Lean and Environment Part 2

How Businesses Use Lean Techniques And Environmental Awareness To Succeed

Lean Building Blocks

- Techniques used to get to lean
- Don’t confuse with “being lean” – lean is a process
- No technique is a fix all

"I suppose it is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail.“ - Maslow

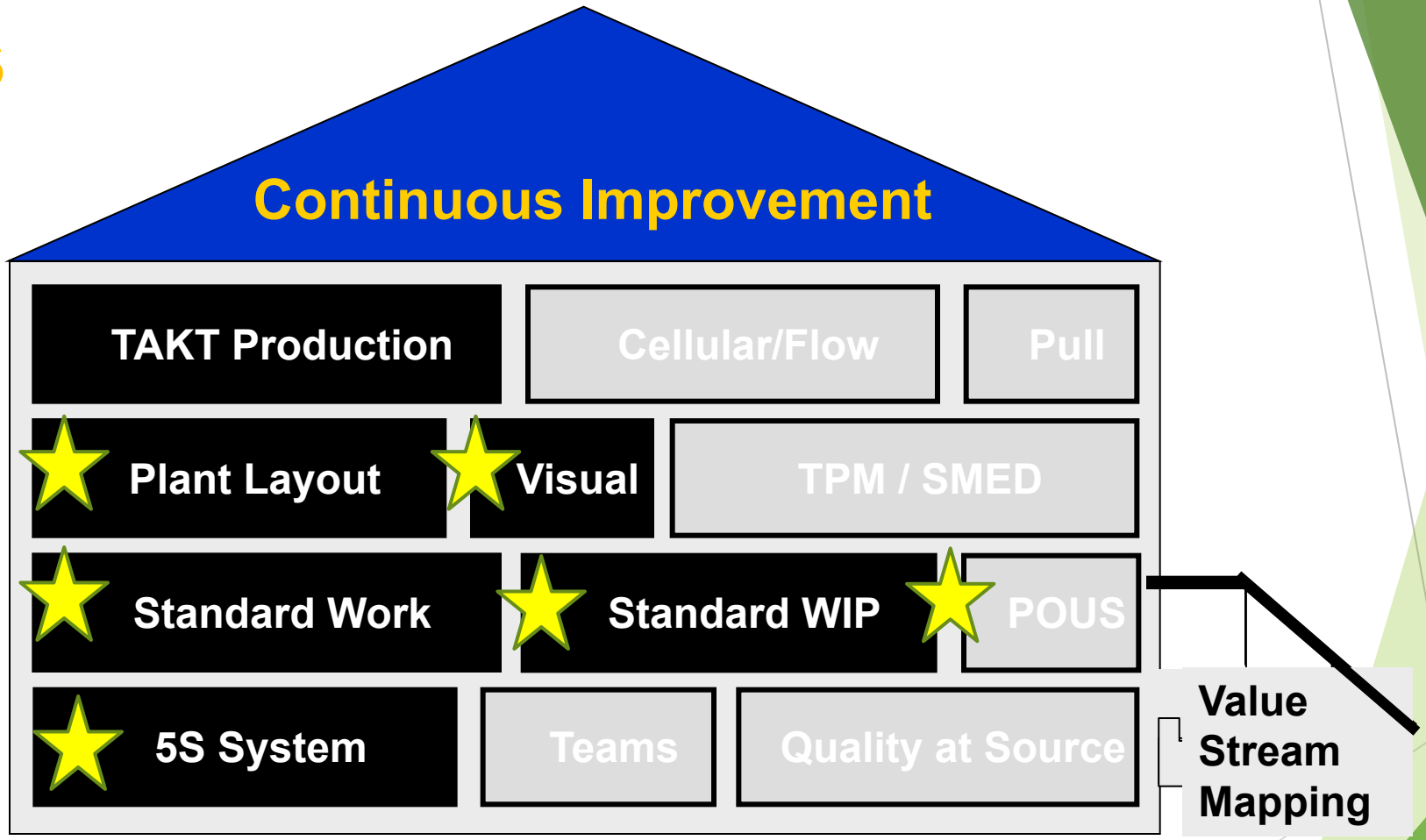
Use a System

- “Clean up your room” is ineffective

Order is Relative

- Lean is about enlisting the skills of the people who do the work.
- If you are going to fix the process, you need to ask the processors.

Lean Building Blocks



VI. Total Productive Maintenance (TPM)

- Systematic approach to the elimination of equipment downtime as a waste factor
- Enlisting the intelligence and skills of the people who are MOST familiar with operations
- Charting/analyzing equipment performance and implementing permanent corrective actions

Six Major Losses

1. Set up and adjustments
2. Breakdown
3. Idling and minor adjustments
4. Reduced Speed
5. Start Up
6. Production Rejects

