



# Herman Miller

## Manufacturing Engagement in New Product Development

Ted Larned

John Miller

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Herman Miller

“Inspiring Designs to Help People Do Great Things”



HermanMiller



## Facts About Our Business

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- \$1.83b Sales
- 6,500 Employees globally
- External Design Partners
- Products are option rich
- Build to order
- Orders made from multiple product lines
- Final assembly done at customer's site

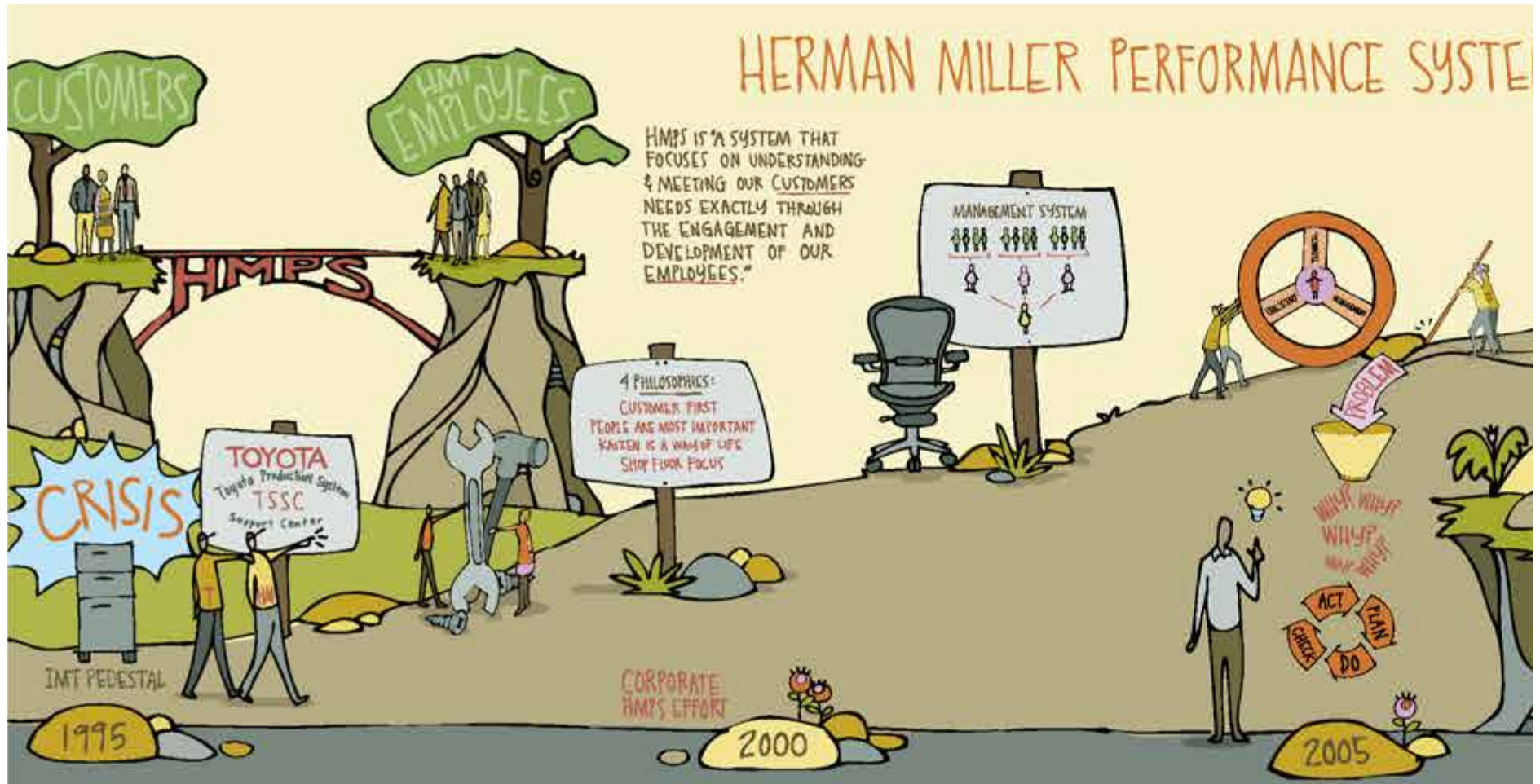


Mirra 2 Chair  
>3,000,000 skus



Canvas System

# Our Lean Journey



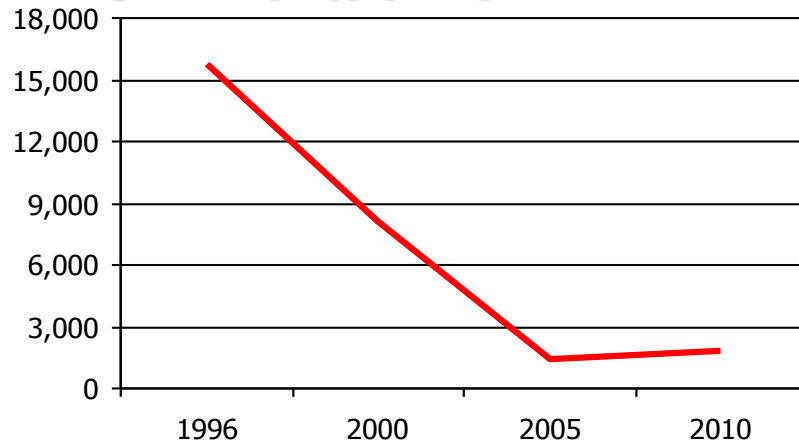
# Our Lean Journey



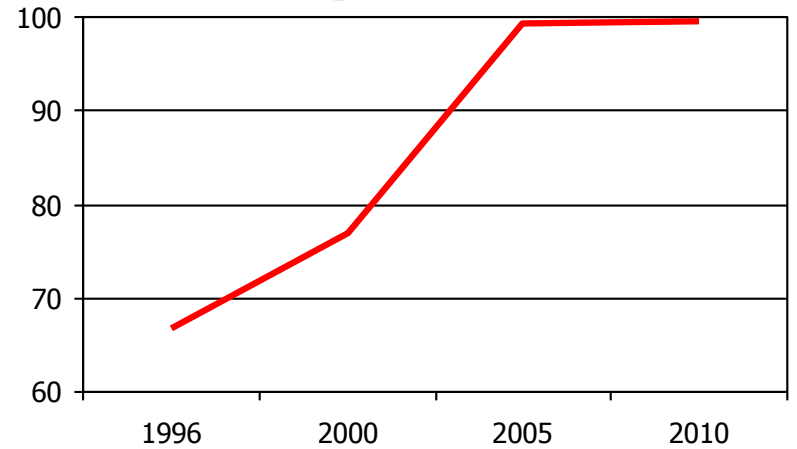


# Corporate Results

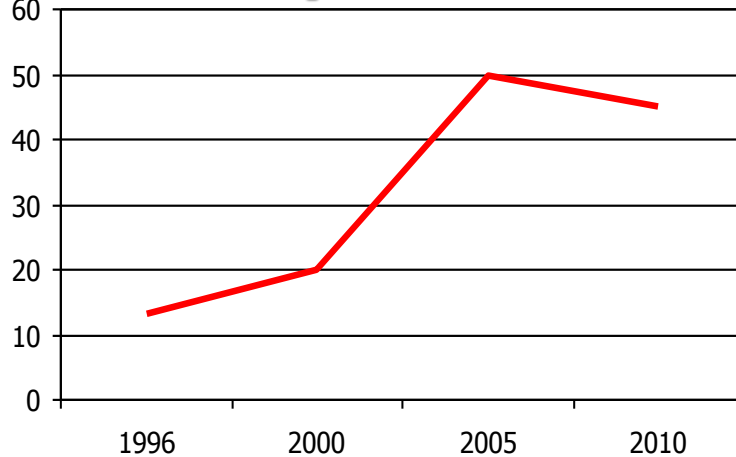
## Quality (ppm)



