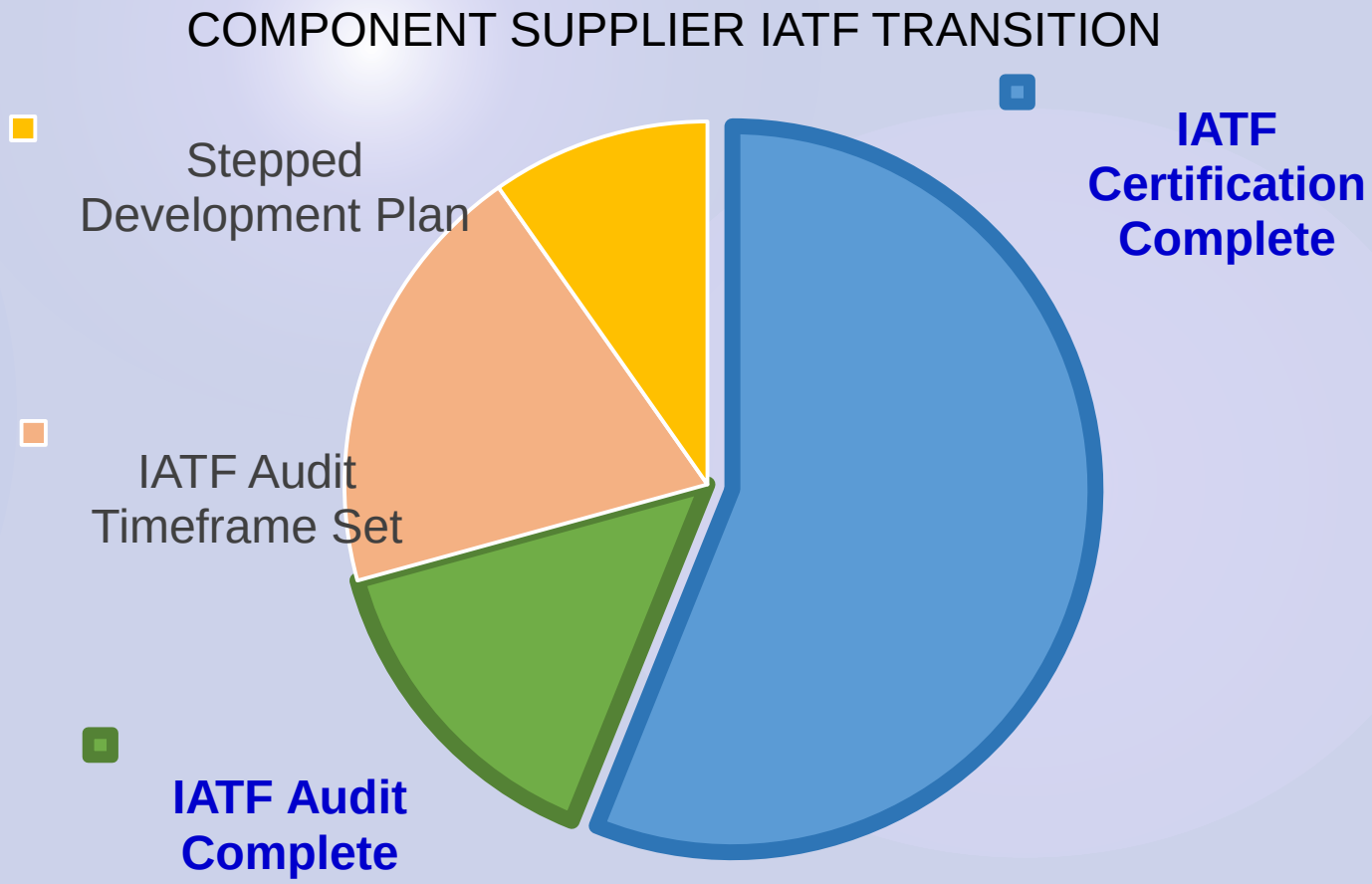
- **Stronger emphasis on repeat occurrences**

QA - Good to Great - Together

IATF 16949 Transition

MACI asks that all of our component suppliers are ISO and IATF certified or working towards IATF certification

Majority of component suppliers have completed their transition to IATF or are actively preparing for their scheduled audit



QA - Good to Great - Together

IATF 16949 Transition in 2017/18

Adkev
AJ Rose Mfg.
Advanced Special Tools
Blue Ridge Metals
Dätwyler Sealing Solutions USA Inc.
Eagle Industry France
Eagle Simrax
Freudenberg NOK Sealing Technology
Grand Rapids Label
Idemitsu Lubricants of America
INA – Schaeffler Group USA Inc.
JST Mfg.
Koyo
MPI Products LLC
Nachi Technology Inc.
NCI Mfg, Inc.
Nitto Denko
NSK
Ogura Corporation
Precision Resource
Rotor Clip Company, Inc.
Sanko Electronics America
Schrader-Bridgeport
Small Parts Inc.
Superior Essex
Taiho Corporation of America
Toray Resin Company
Yazaki North America

THANK YOU!

Product Design
Patrick Flahie

Michigan Automotive Compressor, Inc.

MACI Design/Prototype Localization

From 1989~2012, MACI's Product Design function was purely manufacturing support.

- Issue and maintain manufacturing drawings provided by Japan.
- Maintain production BoMs.
- Pass design change requests from MACI Production/QA to Japan for consideration.

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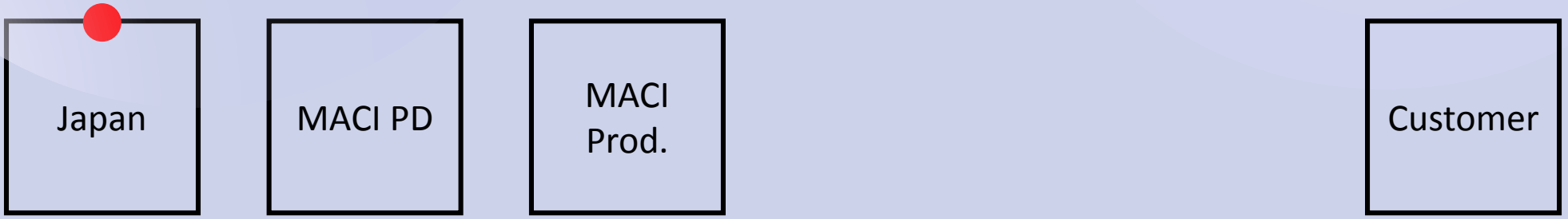
This activity was good enough, but in our customers' eyes it definitely wasn't great.

- Response to design study requests took a long time.
- It was difficult for us to clearly understand and support the customers' needs.



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- Response to design study requests took a long time.
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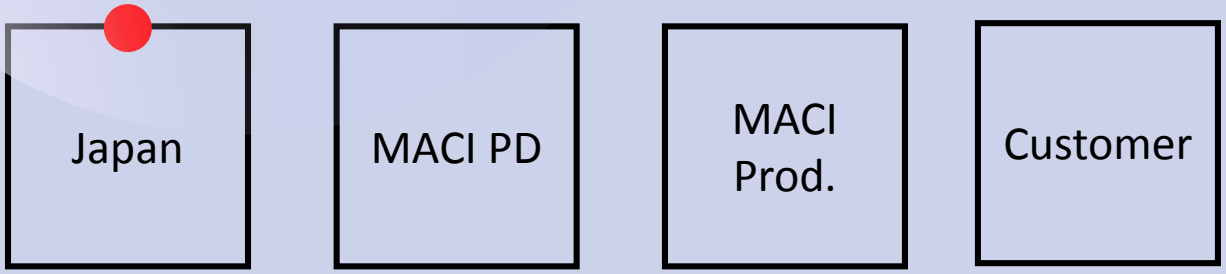
We decided we needed to move from good to great.



MACI Design/Prototype Localization

Direction for this activity came from the top of the organization.

TICO Director (and former MACI president) Suzuki-san:

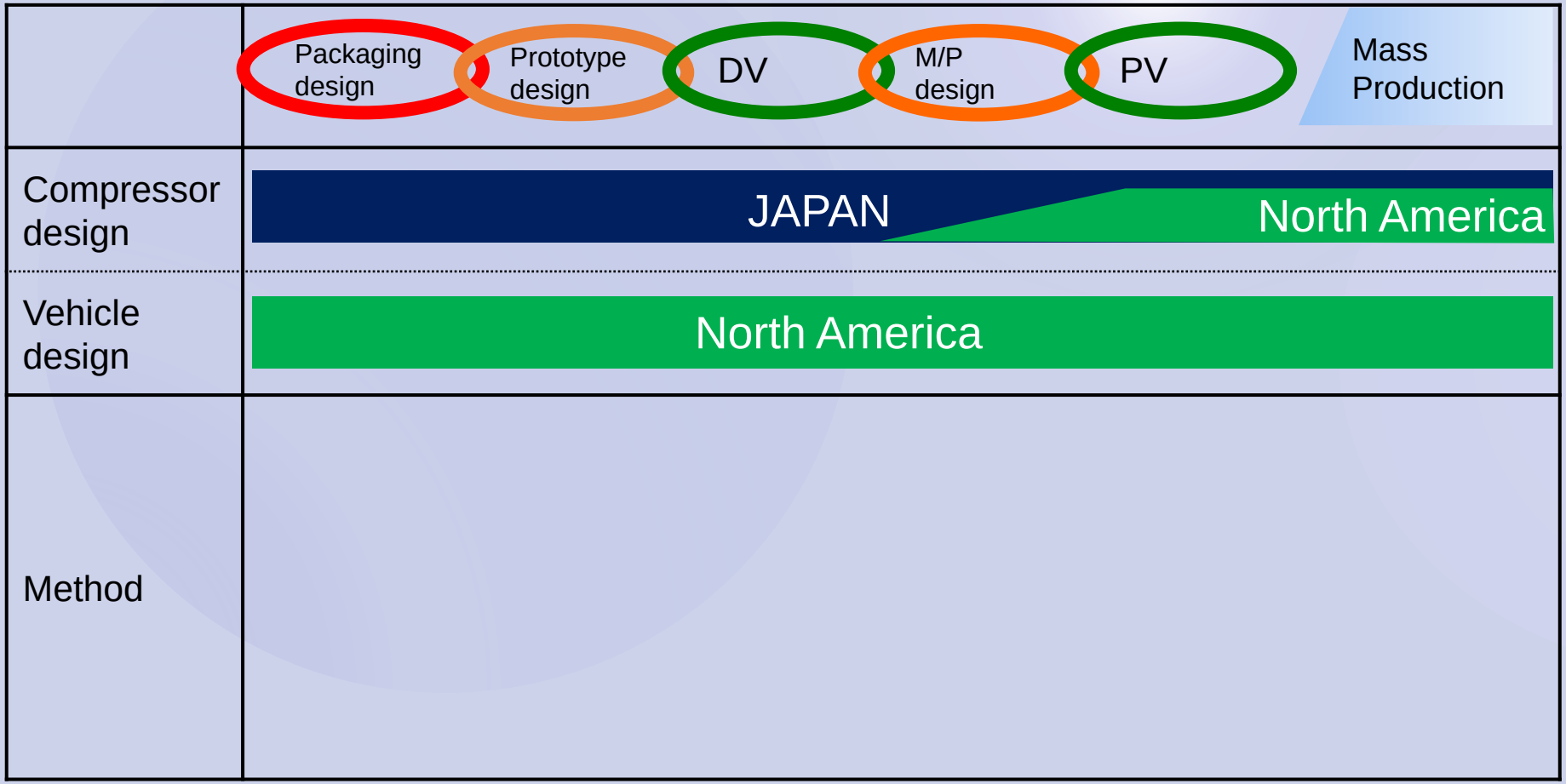
"We should design our compressors where our customers are designing their engines."