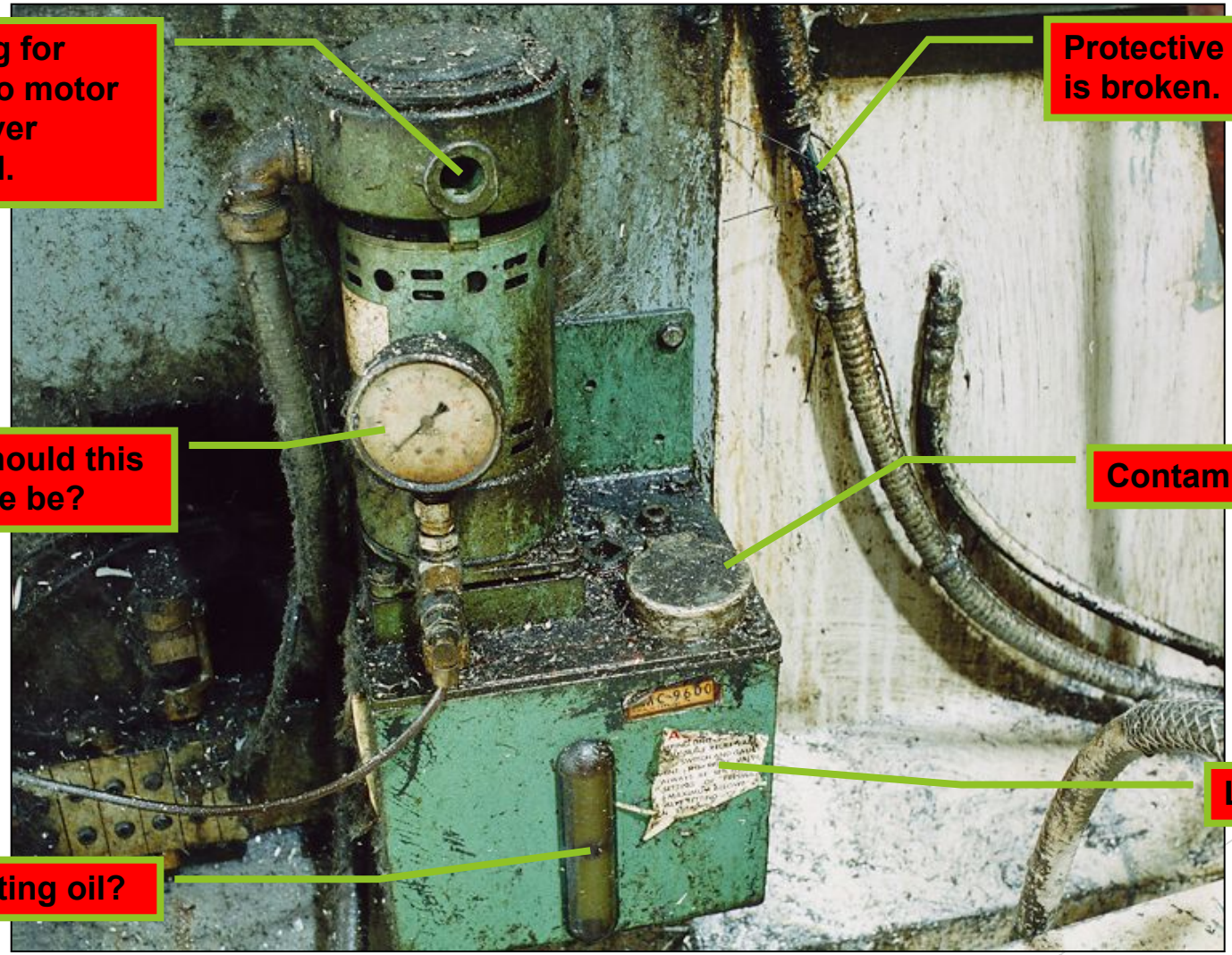
Principles

- Autonomous Maintenance
- Focused Improvement
- Planned Maintenance
- Quality management
- Early/equipment management
- Education and Training
- Administrative & office TPM
- Safety Health Environmental conditions

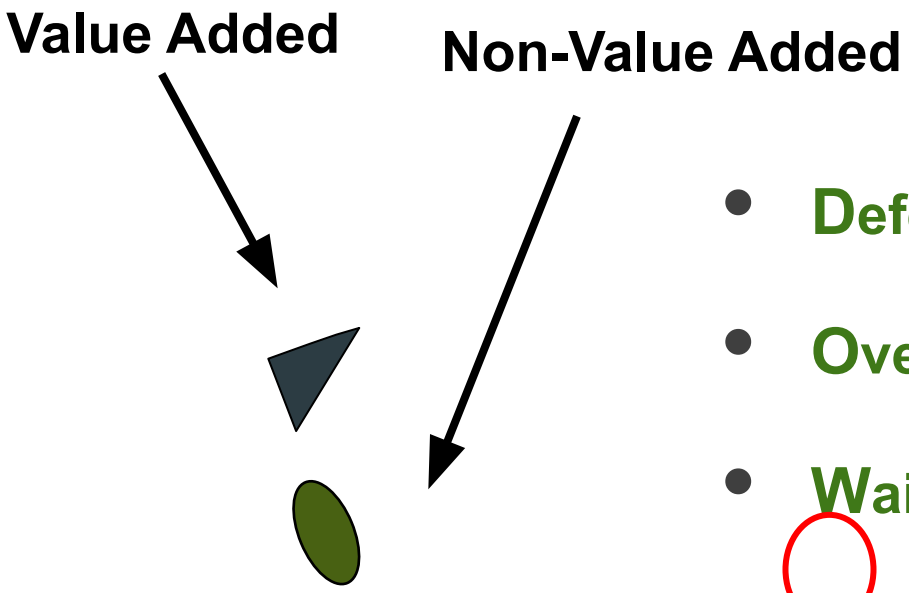
Phases of TPM

- Stabilize Failure Interval
- Lengthen Equipment Life
- Planned Maintenance
  - Equipment Condition
  - Predict Equipment Life

What Problems Do You See?