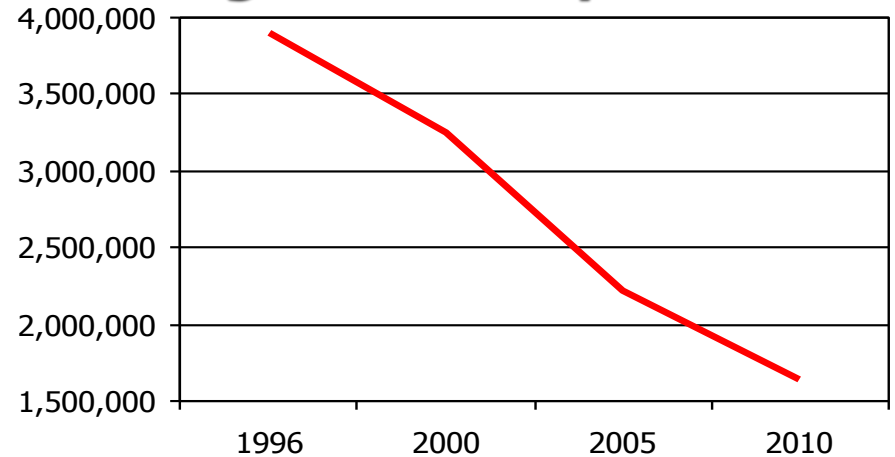
## Reliability



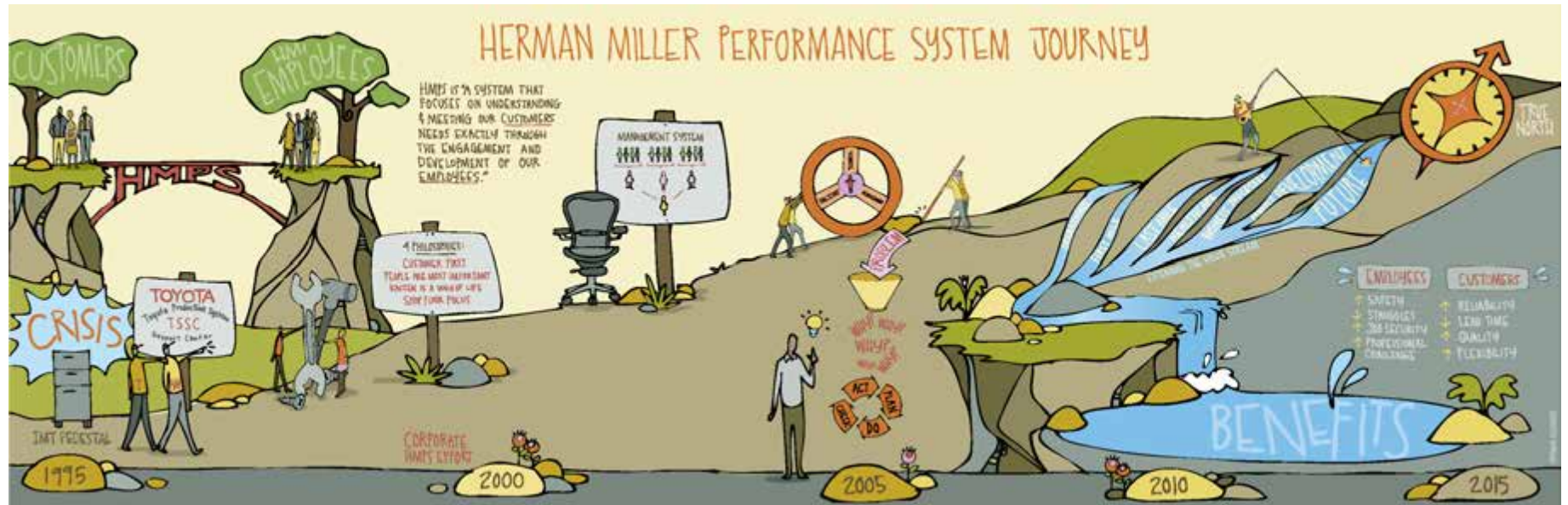
## Inventory Turns



## Mfg. & Dist. Sq. Ft.



# Our Lean Journey





# Our Lean Journey in Product Development

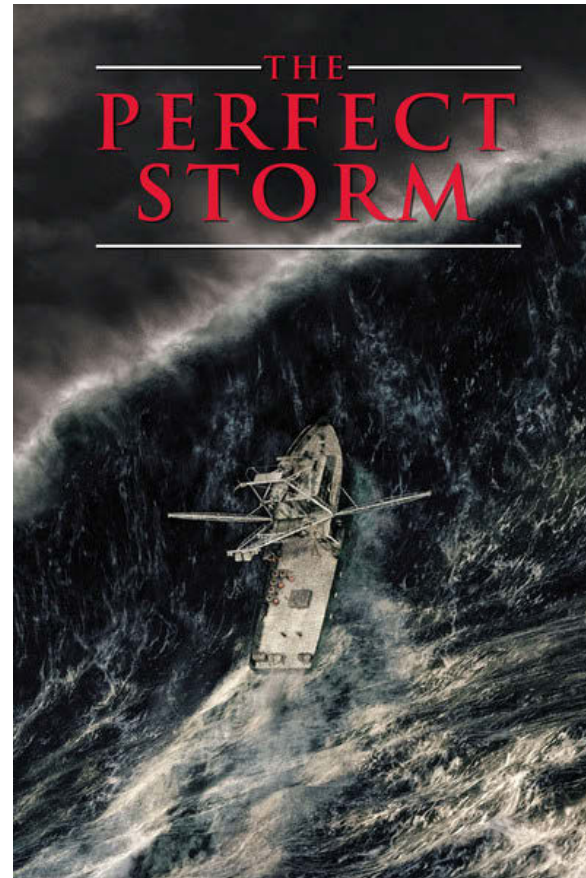
- In 2008, 3 New Products in Development
- Economic Downturn
- Pressure to have new products in revenue stream





# Our Lean Journey in Product Development

- Many Struggles
- Upon Reflecting Coined the Term “The Perfect Storm”
- By 2011 Needed to make Change