Having top-level support really helped drive our improvement activity.

MACI Design/Prototype Localization

First, we identified our gap.

Design / Evaluation Stages



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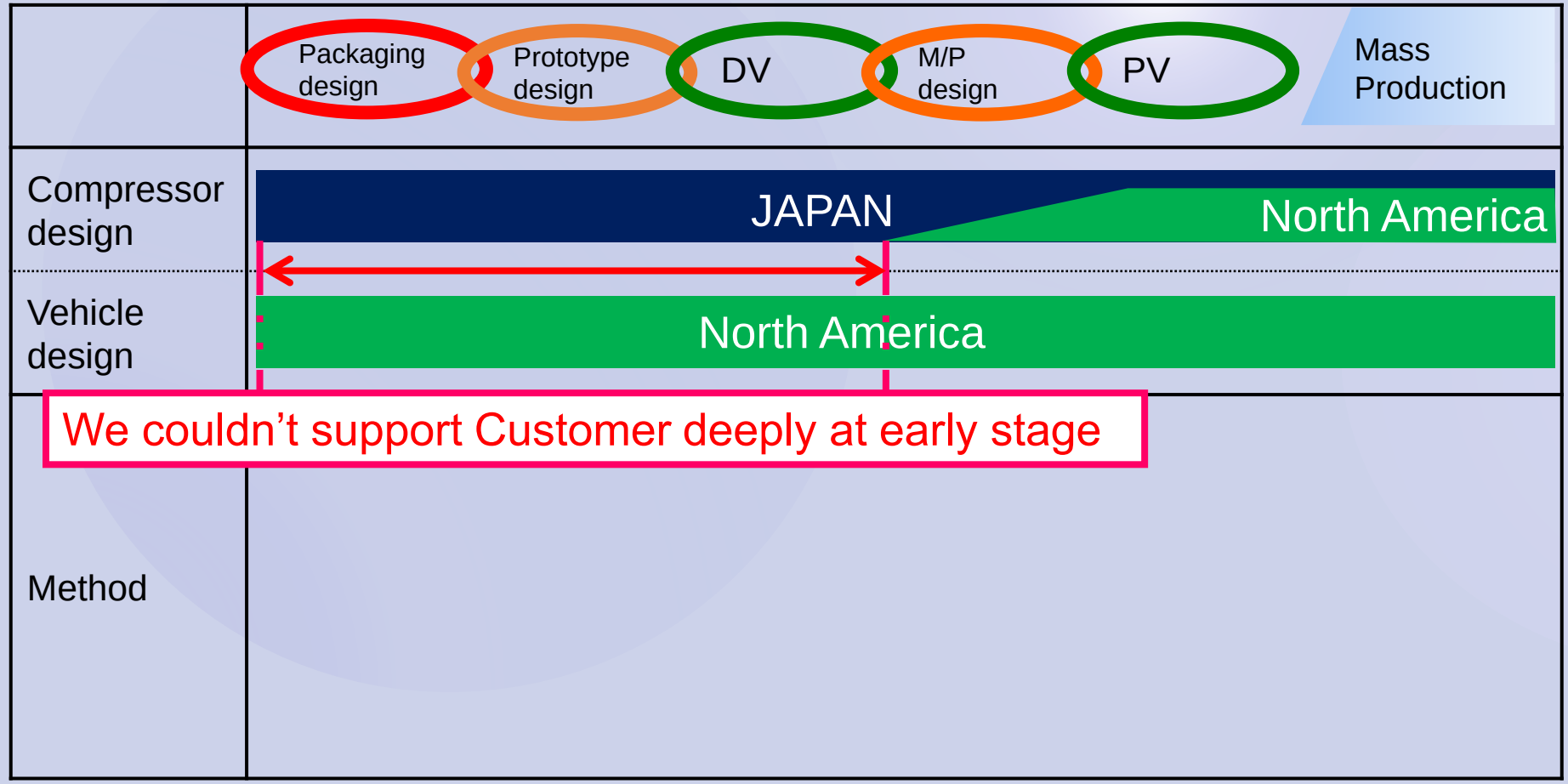
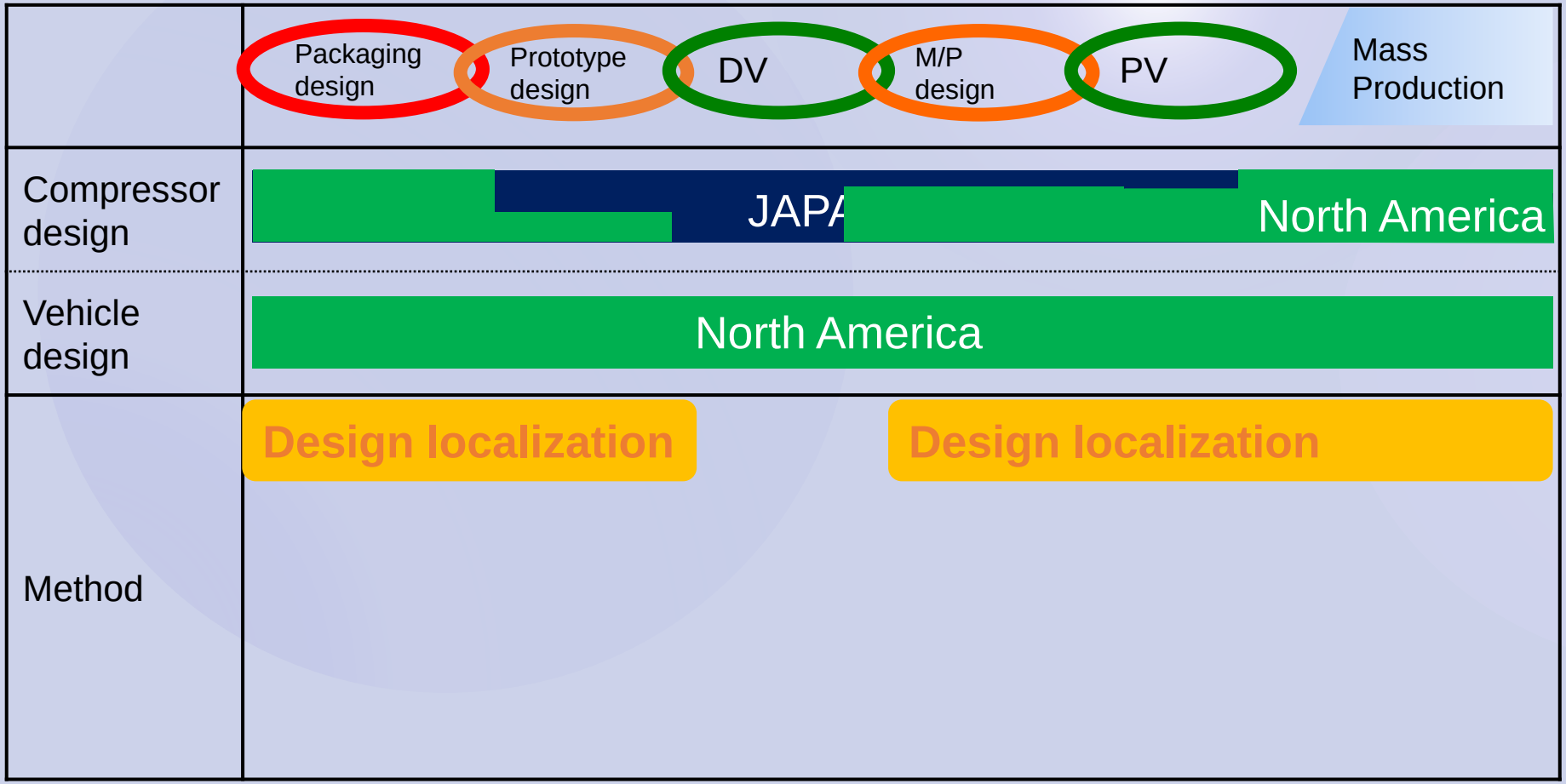


MACI Design/Prototype Localization

First, we identified our gap. Then, we made a plan to address it.

Design / Evaluation Stages



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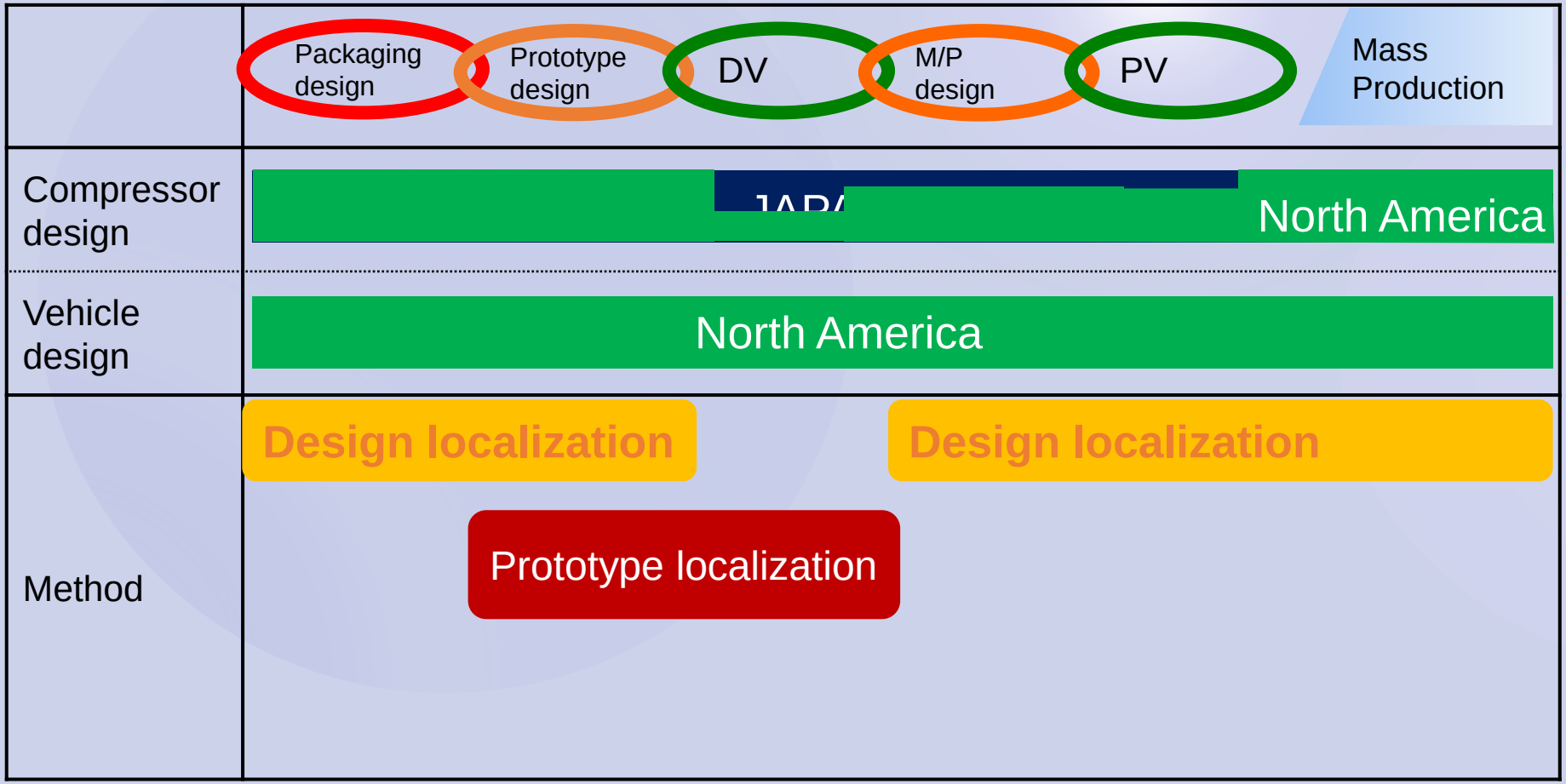