Stabilizing

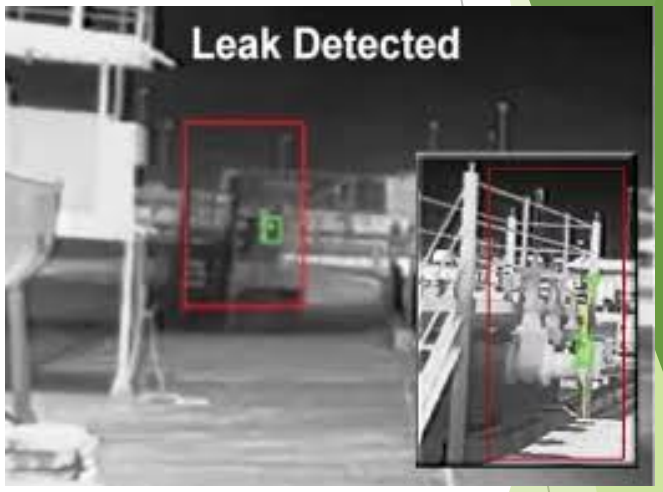


- Defects
- Overproduction
- Waiting
- Non-Value Added Processing
- Transportation
- Inventory
- Motion
- Employees Underutilized

Typically 95% of all lead time is non-value added

Leak Detection and Repair

- Houston Chemical Company
  - Monitor and eliminate leaks of all VOCs
    - 20,000 valves
    - 80,000 flanges.
  - Material losses reduced by 2,500,000 pounds
  - Benzene leaks dropped from 119 per year to less than 36.



VII. Quality at the Source

- Source Inspection
- Operators Inspection
- Established Standards
  - Revisit regular
- Process Documentation
  - Specific to each work area

Quality Control

- Should be conducted at every step
- Defects in the line lead to wasted production throughout

Andon – Calling out Mistakes

- When a defect is found the worker is empowered to call out defects and call for help.

Empowerment of Employees

- 1970s GM Manager in 1980s Toyota Plant
  - Shutting down the line was discouraged at GM
  - Toyata considered it a sign defects weren't being caught
- Employees MUST feel safe
  - Point out unproductive efforts
  - Look for solutions

Lean is a CULTURE Shift

Hotwash

- Immediate "after-action" discussions and evaluations of an agency's (or multiple agencies') performance following an exercise, training session, or major event

FEMA

Evaluation Ideas in a Hotwash

- Goal achievement
- Training and staffing deficiencies
- Necessary upgrades and corrections to protocols and procedures
- Additional coordination needed
- Planning and upgrading future activities

VIII. Defect Prevention: Mistake Proofing

- "Checklist" built into operations
- Process only allows operator to perform task correctly
  - Physical - Jigs, fixtures, stops, aligners
  - Activity - Sequence controller, Quantity controller
  - Data Entry - Bar coding, Specific options (dropdown menu)