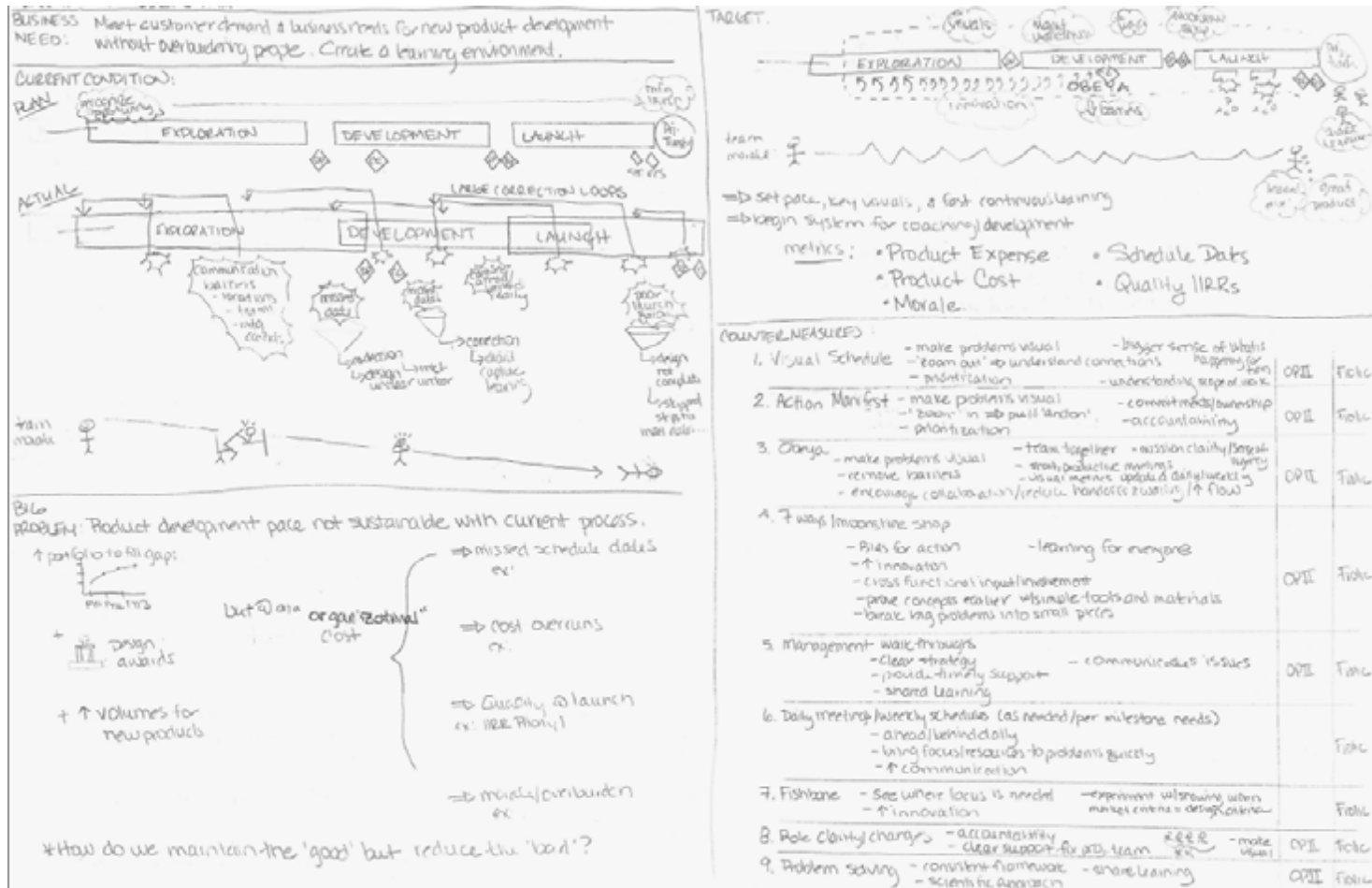


## HMPS in Product Development

- Engaged individuals from the Herman Miller Performance System, (HMPS).
- Some in New Product Development Management wanted to try Lean, not all



# HMPS in Product Development





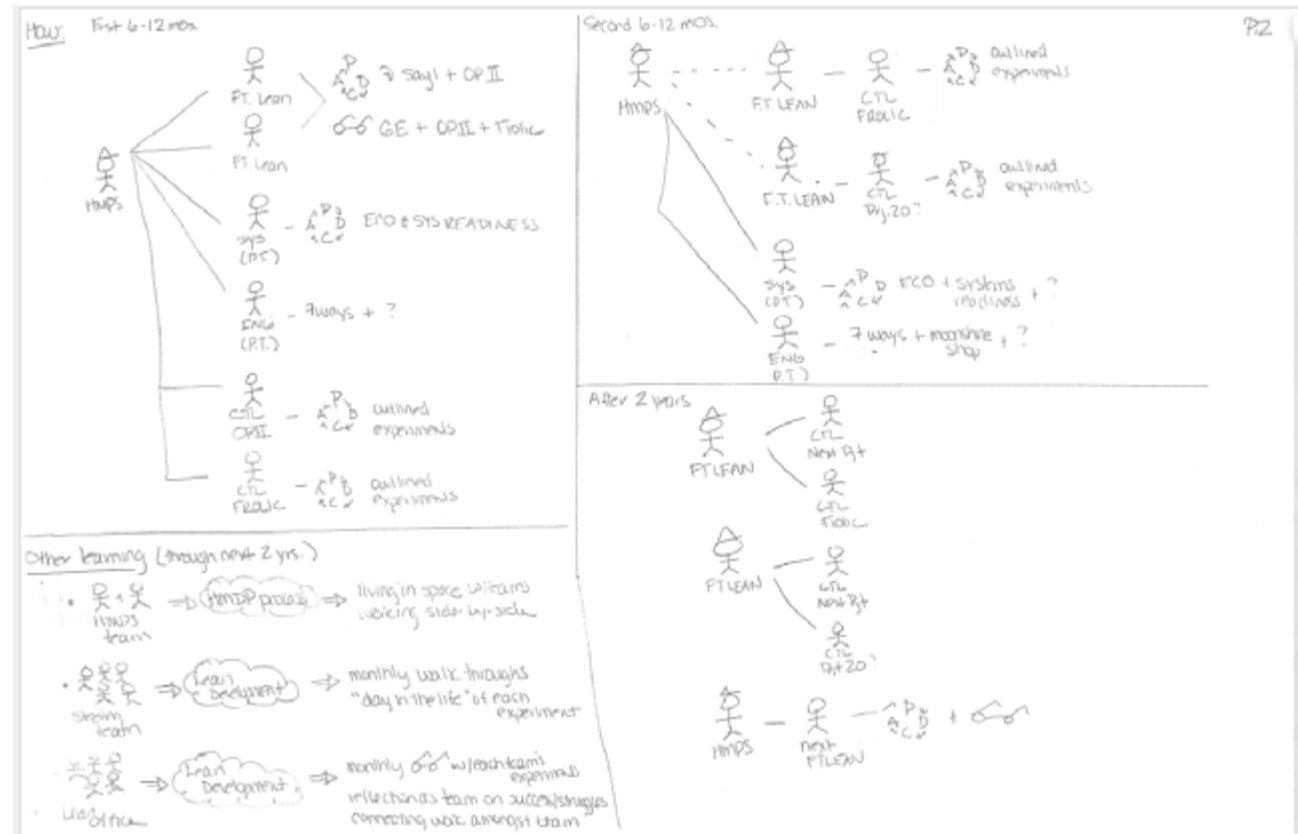
# HMPS in Product Development

- Cultural Differences
- Herman Miller  
New Product Development Culture  
Very Different Than Operations
- A level of Us versus Them,  
Product v Operations