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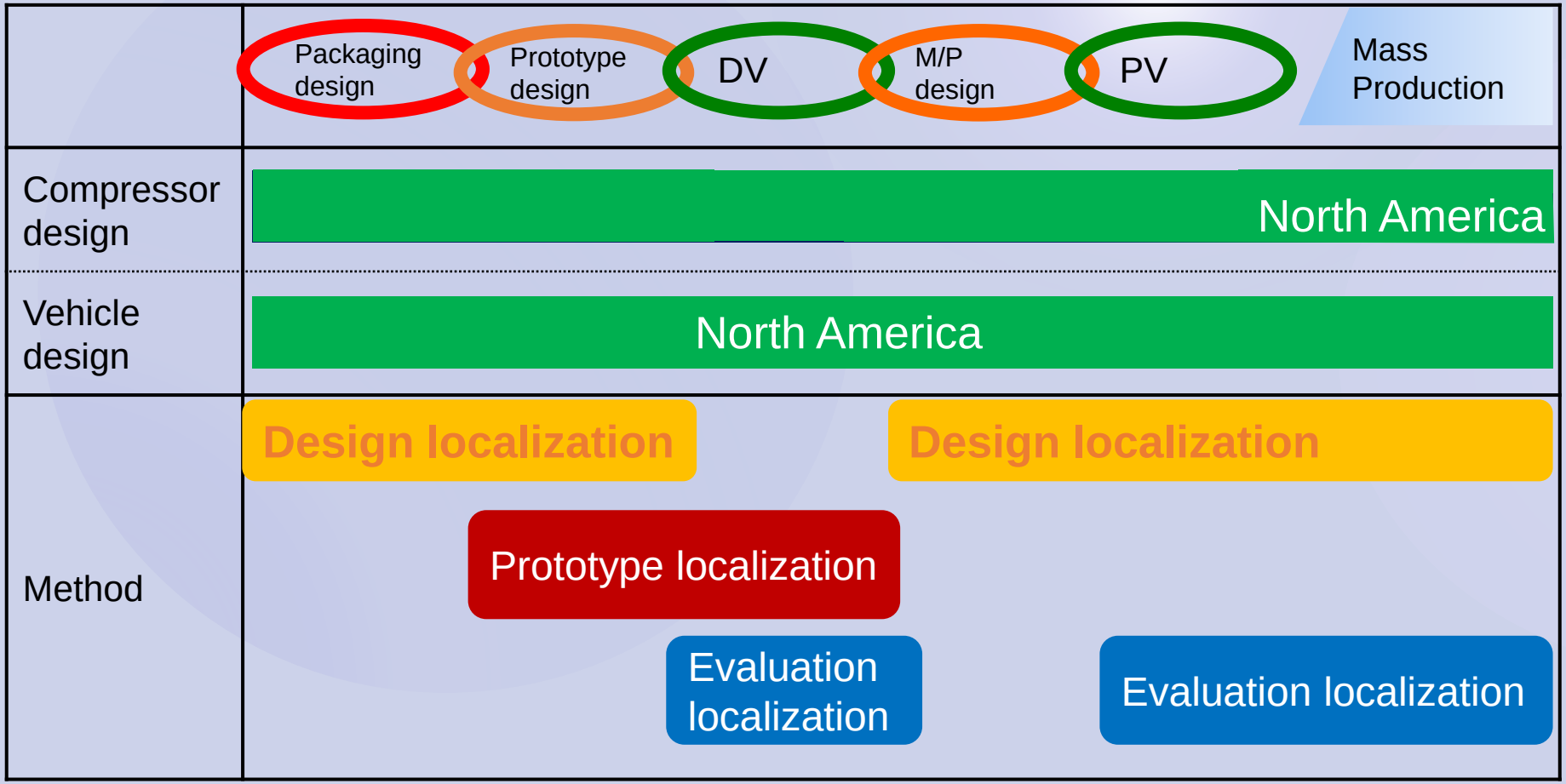

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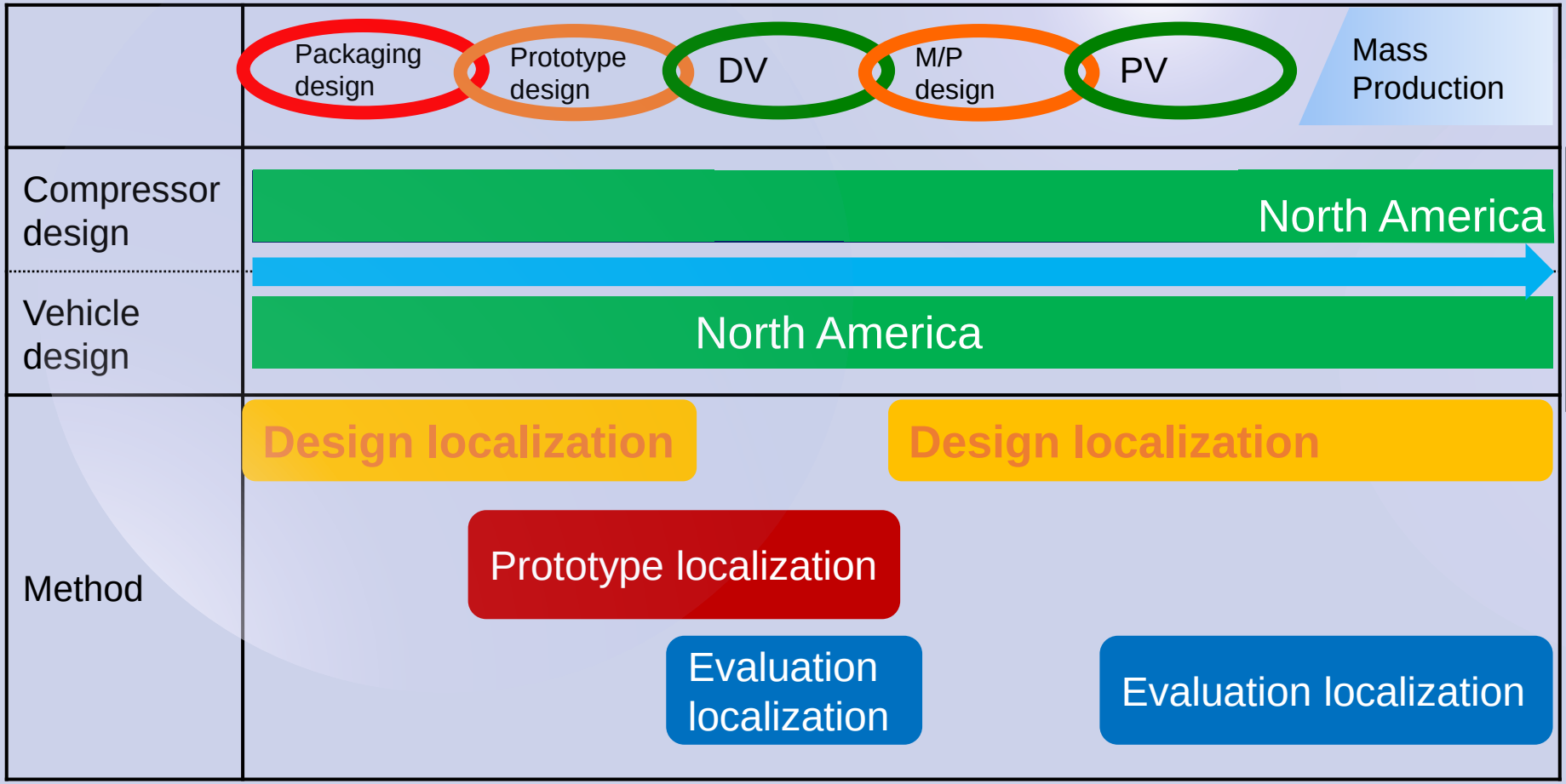
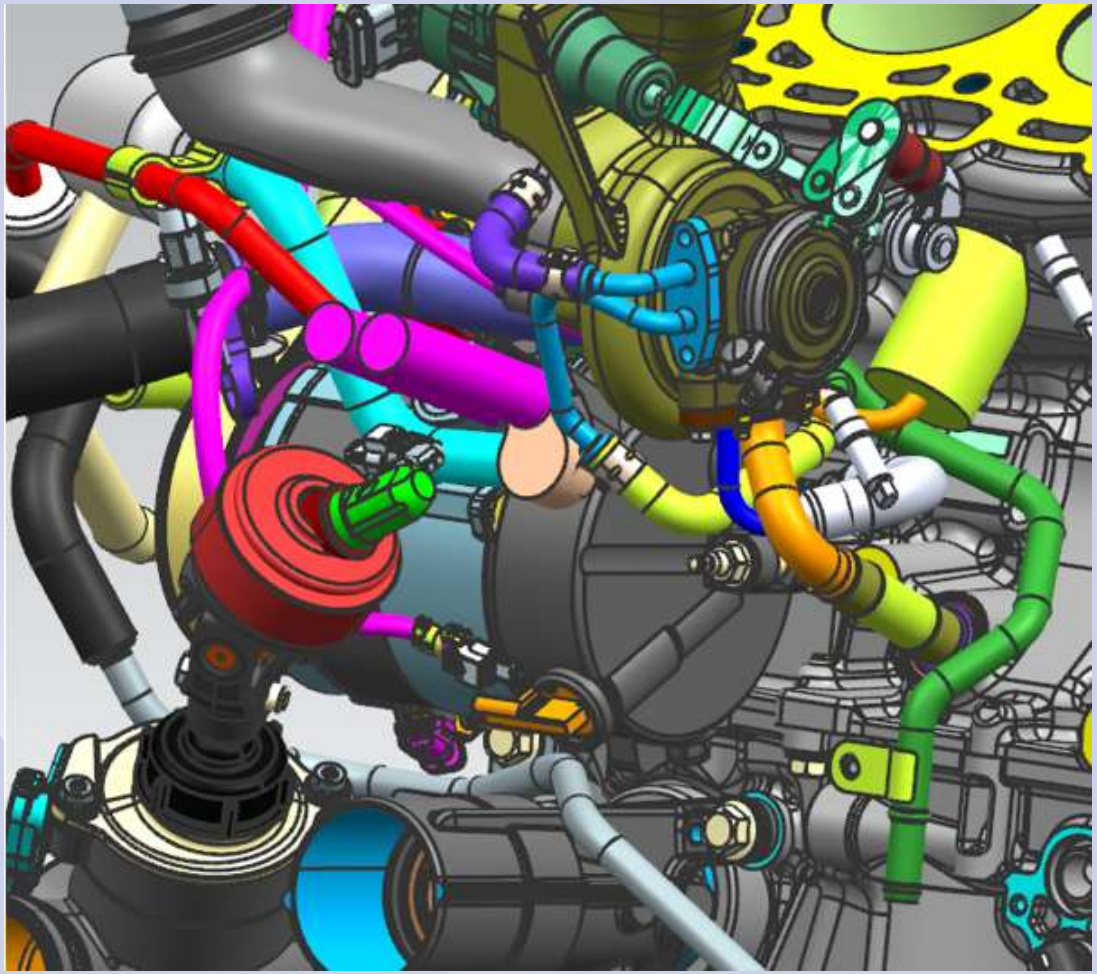


If we transfer these 3 key processes to MACI, we can support Customer throughout their complete development cycle.