Poka Yoke Example: Guide Pins

- Cannot put this in the wrong
- port nor the wrong way

Defect Prevention: Mistake Proofing

Identify places where mistakes happen the most frequently

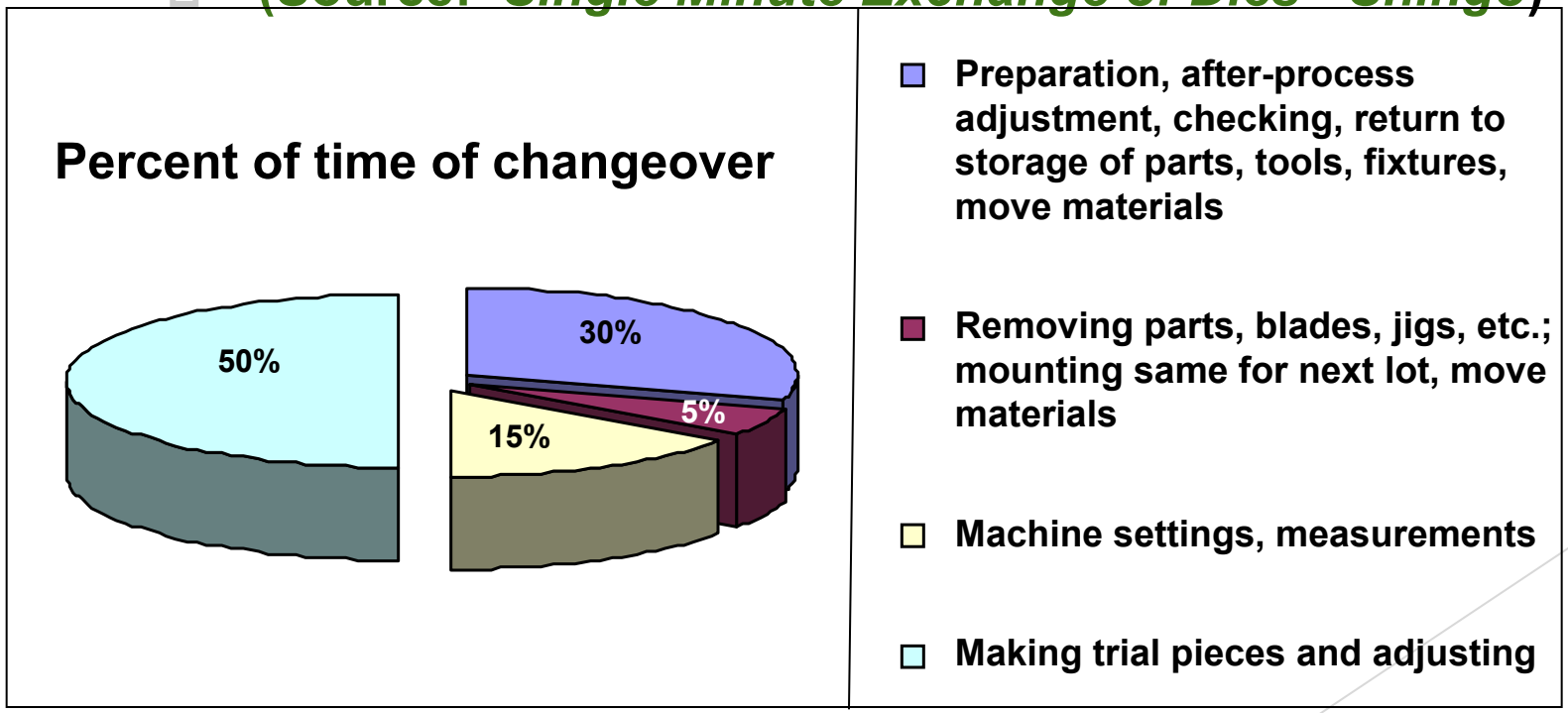
Paint Job Quality Control Checklist

Job: 629555
Inspector: Al Kyder

Problem	Frequency
Clip	
Bubble	
Run	
Scrape or scratch	
Inadequate coverage	
Other	

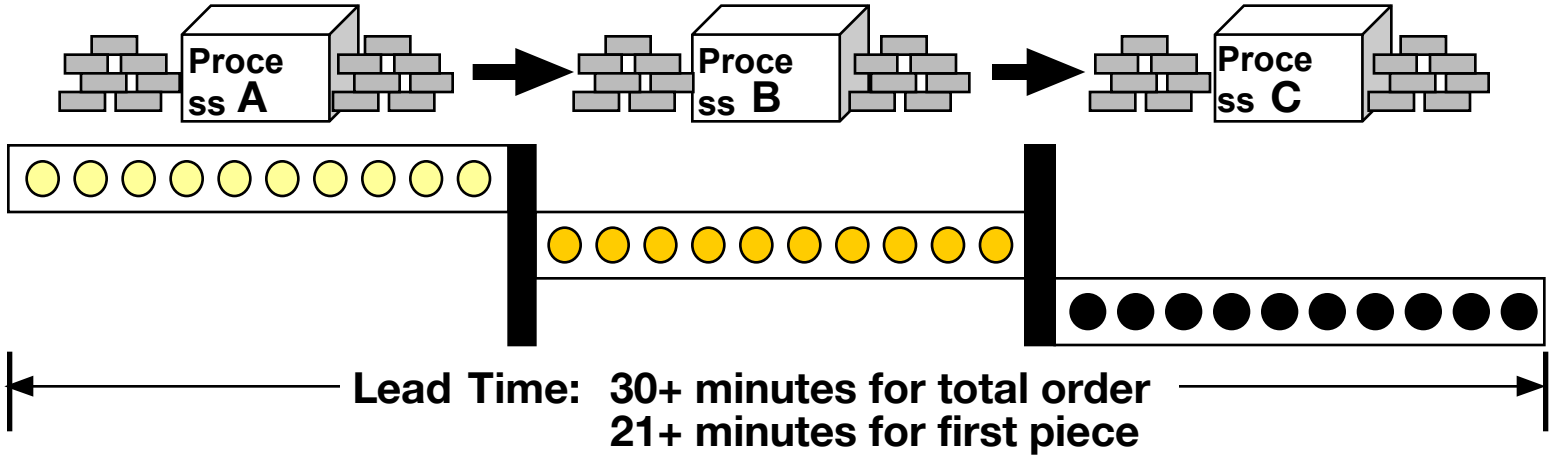
IX. Quick Changeover

- Definition: Changing over a process to produce
  - a different product in the most efficient manner.
- STEPS IN A CHANGEOVER
- (Source: *Single Minute Exchange of Dies - Shingo*)