# HMPS in Product Development

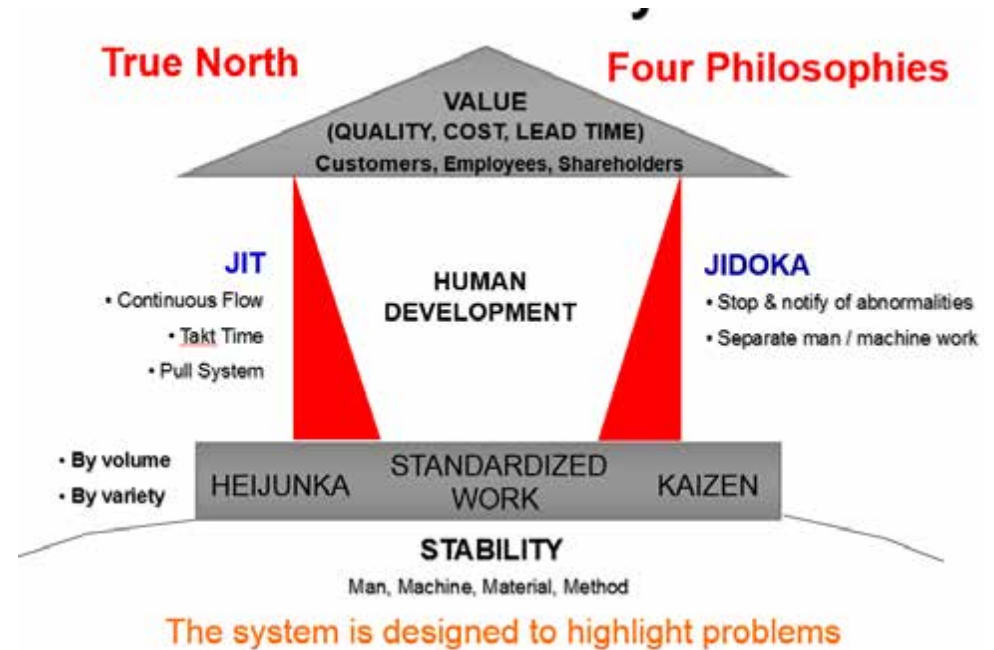
- How?
- Plan for People Development



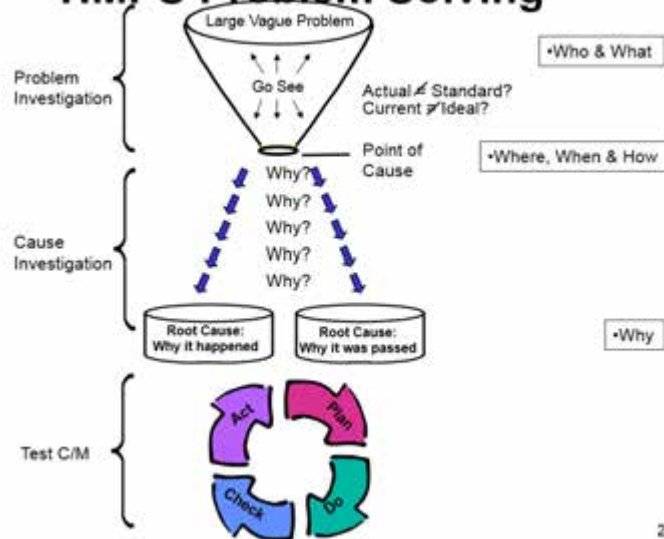


# HMPS in Product Development

- Used the HMPS Toolbox



## HMPS Problem Solving





## Looking Outside of HMI

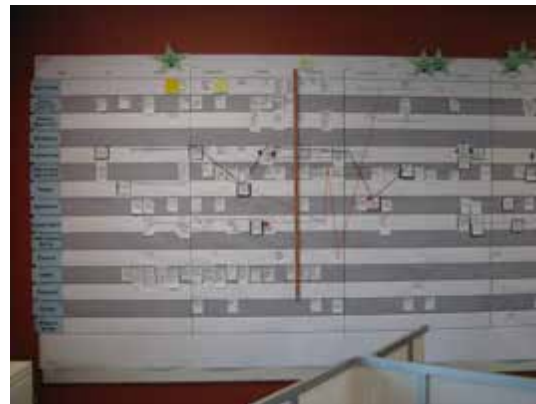
- Business Partnership with General Electric Appliance Park, Louisville, KY
- Dr. Jeff Liker advised us to connect with Dr. John Drogosz
- University of Michigan Lean Product Development Program





## Looking Outside of HMI

- Visual Schedules
- Obeya Spaces
- Fishbone Diagram
- 3P
- Problem Solving







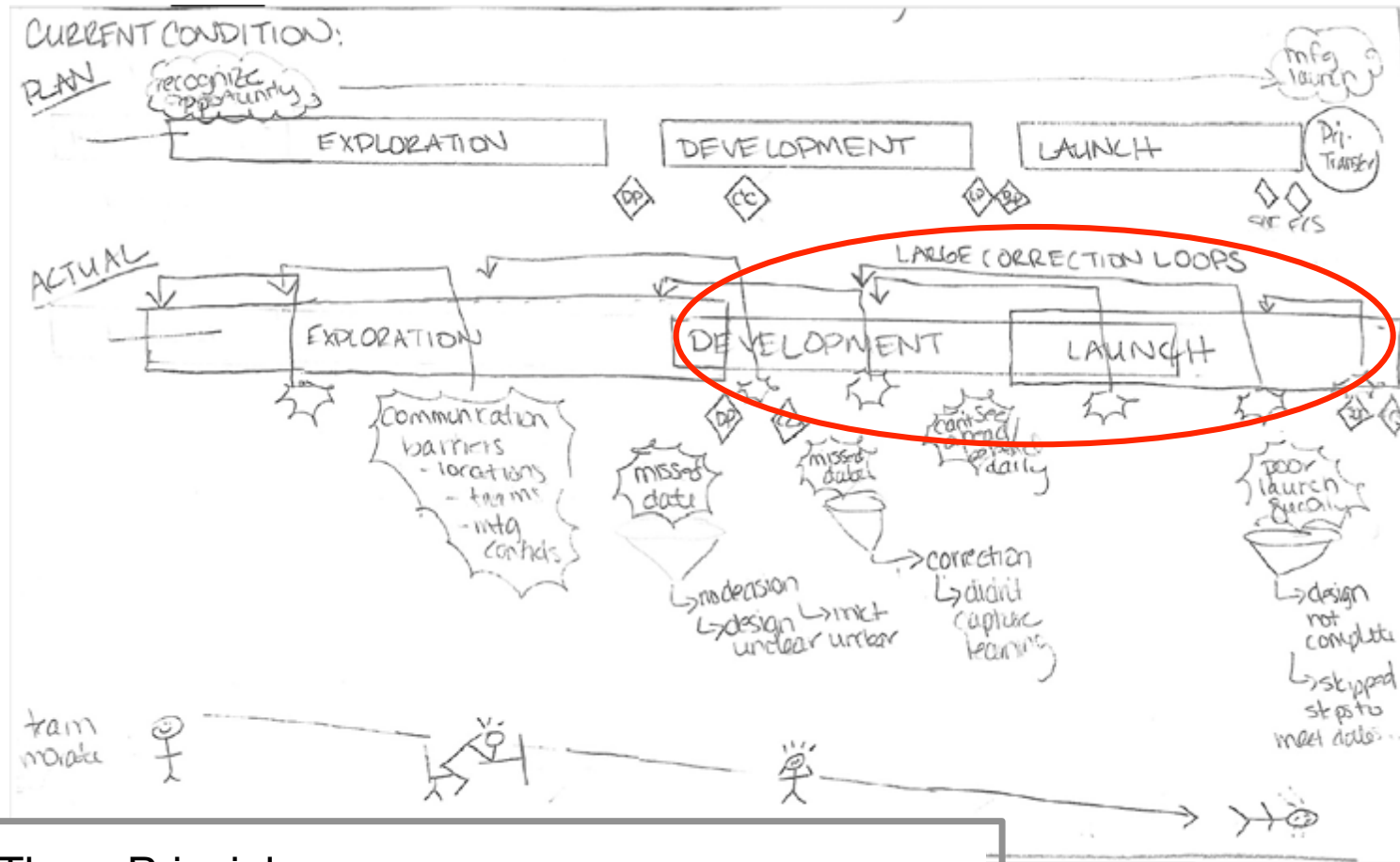
# Early Operations Engagement

The Goal:

- Reduce Operation Struggles at Launch
- Reduce design rework due to Operations issues