MACI Design Localization



MACI started to work directly with Detroit 3 automakers to develop compressor design while engines were still being developed.

This had many benefits:

- Quick response to customer requests for investigation.
- Better understanding of customer's true need.
- Clearer communication of investigation results.

- Early design information to support MACI manufacturing long-term planning.
- Better coordination between design and manufacturing.

MACI Prototype Localization

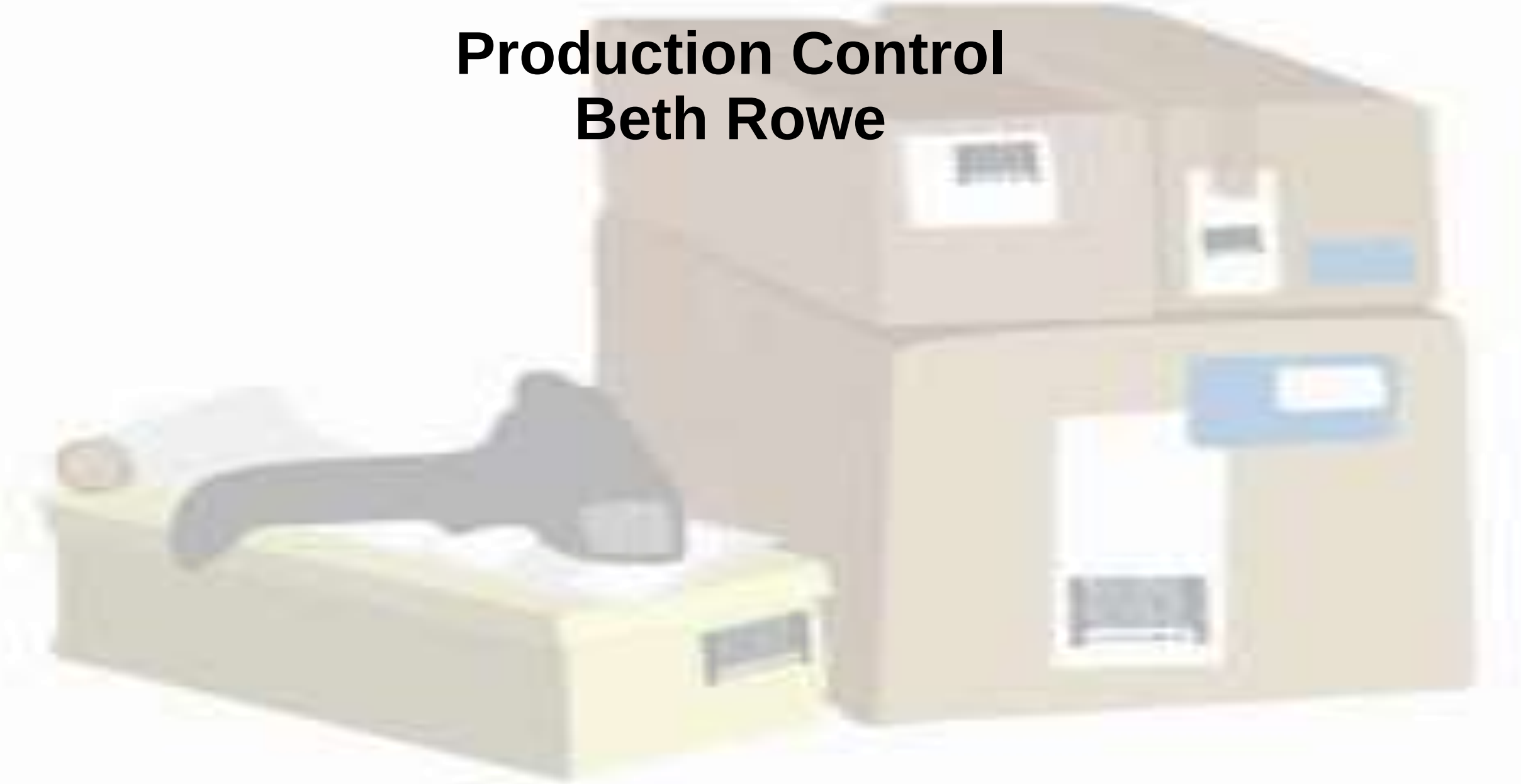
MACI invested in a low-volume prototype assembly line to support customer prototype requirements.

This had two key benefits:

- Shortened lead time for prototype parts.
- MACI Production and QA can perform a hands-on review of compressor before the design is fixed.

We plan to expand scope of local prototype in the future.

Production Control
Beth Rowe



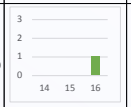
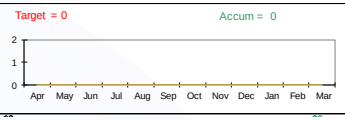
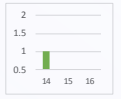
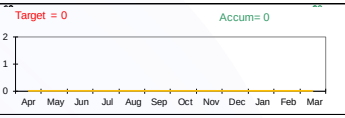
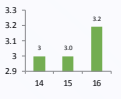
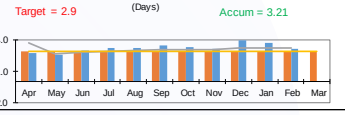
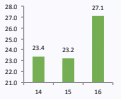
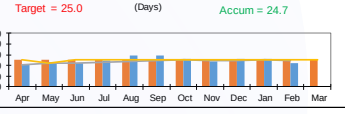
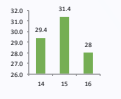
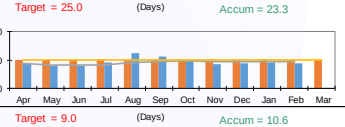
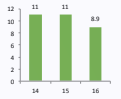
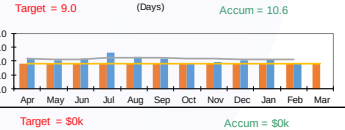
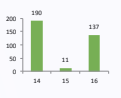
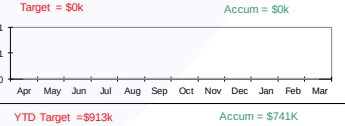
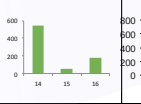
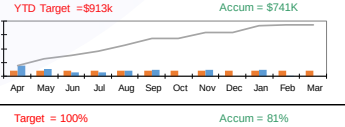
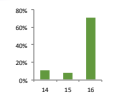
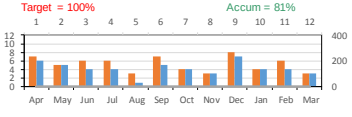
Production Control – 2017 Policy Analysis

Safety

Quality

Cost

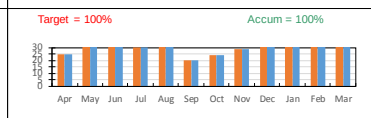
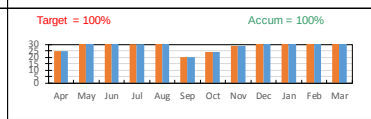
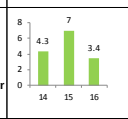
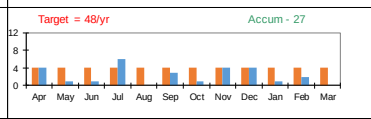
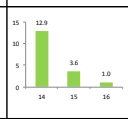
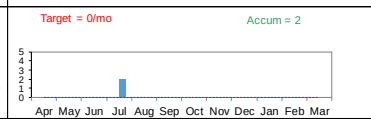
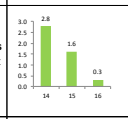
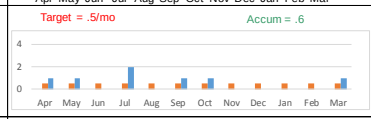
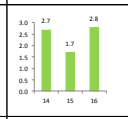
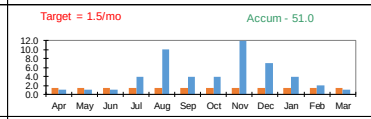
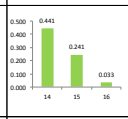
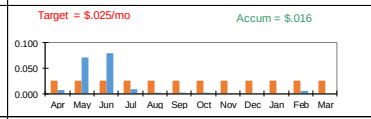
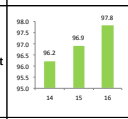
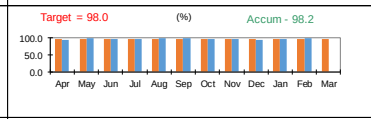
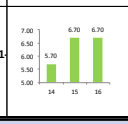
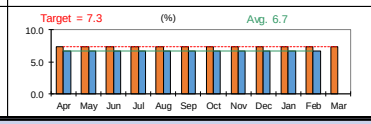
2017 Monthly Policy Results

	Item	Past Results	Current Results	Comments	Mthly. Eval.	YTD Eval.
S1	PC Office Incident Occurrence - Target 0			Good Result	O	O
Q1	IATF Internal Audit - Non-conformities - Target 0			Good Result	O	O
C1	Finished Goods - Target 2.9 Inventory Days			3.09 Advance build ran off for VA04 & VA05	△	△
C2	Denso Components - Target 25 Inventory Days			Good Result	O	O
C3	TICO Components - Target 25 Inventory Days			Good Result	O	O
C4	Domestic Components - Target 9 Inventory Days			Good Result	O	X
C5	Phase Out - Target 0 $			-Honda complete; remaining parts to be used for service	O	O
C6	Stagnant/Obsolete Parts Disposal Plan - $83k/per Month (Issued to BP)			Mar - $0	X	X
D1	Company Project PR, IT, TT & 2QA Meeting Approvals - Target 100% on time			Missed IT for E2SC-K L3T and TT for T1XX LV3 Gen5 Both needed add'l runs for PE/PROD	X	X

Delivery

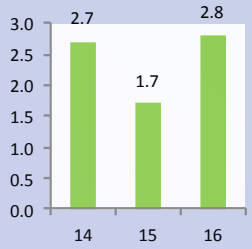
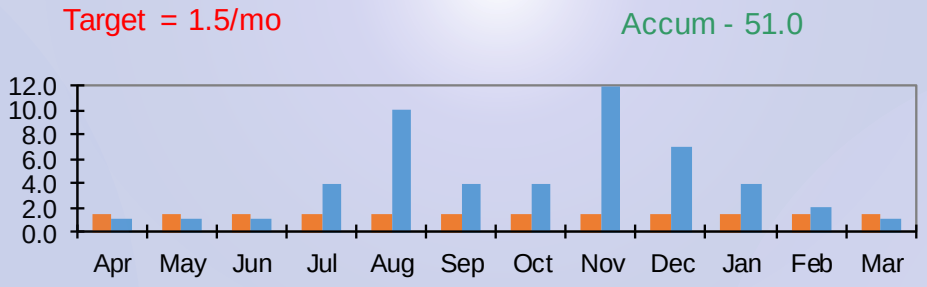
Morale

2017 Monthly Policy Results

	Item	Past Results	Current Results	Comments	Mthly. Eval.	YTD Eval.
D2	Prototype Coordination - 100% on-time shipping	New		Good Result	O	O
D3	Long-term Planning - Nenkei, Shukei, & Chokei - Target 100% on-time	New		Nenkei - Many delays due to Sales plan information	X	O
D4	Customer Delivery Claims/Concerns - Target 4 occurrences/mo; 48/yr			Good Result	O	O
D5	Missed Shipments - Target=0 Occurrences/year			Good Result	O	X
D6	Expedited Deliveries to Customer - Target .5 occurrences/mo			Mar - 1 (due to GF35 changeover)	X	X
D7	MACI Responsible Expedites from Domestic Suppliers - Target 1.5 occurrences/mo			Inventory variance largest contributor	X	X
D8	Air Freight Cost per Piece			Good Result	O	△
D9	Supplier Delivery Performance - Target = 98%			Good Result	O	△
M1	Morale Index (Scale 1-10)			6.7	△	△

Michigan Automotive Compressor, Inc.