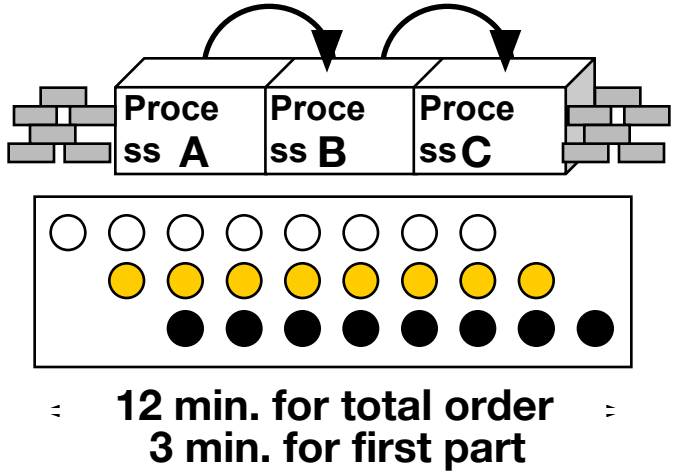


X. Single Piece Flow

- **Batch & Queue Processing *(big batches)***



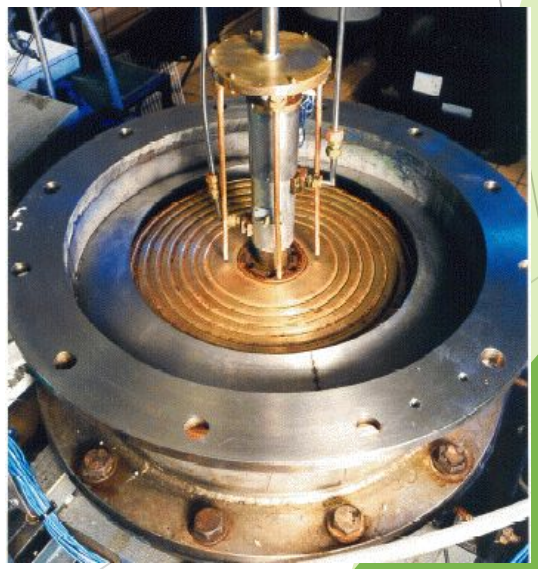
- **Continuous Flow Processing *(small batches)***



Case Study: GlaxoSmithKline

- **99% reduction in inventory**
- **93% reduction in impurities**

Process Intensification
combining separate unit operations such as reaction and separation into a single piece of equipment resulting in a more efficient, cleaner, and economical reactions.



XI. Push vs. Pull Systems

- **Push System - Resources are provided to the consumer based on forecasts or schedules.**

- **Pull System - A method of controlling the flow of resources by replacing only what has been consumed. Pull systems are demand driven.**

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Dell's Make-To-Order System Leaves Competitors In The Dust

The Internet is upending the model for how businesses operate, and companies t don't take advantage of the change will have a difficult time staying afloat, says Michael Dell, chairman, CEO and founder of Dell Computer Corp.

"With the advent of the Internet, process innovation will no longer be measured

Pull System

- Pull System is a flexible and simple method of controlling/balancing the flow of resources.
  - Eliminates waste of handling, storage, expediting, obsolescence, repair, rework, facilities, equipment, excess inventory (work-in-process and finished)
- Pull System consists of:
  - Production based on actual consumption
  - Small lots
  - Low inventories
  - Management by sight
  - Better communication

Kanban System

1. Each process issues requests (kanban) to its suppliers when it consumes its supplies.
2. Each process produces according to the quantity and sequence of incoming requests.
3. No items are made or transported without a request.
4. The request associated with an item is always attached to it.
5. Processes must not send out defective items, to ensure that the finished products will be defect-free.
6. Limiting the number of pending requests makes the process more sensitive and reveals inefficiencies.

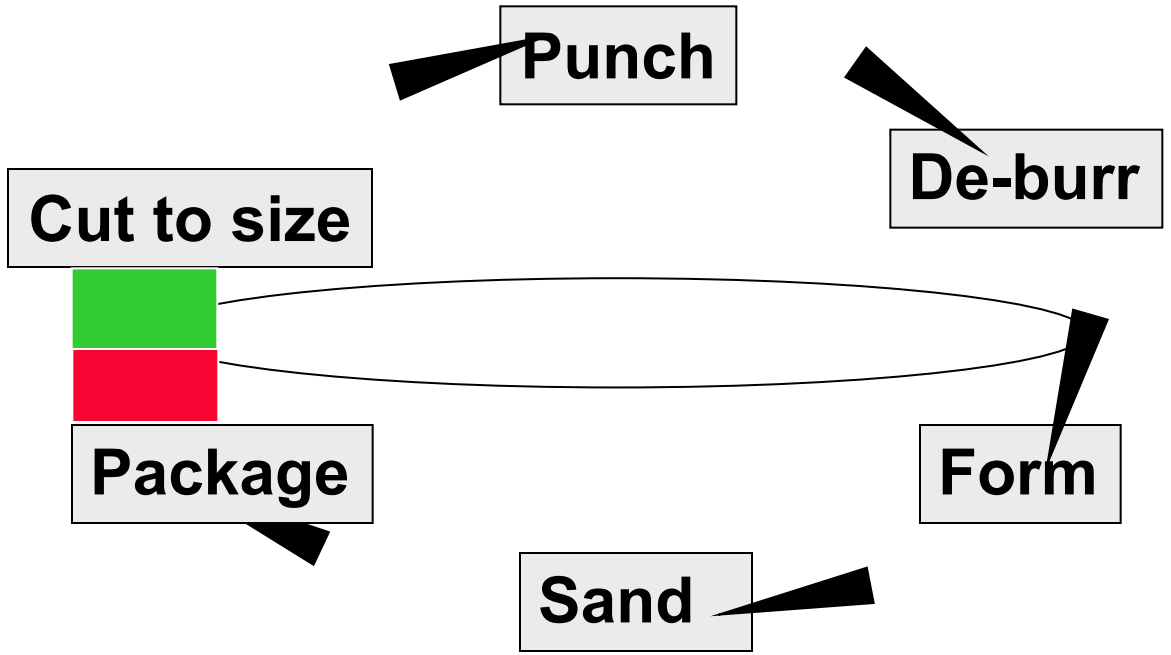
Hybrid

- Forecast general demand but assemble only when ordered.