# Early Operations Engagement



## Three Principles

1. Make the Work Visible
2. Recognize the Normal from the Abnormal
3. Pull the Learning Forward

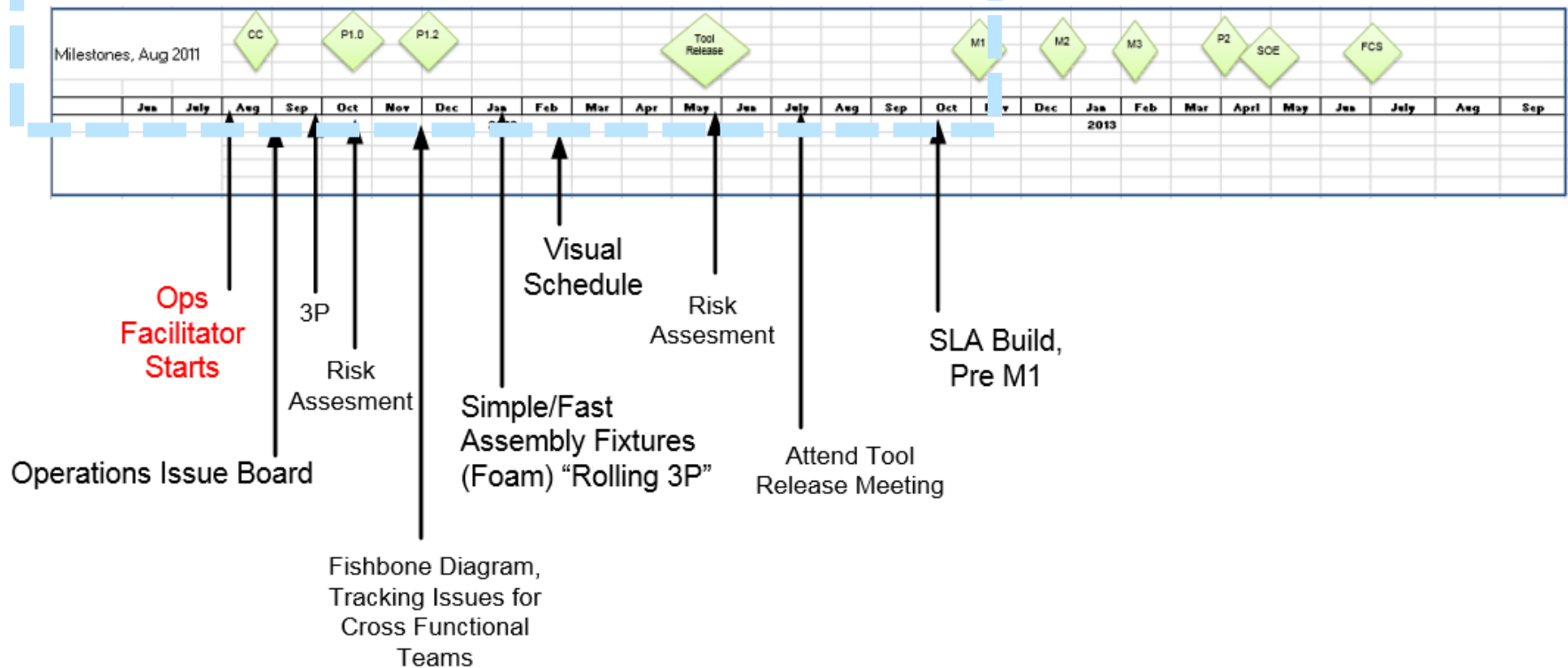


# Early Operations Engagement

Early  
Concept  
Builds

First  
Pilot  
Builds

## Early Operations Involvement Time Line





# Manufacturing Person Upstream

## Selection Criteria:

- From the shop floor
- Has experience assembling product
- Some lean experience



## “The Pierre Experiment”

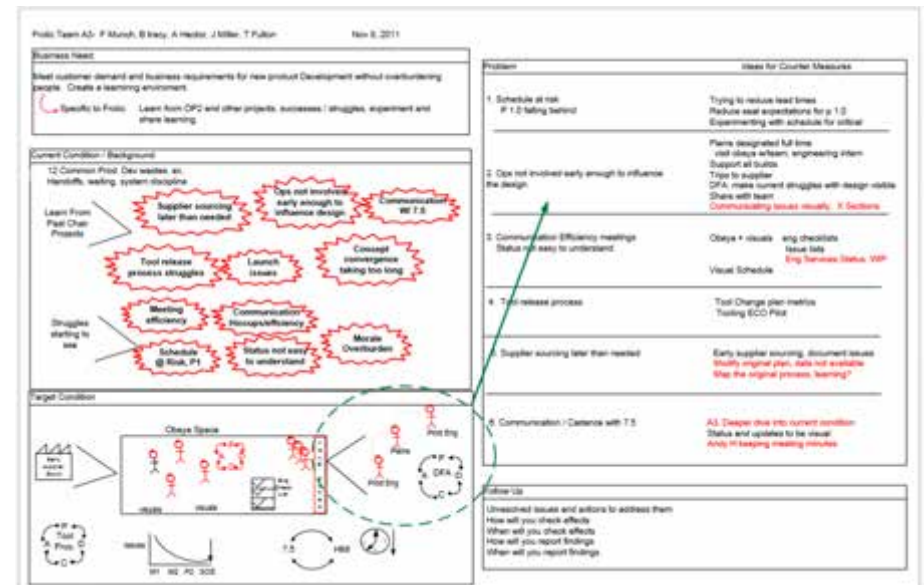
- Chose a facilitator
- Were not quite sure what the job was?
- Going to make the attempt to get better



# Manufacturing Person Upstream

## The Pierre Experiment:

- Attend engineering reviews
- Share with Prod Engineers what Operations goals were
- Communicate Issues to Development Team





# Manufacturing Person Upstream

**STEP 1: Clarify the Problem**  
 Ultimate Goal: Provide HMI customers w/ high quality product, on time, at reasonable cost.  
 Ideal Situation: First time quality at Assembly = 95% or greater  
 Current Situation: First time quality at Assembly = 89.2% (June 2014)  
 Gap Statement: First time quality at Assembly is 5.8% below our standard of 95%.

**STEP 2: Break down the Problem**  
 FTQ is 5.8% below our standard of 95%  
 70 Back Issues

**STEP 3: Target Setting**  
 Eliminate 100% of the Backs rejected for quality issues found in inspection

**STEP 4: Root Cause Analysis**  
 P.O.C.: 63 Backs rejected for quality issues that were found in inspection

**STEP 5: Develop countermeasures**  
 Backs with excessive bend flash are passing inspection at the supplier

**Root Cause**

Countermeasure	Cost	Quality	Feasibility	Cost of Implementation	Overall
1. Communicate and Post Quality Criteria in Back Packaging area, provide tags for team to measure	X	Δ	●	●	●
2. Meet with quality teams from GSO + Cascade to clarify quality criteria	X	●	●	●	●

● = Good Δ = Slight X = No Improvement  
 \* To be done at GSO + Cascade



## The Work:

- Familiar with Design
- Assembly Sequence
- Elemental Times
- Find Ergo Struggles
- Work Breakdown
- Assembly Equipment



# Manufacturing Person Upstream

- Going to meetings
- Voicing concerns

HMPD DISCUSSION FORMAT	
<p><b>Project Name:</b> <i>Fabric launch</i></p> <p><b>Discussion Business Goal:</b> <i>Eliminate Handled Parts on Adj. seat Mech</i></p> <p><b>Context:</b> <i>Adj. seat mech has coil loaded springs, which cause distortion / bend of wiring in pressurization - added hardware</i></p>  <p><b>Notes:</b></p> <ul style="list-style-type: none"><li>- design change cannot be occurred on a part of the handle</li><li>- previous design increased in part in handle on both sides.</li><li>- this will require a production</li></ul>	<p><b>Name:</b> <i>Steve Fisher</i></p> <ul style="list-style-type: none"><li>- work w/ engineer and HPO as different options</li><li>- discuss ideas with lead engineer and project manager</li><li>- get input/ideas and sign off from Designer</li></ul> <p><b>Next:</b> <i>Open required assembly's part and allow it to go to final fit station - lead engineer/lead designer to agree to launch - discuss next steps on both sides.</i></p>  <p><b>Reason for Escalation:</b> <i>As the production unit 2400 being developed ago identified potential struggle, and communication between opt / engineer / and Designer. Multiple suggestions to correct the issue before landing with this.</i></p> <p><b>Next Steps / Conditions for Escalation:</b> <i>As a part of future now that testing have been kicked off. - resistance. See traction and cycle times</i></p>

**No Traction**



# Manufacturing Person Upstream

- Make Operation Struggles Visual

Product/Part/Process Status – Operations Focus

D	C	B	A
<p>?</p> <p>No industrial design concept has been provided or selected.</p> <p>DFA feasibility of concept has not been explored.</p> <p>?</p> <p>Unknown Solution</p>	<p>Potential concept(s) exist and are being developed and evaluated/prototype parts may exist. DFA feasibility has not been proven or sufficiently demonstrated.</p> <p>Developing Potential Solution(s)</p>	<p>Prototype parts have been developed and reviewed and/or demonstrated. Confidence in DFA feasibility is growing.</p> <p>Demonstrating Chosen Solution</p>	<p>Prototype/Production intent tooling parts have been significantly/ completely developed and DFA feasibility has been successfully demonstrated at P1 or M level build.</p> <p>Confident in Chosen Solution</p>