Production Control – 2017 Policy Analysis

D7	**MACI Responsible Expedites from Domestic Suppliers - Target 1.5 occurrences/mo**			Inventory variance largest contributor	**X**	**X**

MACI Responsible Expedites from Domestic Suppliers is over target. This is not only an expense to MACI but also a burden for our suppliers.

Production Control – 2017 Policy Analysis

Gray shade = Inventory discrepancy

Blue shade = Usage swing

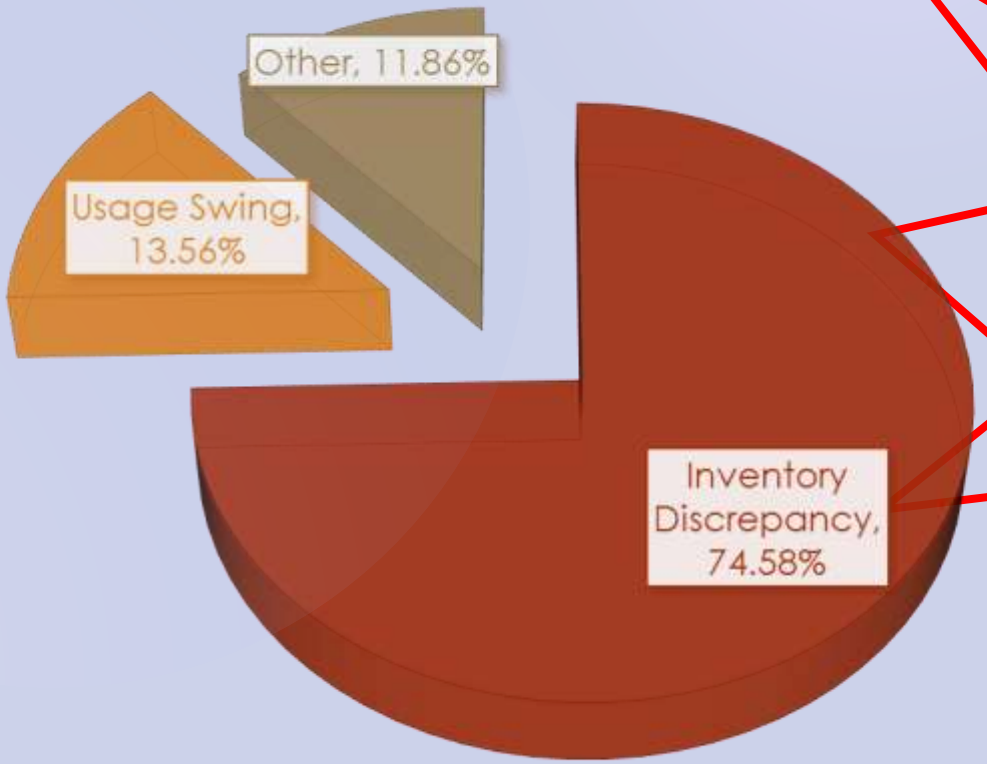
Yellow shade = Other

Department Expedite Log

Expedites at MACI Expense (from domestic suppliers)						
Ship Date / Receive Date	Customer / Supplier	MACI Part Number	Qty	Carrier	Pro # / Tracking # /AETC #	Cause
3/22/17	Ogura	MC047363-2690	1920	Apollo		inventory variance
3/23/17	Small Parts	7391	3000	XPO Express	1661537-0-A	inventory variance
4/27/17	Koyo (Jtekt)	MC047295-0660	12800			Incorrect spreadsheet used to updated thrust bearings
3/22/17	Ogura	MC047363-2680	1920	Apollo		inventory variance
5/2/17	Koyo (Jtekt)	MC047295-0660	15200			Incorrect spreadsheet used to updated thrust bearings
2/28/17	Taiho	MC047034-0860	1 pallet	Lee Transport		usage swing
6/1/17	TICO	447250-25200g	60	fedex custom critical	20934254 bill#	fedex delayed shipment, expedite from DTW
6/29/17	NCI	MC047291-1151	12000	RL Transfer	236558901	Parts damaged on milkrun
7/5/17	Rocknel	MC047293-0790	19200	Lee transport	RF.5421	inventory discrepancy
7/18/17	GRL	Many p.n.		Lee Transport	5994	miscommunication - supplier asked for delay, MACI agreed 7/18 but had to have some on 7/14.
7/26/17	AJ Rose	MC047451-5450	720	Lee Transport	5997	Cycle count out 1000pcs
7/28/17	GSW	MC047338-5711	1680	Lee Transport		Cycle count loss of 1021pcs
8/2/17	Rotor Clip	MC047294-0030	18000			inventory discrepancy
8/3/17	Jtech/Koyo	MC047295-0670	12800			inventory discrepancy
8/7/17	Jtech/Koyo	MC047295-0670	12800			inventory discrepancy
8/8/17	TICA	MC047010-2420	4800			inventory discrepancy
8/10/17	Rotor Clip	MC047294-0511R	54000			inventory discrepancy
8/10/17	MPI	MC047151-0710	1920			inventory discrepancy
8/147/17	OGURA	MC047363-2680	3600	XPO Logistics		inventory discrepancy
8/21/17	Rocknel	MC047293-1620	28800	XPO Logistics	1725276-0-A	inventory discrepancy
8/21/17	Bags, Paper and More	MC146714-0000	3000	Supplier in Lansing	Hand Carry	inventory discrepancy - not registred in BOM
8/22/17	TICA	MC047010-2360	480	milkrun		inventory discrepancy
9/7/2017	Blue Ridge METAL	MC949036-3160	96000	LTL - CH Robinson		inventory discrepancy
9/8/17	TICA	MC047010-2830	480	XPO Logistics	1732037	New Model - Per Stephanie W., needed to add additional TT run and inventory discrepancy
9/21/17	GSW	MC047334-7020	2160	Lee Transport	123225	inventory discrepancy
9/21/17	GRL	MC447164-5823	1000	Kelley Air Services		inventory discrepancy on phaseout
9/27/17	Koyo (Jtekt)	MC047295-0570	10800	XPO Logistics	MACI arranged	Just started using for first time on Honda (phantom had import part not MC)
9/28/17	Hytech	MC047296-0330	120000	Fedex		Physical Inventory Loss
10/5/17	Idemitsu	997635-0820	8	LTL		Customer Increase
10/11/17	BRM	2850 - rivets		XPO		inventory discrepancy
10/22/17	Koyo (Jtekt)	MC047295-0680	5000	Lee Transport	6033	inventory discrepancy
10/22/17	Koyo (Jtekt)	MC047295-0680	6400	XPO	1751336	inventory discrepancy
11/7/17	Nachi	MC949100-8110	3456			Parts in Qhold are NG
11/8/17	Blue Ridge METAL	MC949036-2850	90000			Inventory disrepancy(70k)
11/8/17	Koyo (Jtekt)	MC047295-0580	10000			Inventory discepancy(60k)
11/10/17	Ogura	MC047363-2690	1500	Lee Transport	2 deliveries - no trucks avail for full qty	Inventory Discrepancy
11/10/17	Ogura	MC047363-2690	2400	XPO	2 deliveries - no trucks avail for full qty	Inventory Discrepancy
11/17/17	Koyo (Jtekt)	MC047295-0580	25600			inventory discrepancy
11/17/17	TACG	MC047295-0580	10000			inventory discrepancy
11/21/17	Taiho	MC047034-0830	60000			usage swing
11/27/17	Taiho	MC047034-0820	100000	Lee Transport		Inventory Usage
11/30/17	Koyo (Jtekt)	MC047295-0670	25600			Inventory Discrepancy
12/1/17	Hytech	MC047296-0330	240000			Inventory Discrepancy
12/1/17	Hitachi	MC949574-7120	30000			Inventory Discrepancy
12/7/17	TACG	MC047151-0552	4800	Milk Run		Inventory Discrepancy
12/12/17	Koyo (Jtekt)	mc047295-0670	64000	CH Robinson		ratio change -inv loss
12/19/17	TICA	MC047013-1090	3600	Premium Freight		Inventory loss - backflush
1/5 / 1/8	Rotor Clip (R01)	MC047025-0220	28000	Fed Ex		Cycle Count Loss
1/8/18	Ina (I33A2)	MC047045-1060	38400			12/28 Shipment due 1/4 Lost in Transit
1/9/18	Rotor Clip (R01)	MC047025-0320	4000	Fed Ex		Cycle Count Loss
1/9/18	Rotor Clip (R01)	MC047294-0511R	72000	Fed Ex		Cycle Count Loss
1/9/18	Nachi	MC949100-9530	3456	XPO Logistics	20904484	CYCLE COUNT LOSS
1/10/18	Rotor Clip (R01) but get	MC949070-1000	51000	intercept milkrun	CH Robinson	Inventory Discrepancy
1/11/18	TICA	MC047010-2420	3840	milkrun		Cycle Count Loss
1/23/18	Koyo (Jtekt)	MC047295-0580	5600	XPO		Ratio swing
1/26/18	Koyo (Jtekt)	MC047295-0560,0570	5200 . 5200	XPO		Ratio swing
1/30/18	Koyo (Jtekt)	MC047295-0570	8,000	XPO		Ratio swing
2/1/18	Koyo (Jtekt)	MC047295-0570	12800	XPO		Ratio swing
2/16/18	Rocknel	MC047293-0790	9600			Cycle Count Loss

Production Control – 2017 Policy Analysis

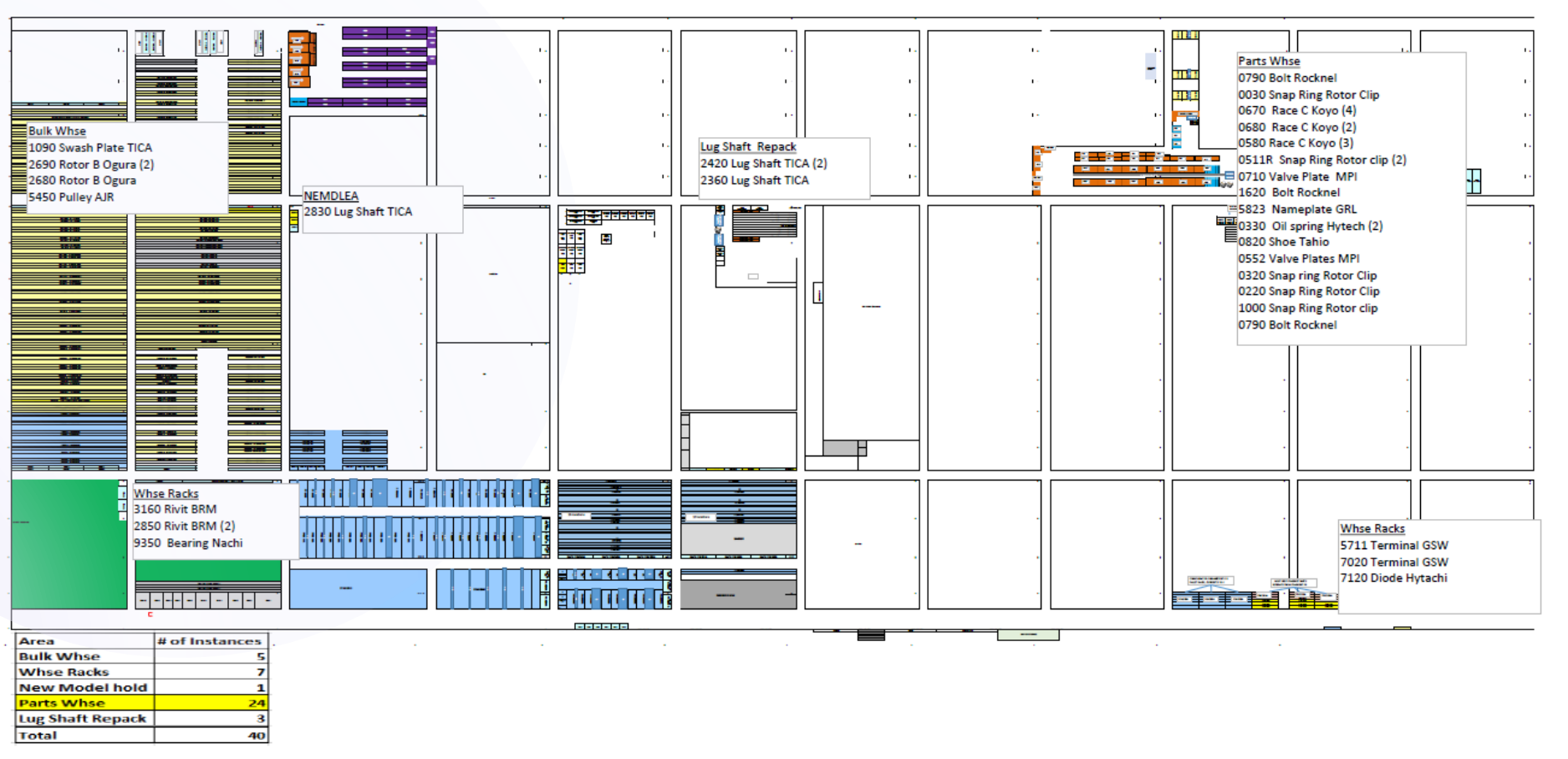
Calculation of items that caused MACI responsible expedites from Domestic suppliers