- Useful if uncertainty in demand is high, while economies of scale are important in reducing production and delivery costs.
  - Examples furniture manufacturing

XII.Cellular Manufacturing

Linking of manual and machine operations into the most efficient combination to maximize value-added content, while minimizing waste.



Work Cell

Refining the Cell

Step 1: Group products

Step 2: Measure demands – establish Takt time

Step 3: Review work sequence

Step 4: Combine work in balance process

Step 5: Design cell layout

Step 1: Group Products

Processing Steps / Product	Insert Springs	Insert Diodes	Insert 1k Resistors	Insert Light	Insert 100k Resistors	Test
Red	X	X	X	X	X	
Blue	X	X	X	X		X

Products with similar processing requirements are grouped into product families

TAKT Time

- The Rhythm of Production
- Calculate the takt time for every step to eliminate bottlenecks

Step 2: Establish Takt Time

Takt Time = Demand Rate

$$\text{Takt Time} = \frac{\text{Work Time Available}}{\text{Number of Units Sold}}$$

$$\textbf{Takt Time} = \frac{\text{\_\_\_ Seconds}}{\text{\_\_\_ Unit}} = \text{\_\_ Sec/Unit}$$

$$\frac{\text{Cycle time}}{\text{Takt time}} = \text{Minimum \# of People}$$

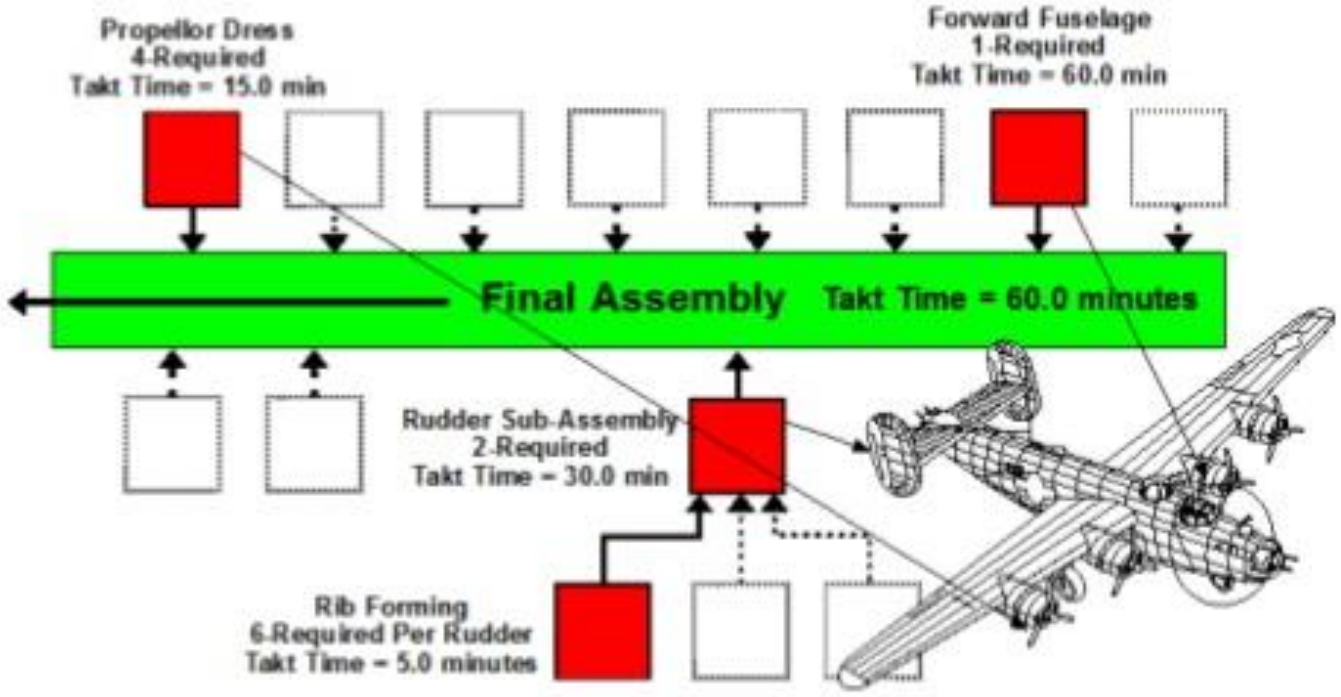
Step 3: Review Work Sequence

- **Observe sequence of tasks each worker performs**
- **Break operations into observable elements**
- **Identify value added versus non-value added (NVA) elements and minimize NVA**
- **Study machine capacity, cycle times and change over times**