Overall Status			
	Mid Feb	Mid Mar	Mid Apr
A	7	12	36
B	15	23	5
C	17	7	6
D	8	5	--

Tilt Cassette to Housing Connection		Greasing of Tilt		Lumbar/Spine to Antler Connection		Antler/Tilt Spring Interference	
Status	Est. date to next level	Status	Est. date to next level	Status	Est. date to next level	Status	Est. date to next level
C	Before Tool Release	E	M1 Build	A	Completed at P1.2 Build	C	P1/M1 Build
<p>Next Step(s): Design revised to eliminate. Evaluate block up before Tool Release.</p> <p>Note: To allow a certain one when placing cassette in correct location, install pin in housing.</p>		<p>Next Step(s): Investigate why lubricants, work with tilt engineer to evaluate by M1 Build.</p> <p>Consult with transferring group to locate and other parts of chair.</p>		<p>Next Step(s): Lumbar/Spine hinge not self lubricating - if lubrication required until lubricant applied.</p>		<p>Next Step(s): Same condition as P1.2 tilt. Review concerns with tilt engineer by M1/M2.</p> <p>Tilt springs have large side to tilt plate and the other can contact them when printing.</p>	
Special Tool Needed for Pivot Stud		Pivot Stud to Arm Stem Connection		Back to Spine Connection			
Status	Est. date to next level	Status	Est. date to next level	Status	Est. date to next level	Status	Est. date to next level
A	Before Tool Release	C	Before Tool Release	B	P1.2 Build	C	P1.2 Build/ P1/M1 Build
<p>Next Step(s): Initial diameter increased.</p> <p>Needed to print down diameter of stud (S) to fit the hole into the stud in the arm when printed part.</p>		<p>Next Step(s): Evaluate cross thread potential by A/DK. Review results with arm engineer.</p> <p>Adjust to meet good stud with arm stem threads (stud should be able to be hand stamped).</p>		<p>Next Step(s): Review revised design (3 parts down to 2) at P1.2 build.</p>		<p>Next Step(s): New design has extra feature to hold top. Evaluate block up before Tool Release.</p> <p>Each corner thread orientation when attaching lower footrests should be same to be consistent.</p>	

## Pivot Bearings

Status	Est. date to next level
B	P1.2 Build
<p>Next Step(s): Validate revised design at P1.2 build.</p>	

Pivot bearings could be/were put on wrong side of chair at P1.2 build.







# Manufacturing Person Upstream

## Getting on the Same Page

- Needed to explain the “why”
- Needed to “Show” the Why

## Showing Why a Problem is a Problem

- “See the Problem”
- Hands on learning
- Rapid Learning Cycles



# Manufacturing Person Upstream

Showing Why a Problem is a Problem

Wanted to:

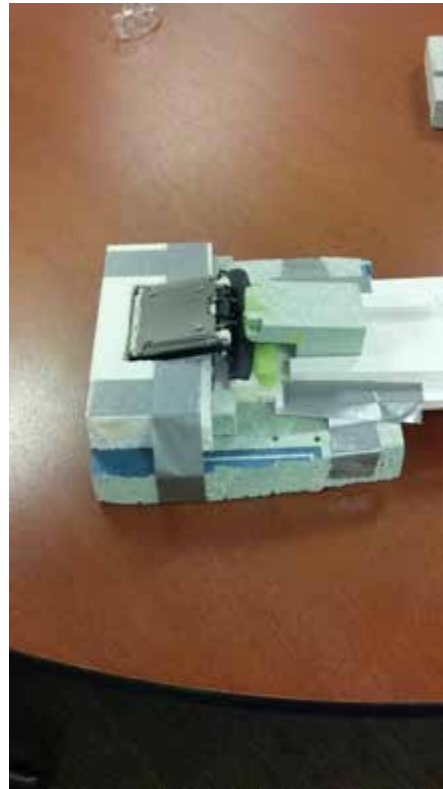
- “See the Problem”
- Hands on learning
- Rapid Learning Cycles



## Early Process Development

Mock up simple prototypes:

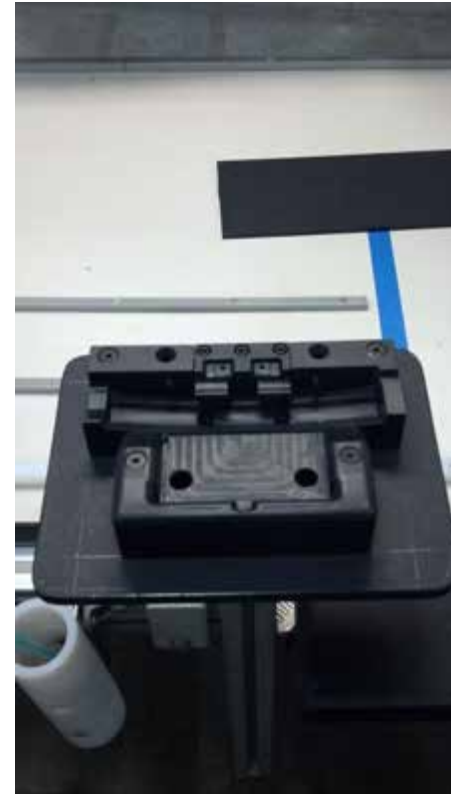
- Find struggles
- Make tradeoffs between product and process
- Keep trying





## Early Process Development

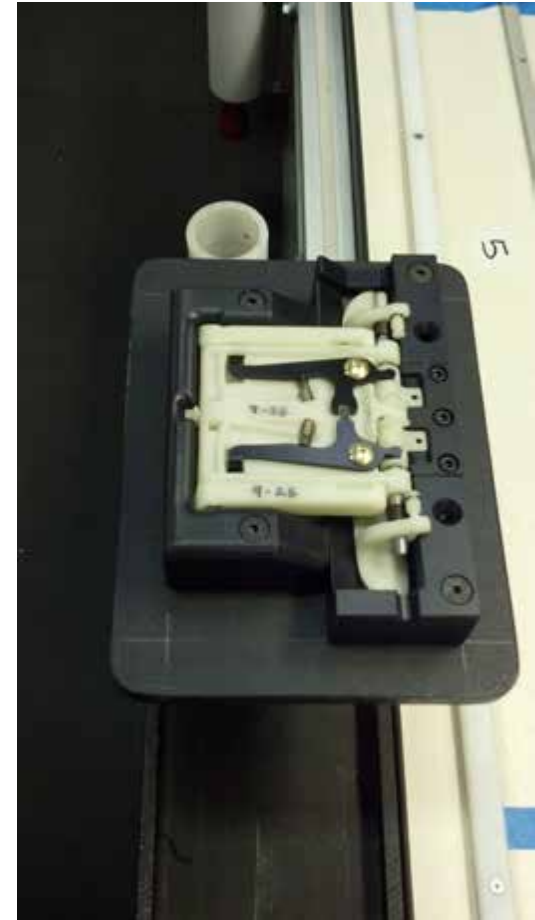
- Keep Learning and Refining the design and the assembly process
- PDCA





## Early Process Development - Reflection

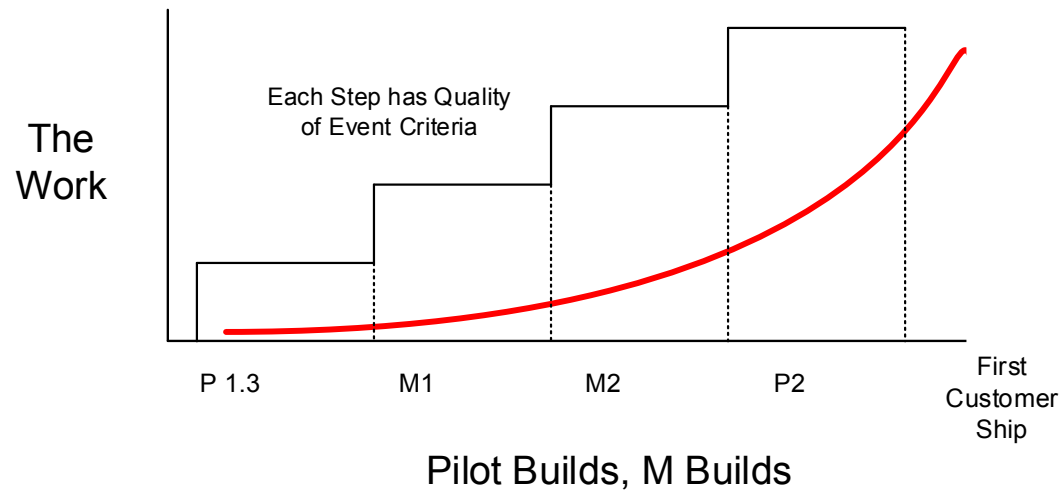
- Fast and Simple fixtures at the Product Engineering Location.
- Start before design is considered complete by PE
- Have the Product Engineer Attempt to Build





# Early Assembly Site Engagement

- Pull the Learning Forward
- Stage the Learning and stage the Work





## Early Assembly Site Engagement

Visual Schedule at Assembly Site:

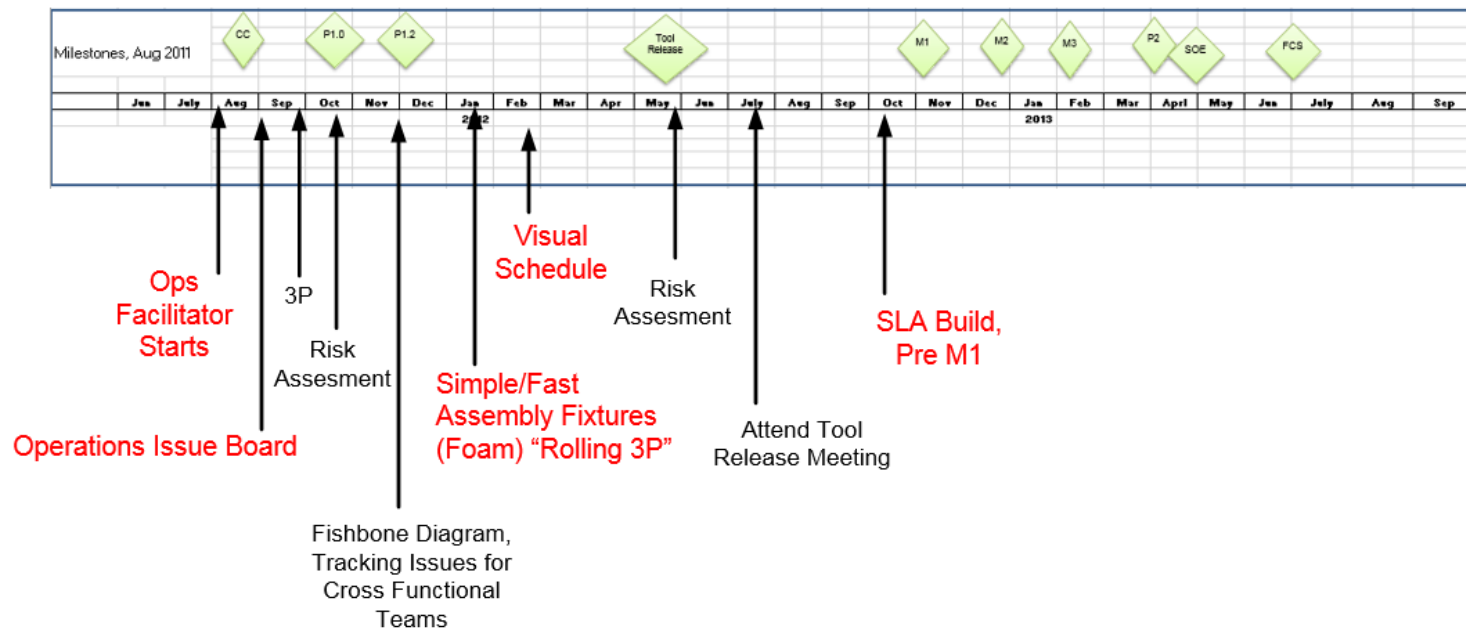
- See the Work
- Start Preparing the Assembly Plant
- Create Tasks/Deliverables
- Inputs and Outputs to create flow





# Early Operations Engagement

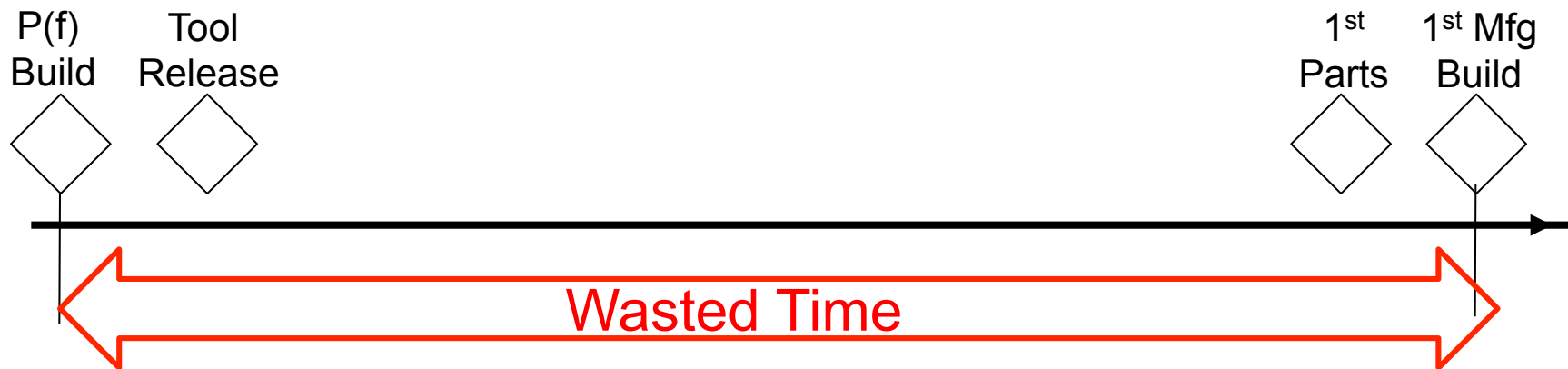
## Early Operations Involvement Time Line







## Early Operations Engagement – SLA Builds



- Pull the Learning Forward
- Front load the Learning for first manufacturing build
- Manufacturing build goal is to Validate not Discover



## Early Operations Engagement – SLA Builds

–Learn from late engineering changes that were not part of prototype builds.

–Before first pilot build (M1)





## Early Operations Engagement – SLA Builds





## Results – SLA Builds

- Validated the production assembly sequence
- Went from estimated time studies to actual time
- Improved accuracy time studies which increased confidence in the sigma cycle time
- Improved accuracy of labor costs
- Job Instructions were completed by the first build



## Results – SLA Builds

- Validated assembly sequence before first manufacturing build
- Completed actual time observations before manufacturing build
- Confirmed total cycle time before first manufacturing build
- Improved accuracy of labor cost
- Completed Job Instructions for operator training by the first manufacturing build



## Early Operations Engagement – Learning

- Ops became an advocate when launching, defending the design
- Ops Management now trusting the launch team, less noise
- Operations and Development Engineering developed a deeper understanding of each others struggles





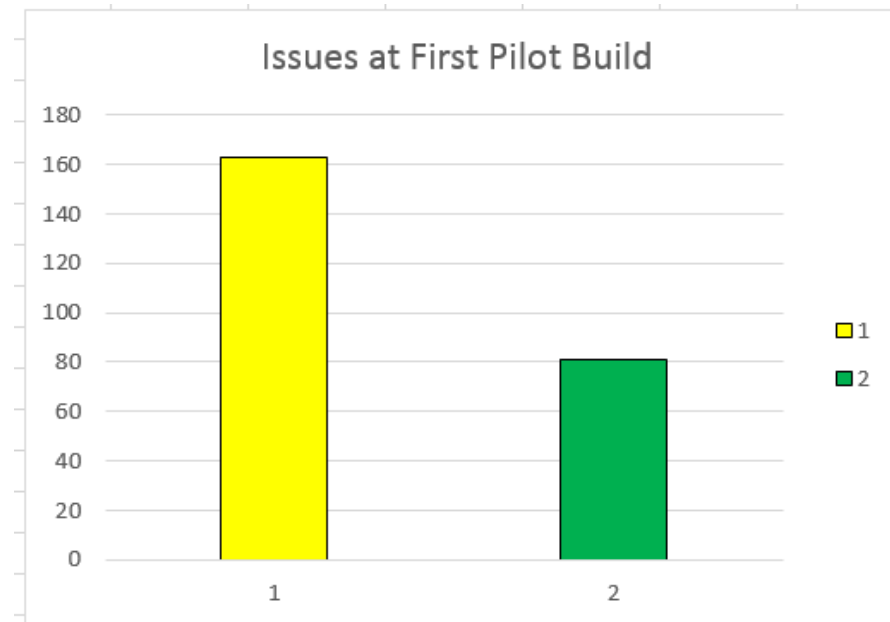
## Early Operations Engagement – Learning

- Operations and Development  
Engineering developed a deeper understanding of each others struggles



## Early Operations Engagement – Results

- Previous Project, 163 issues at first Pilot Build
- With new process, 81 issues at first Pilot Build