Inventory Discrepancies account for 75% of MACI responsible expedites from domestic suppliers – **this area needs our attention**

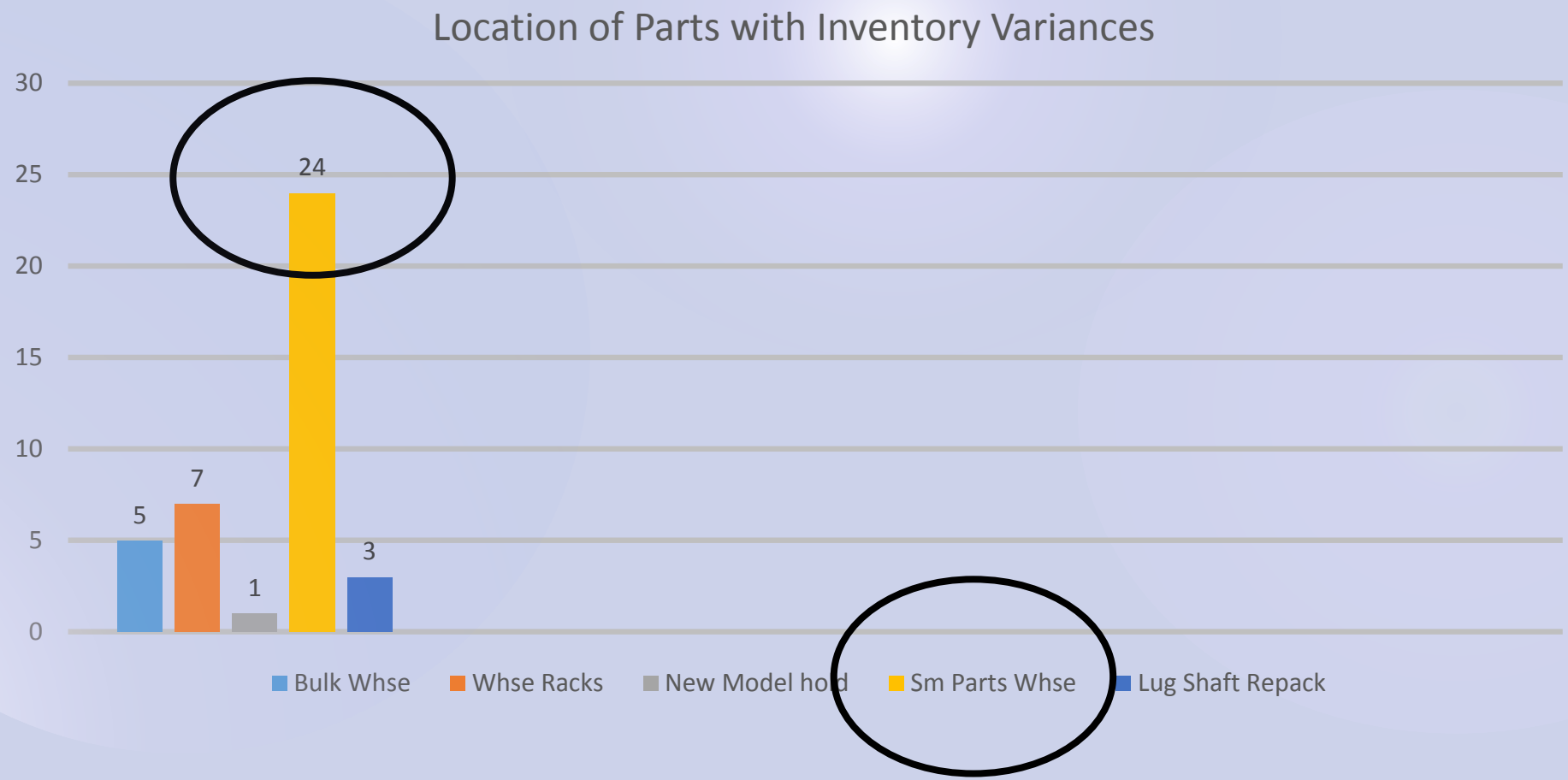
Production Control – 2017 Policy Analysis

Analysis of the Inventory discrepancies – Most of the domestic supplied parts are physically stored in the PC variable small parts warehouse area.



Area	# of Instances
Bulk Whse	5
Whse Racks	7
New Model hold	1
Parts Whse	24
Lug Shaft Repack	3
Total	40

Production Control – 2017 Policy Analysis



Production Control – 2017 Policy Analysis

MACRO

QSCDM From Policy – all NG YTD (X evaluation)

MACI responsible Expedites from Domestic Suppliers

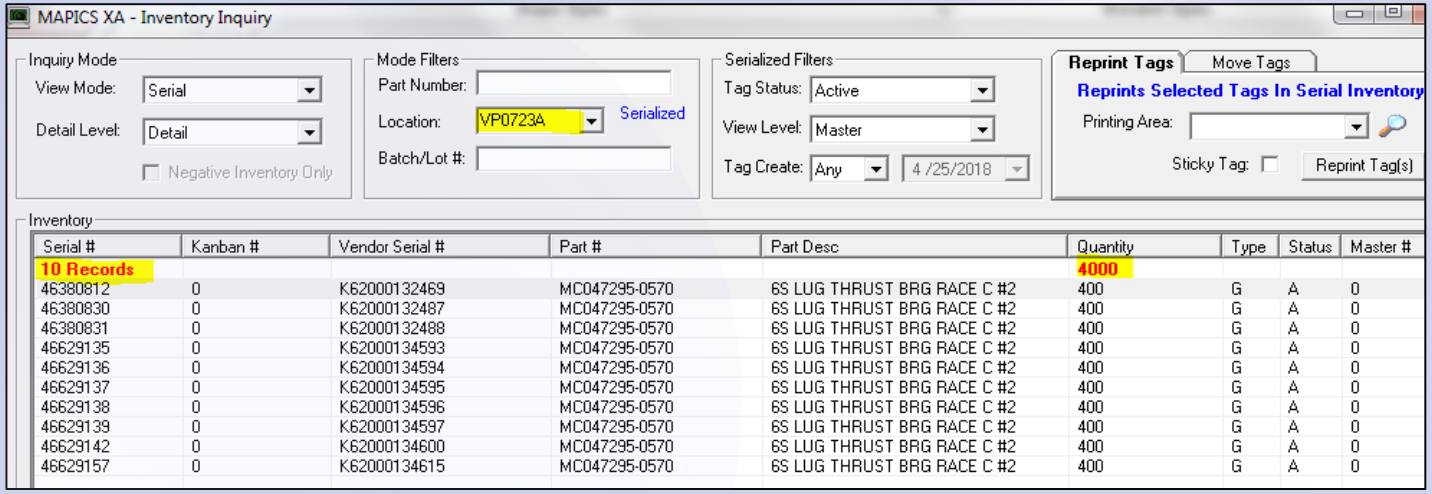
Inventory Discrepancy is the largest outside influence

Looked for Biggest cause of inventory discrepancy

Reduce amount of inventory discrepancies out of variable small parts warehouse

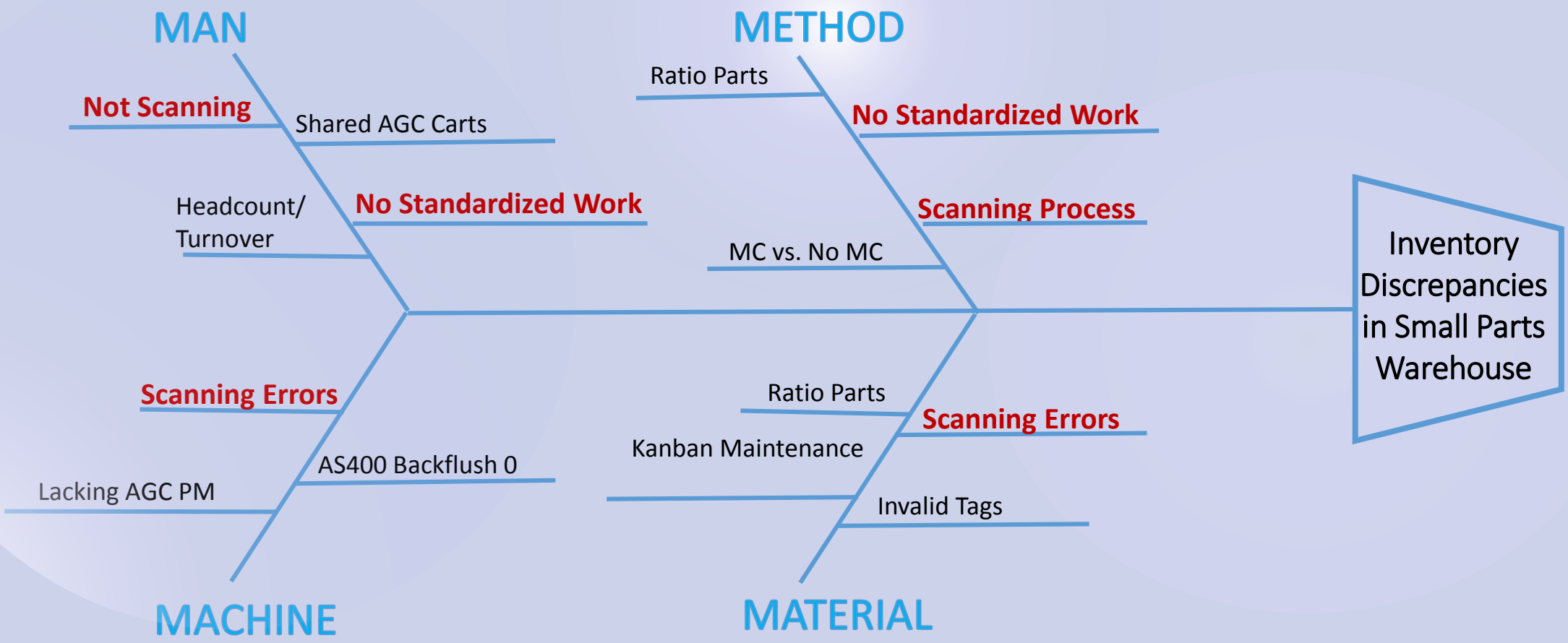
MICRO

Production Control – 2018 Improvement Activity



- System shows location VP0723A to have 10 boxes @ 400 pcs each = 4000pcs.
- In the physical location VP0723A we actually have 6 boxes @ 400 pcs each = 2400pcs.
- Inventory Discrepancy is 1600 pcs (4 boxes).
- Issue: The associate did not scan 4 boxes/ tags to the variable line when the boxes were delivered to the line.