Willow Run Bomber plant

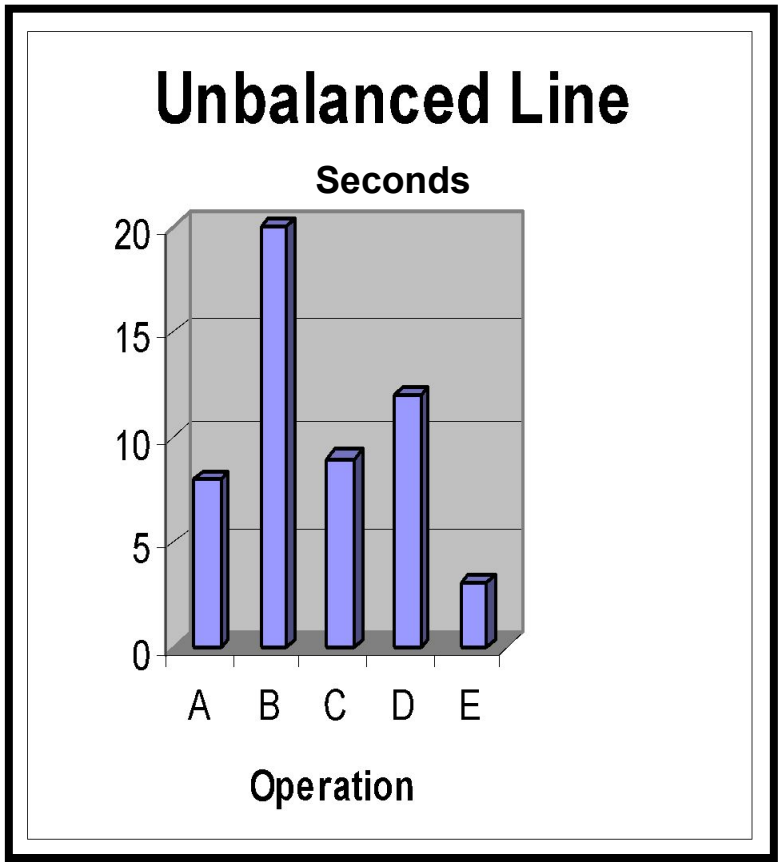
- 488,193 parts
- Ford built one EVERY HOUR

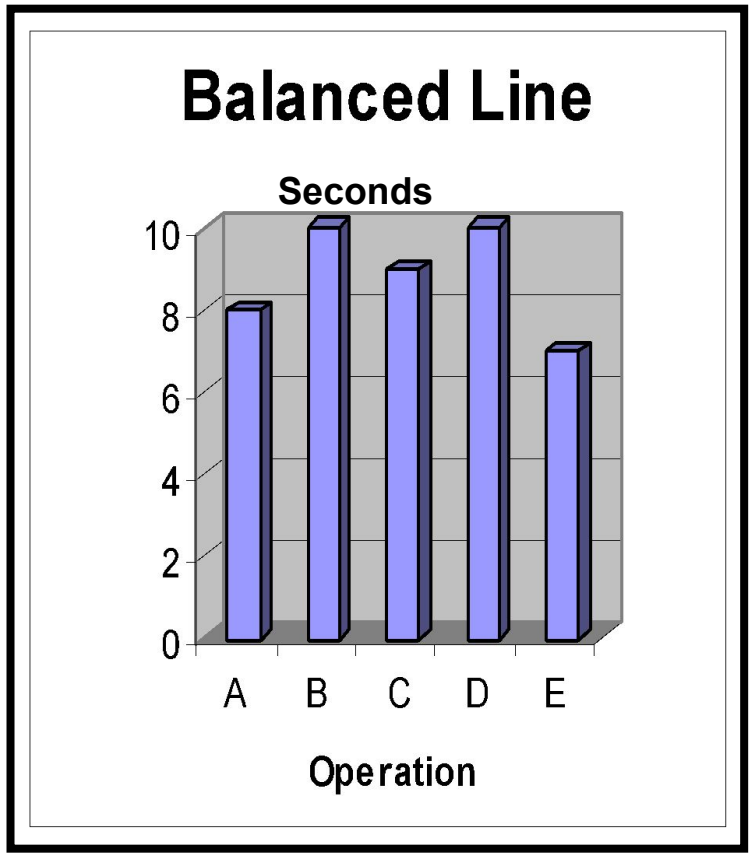
Takt Time



Slide shared by **Chinar Agarwal** , slideshare on Linked In

Step 4: Combine Work to Balance Process





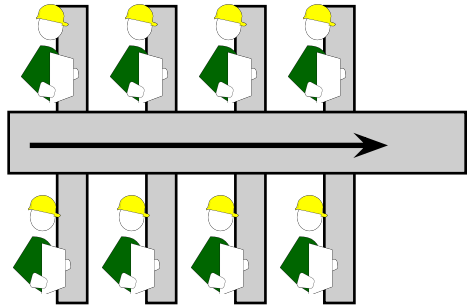
Takt Time = 10 seconds

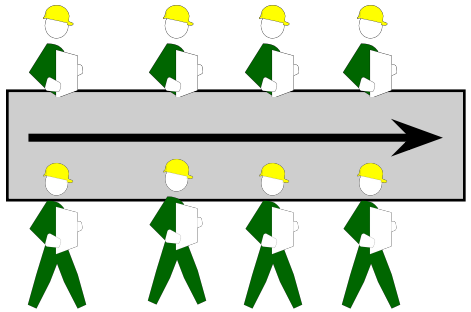
Step 5: Design a Cell

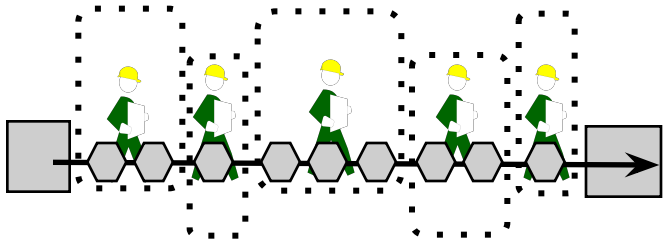
- **Design Goals**
  - Flexible layout, lot size = 1, point of use storage,
  - Visual management
  - Mixed models
- Simplify Flows
  - Integrate process operations, materials flow one way
- Minimize Materials Handling
  - Concentrate on value-added motions
  - Establish material replenishment procedure
- Make Use of People 100 Percent
  - Promote visibility and flexibility
  - Operators stand for flexibility