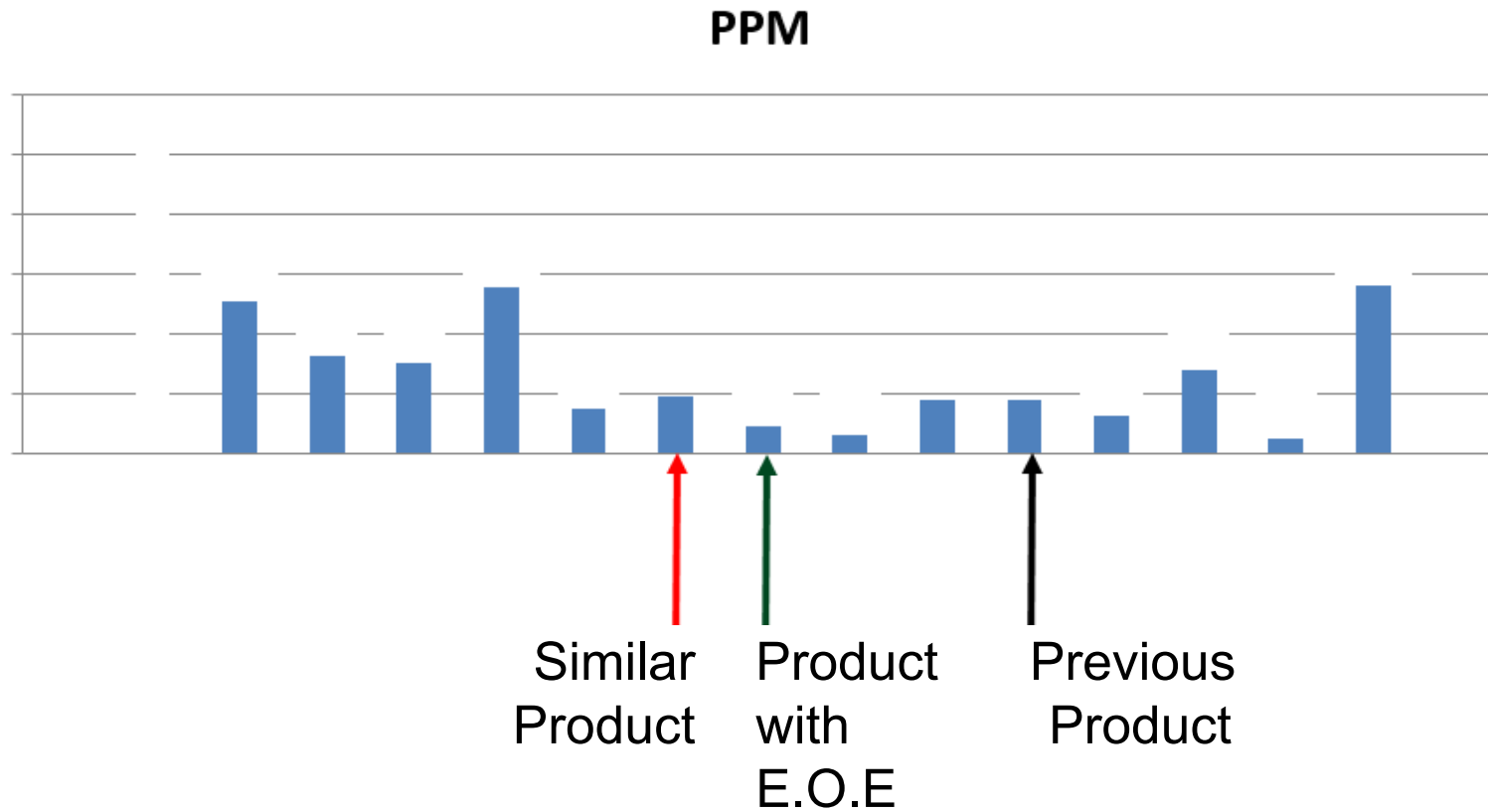






## Early Operations Engagement – Results

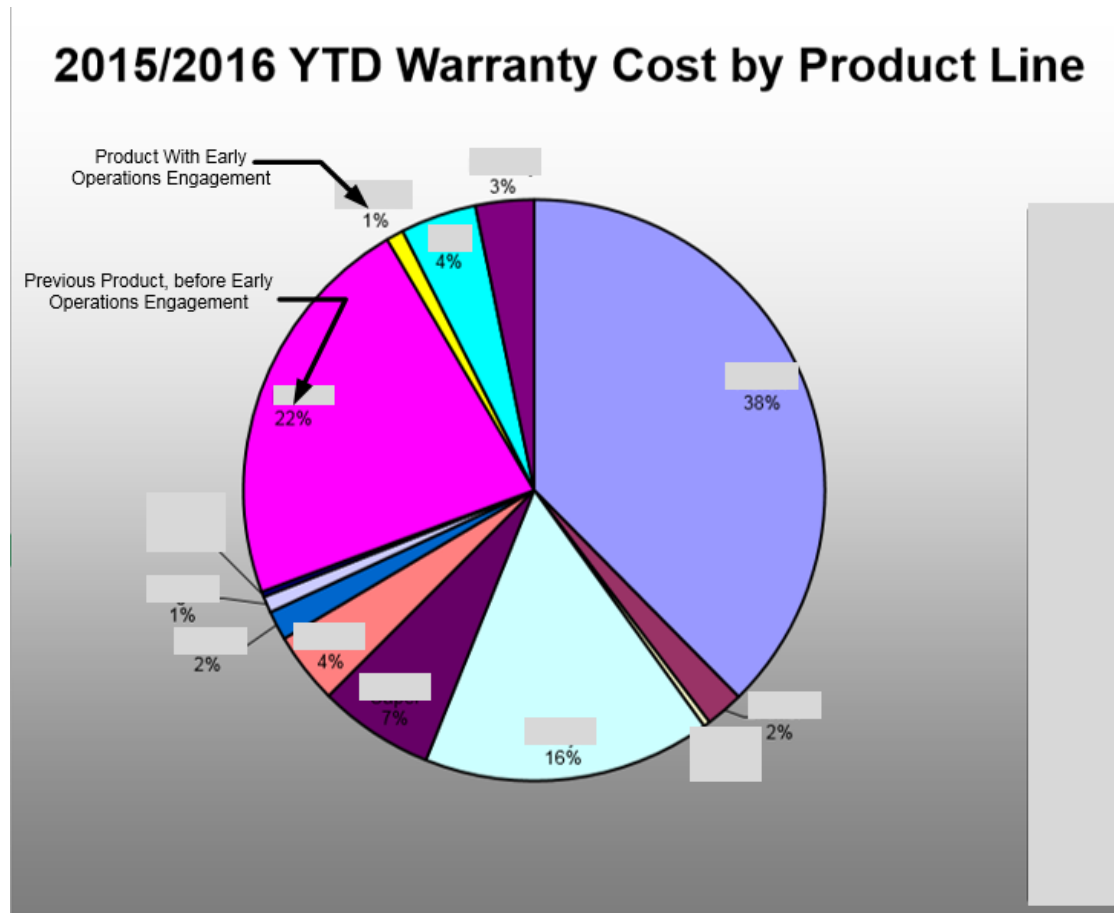
- One of the Lowest PPM of all products
- Half of previous launch





# Early Operations Engagement – Results

- One of the Lowest Warranty Costs
- 1%





## Learning

- Start Sooner in Development
- Must have a Deliverable
- Keep asking, “what useful knowledge is being generated?”



## Standards

- Identify and “show” the problem
- Impact to key metrics with data: cost, quality, human struggle, function...
- Develop & share target condition
- Make feedback actionable to the Product Engineer
- Tradeoffs



## Reflection

- Culture Resistance/ Challenges
- 'Go and See' & keep it simple
- Pull the learning upstream in the process
- Revisit your Approach
- Reflect Early and Often
- Patience



Questions

Questions?



In your small group –

1. Briefly discuss your Product Development connection with Manufacturing
  - What is your current condition?
  - What opportunities do you have for improvement?
  - What are you going to try on Monday?
2. Choose a spokesperson to share one story with the rest of the room.



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