Production Control – 2018 Improvement Activity

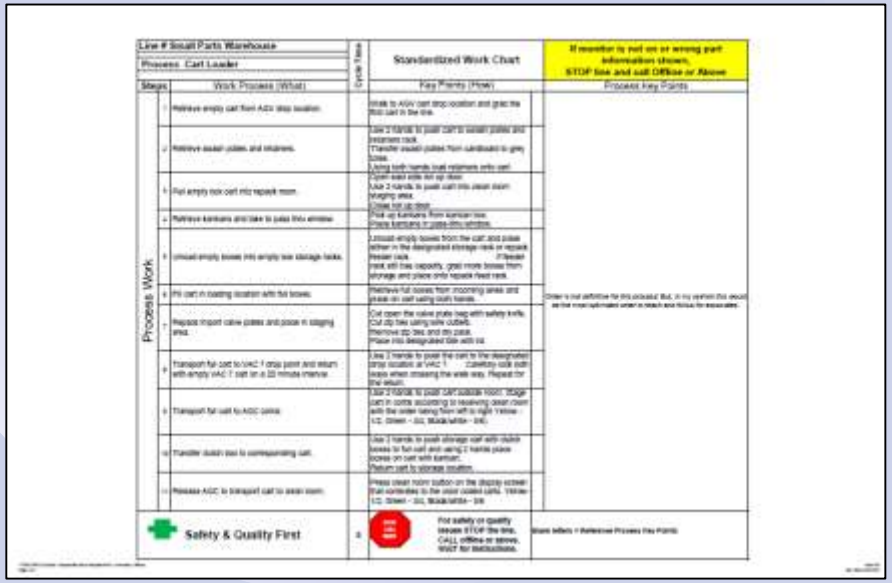


Production Control – 2018 Improvement Activity

Countermeasure	PIC	Due Date	Complete/ Comment
Reorganize & rewrite standardize work for Small Parts Warehouse	Stephanie W.	6/29/2018	Complete
One Point Lesson for “like” Import vs Domestic supplied parts	Stefanie S.	7/13/2018	Complete
Purchase new scanner	Rebecca W.	11/1/2018	Under investigation
Improve Kanban maintenance	Rebecca W	6/4/2018	Complete

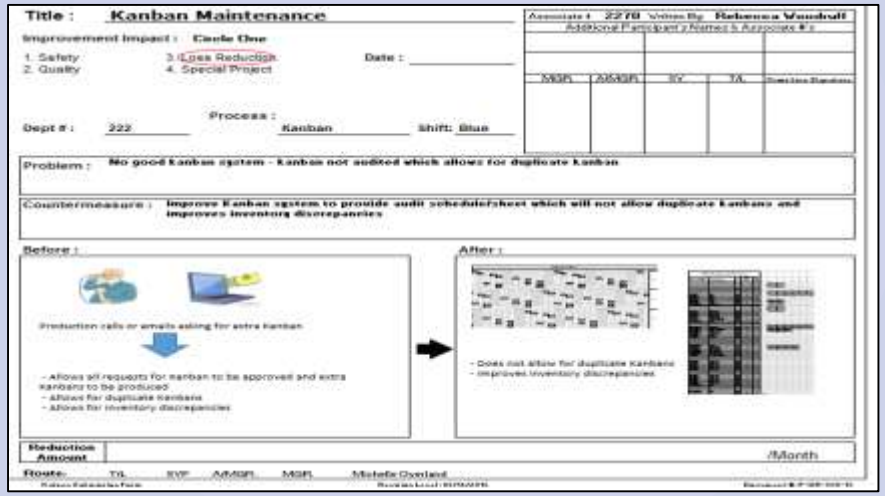
Production Control – 2018 Improvement Activity

Small Parts Warehouse Standardize Work

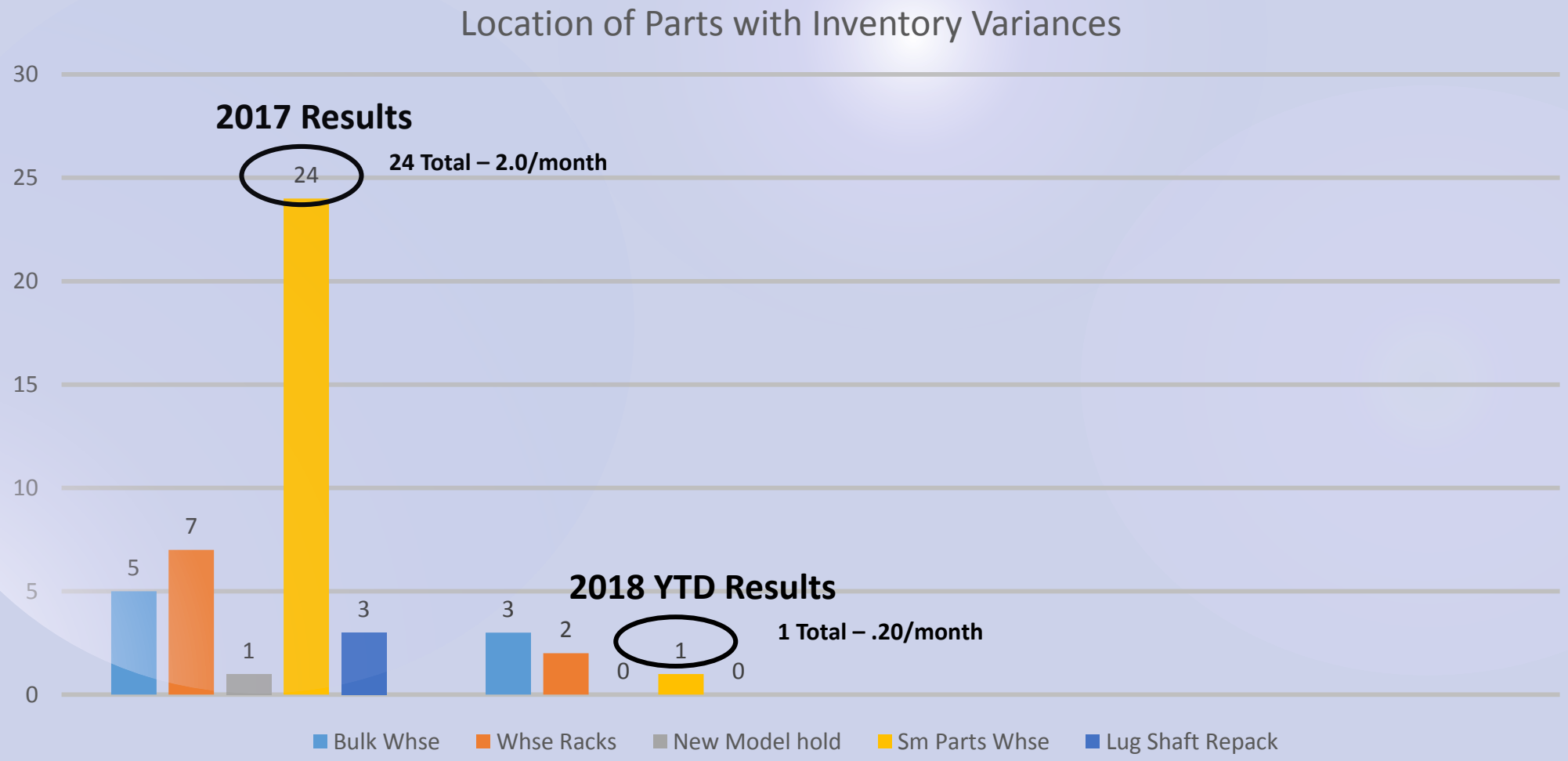


OPL "like" Import vs
Domestic supplied parts

Kanban Maintenance



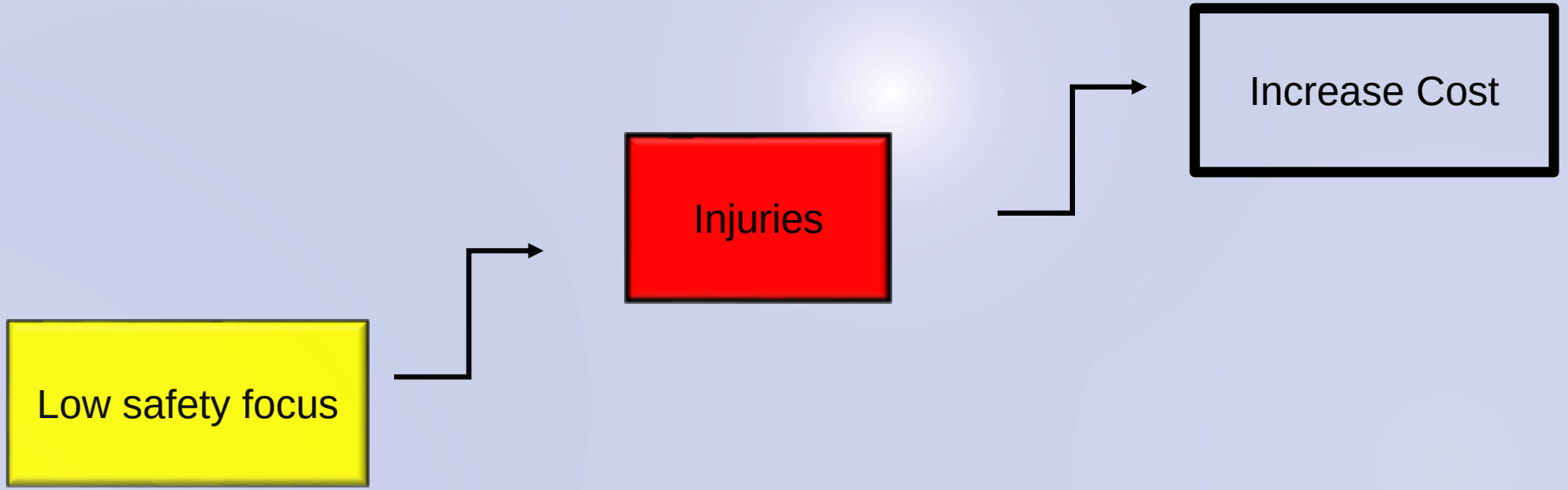
Production Control – Going From Good to Great



Purchasing
Steve Sitko

Cost To An Organization

Safety:

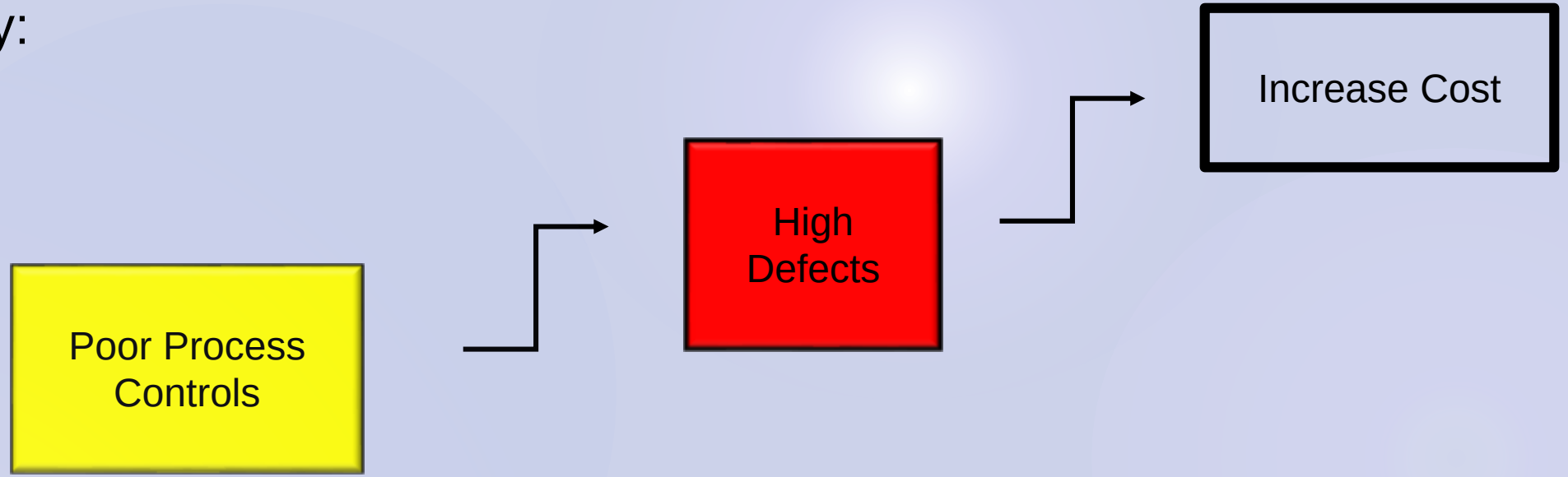


Is your organization Good or are you Great?

Do you talk safety EVERY DAY?
Do you evaluate all processes, positions?
Do you track incident trends, identify top concerns, initiate improvement activity, cross-line?

Cost To An Organization

Quality:

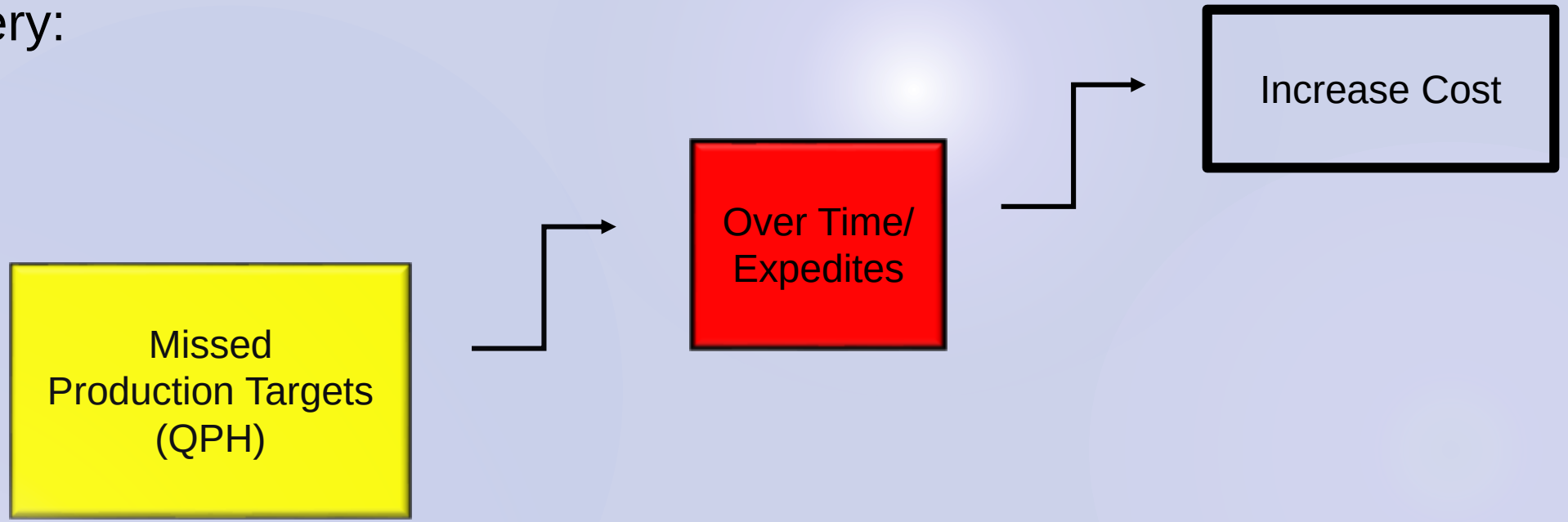


Is your organization Good or are you Great?

Do you track quality results – totals only or by each defect type?
Do you analyze trends and identify top defects (pareto)?
Do you initiate improvement activity (5 why, fishbone, etc.), track due dates and progress?

Cost To An Organization

Delivery:

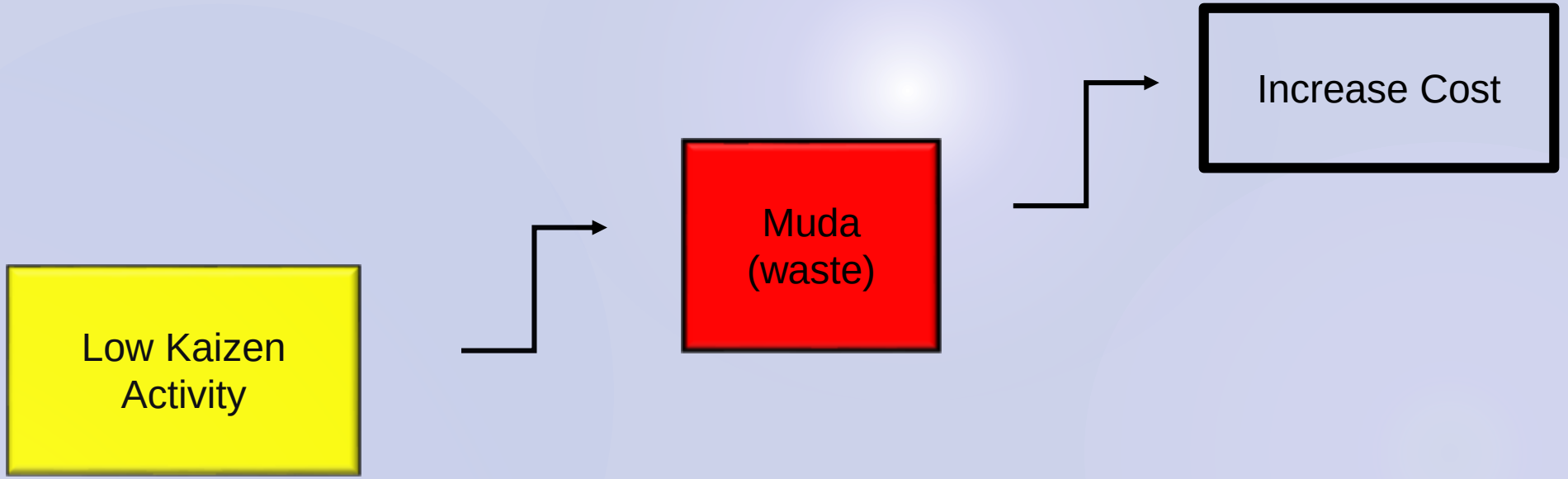


Is your organization Good or are you Great?

Do you fix the immediate problem and file paperwork away **OR**
Do you track all down-time - long and short period stops?
Do you analyze trends (weekly, monthly, etc.), initiate improvement activity, cross-line?

Cost To An Organization

Cost:



Is your organization Good or are you Great?

Do you have cost reduction programs (Kaizen, Quality Control Circles)?
Are all employees, all levels, participating?
Do you set cost reduction targets for every area?

Supplier Awards

Supplier Awards

Supplier Rating Judgment Criteria:

Quality - Defect free deliveries, risk evaluation, non-reoccurrence

Cost - Price improvement, VAVE submission, service

Delivery - On-time deliveries, SCAR free deliveries (no label/EDI problems, etc), premium free freight

Performance Level	Overall Yearly Point Rating	Percentage (%)	Award
Superior	296 ~ 300	≥ 98.7	Excellence
Outstanding	290 ~ 295	≥ 96.7	Merit
Good	260 ~ 289	≥ 86.7	None
Acceptable	225 ~ 259	≥ 75.0	None
Unsatisfactory	0 ~ 224	< 75.0	None

Supplier Awards

2017 Results Summary:

Performance Level	Production Parts	Raw Material	Sub Material	Spare Parts	Contracts	
Superior 296-300	-	-	1	1	-	3%
Outstanding 290-295	3	-	-	-	-	4%
Good 260-289	20	8	4	7	5	60%
Acceptable 225-259	7	1	6	6	5	33%
Unsatisfactory 0-224	-	-	-	-	-	

Supplier Awards

2017 Merit Winners:

Outstanding Performance 290 – 295 points

Production Parts

Nachi Technology Inc.
Greenwood, Indiana

Rotor Ball Bearings
MACI Supplier for 22 years

Production Parts

NSK
Clarinda, Iowa

Rotor Ball Bearings
MACI Supplier for 16 years

Production Parts

Rotor Clip
Somerset, New Jersey

Designed for Quality

ROTOR CLIP

Clutch Snap Rings and Housing Bolt Seals
MACI Supplier for 25 years

Supplier Awards

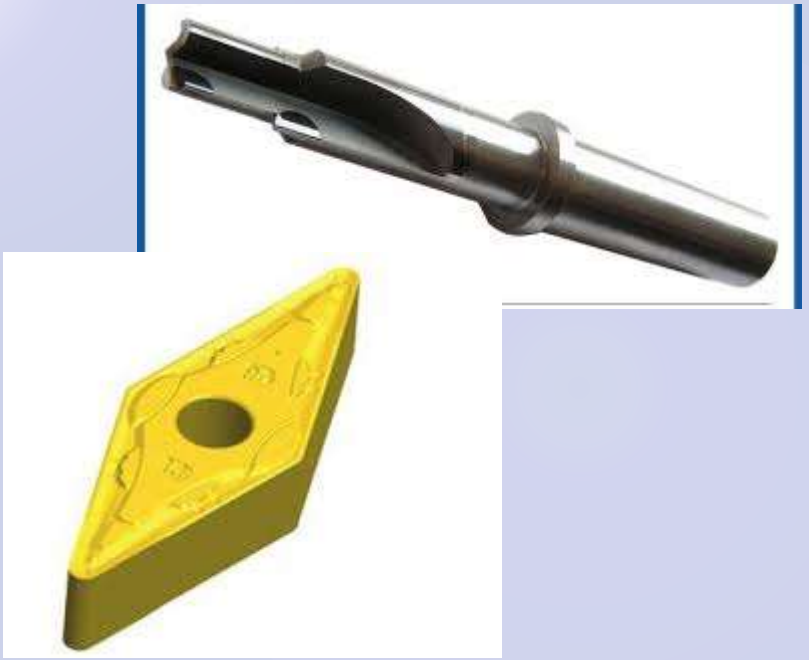
2017 Excellence Winners:

Superior Performance 296 – 300 points

Spare Parts

Alro Industrial
Jackson, Michigan

Alro Industrial Supply



Distributor - Cutting Tools
MACI Supplier for 24 years

Sub Material

Chem-Trend
Howell, Michigan

Release Agents and Casting Lubricants
MACI Supplier for 18 years

Final Comments
President Kusaba