Cellular vs. Linear

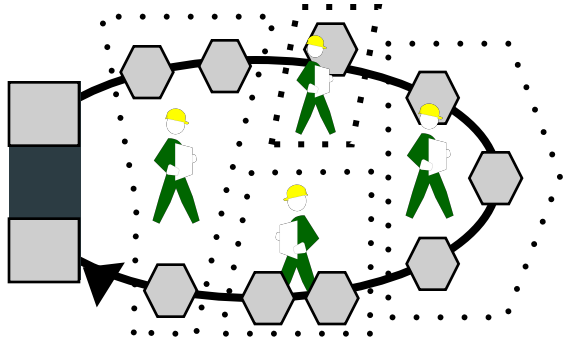
Traditional



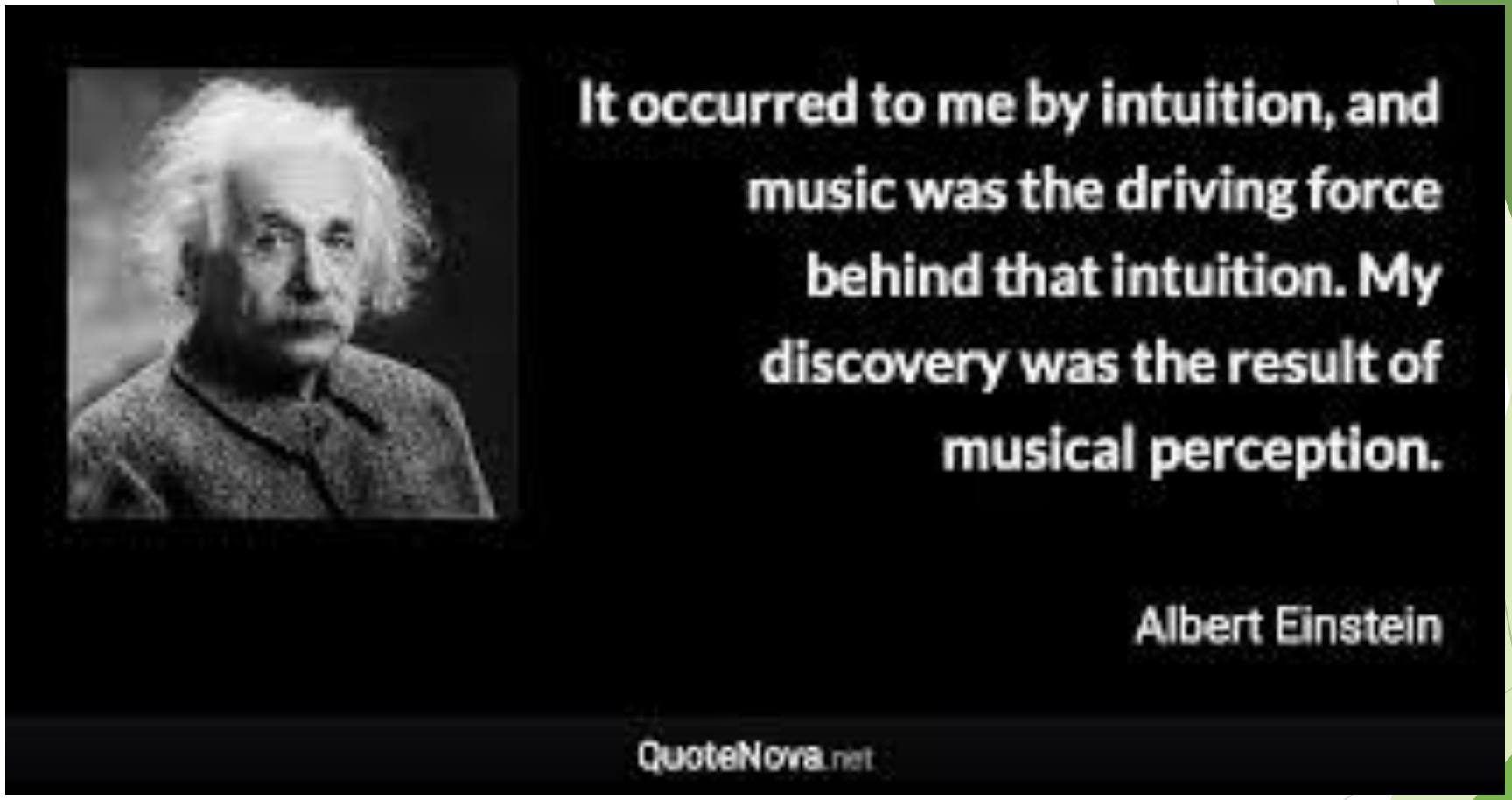


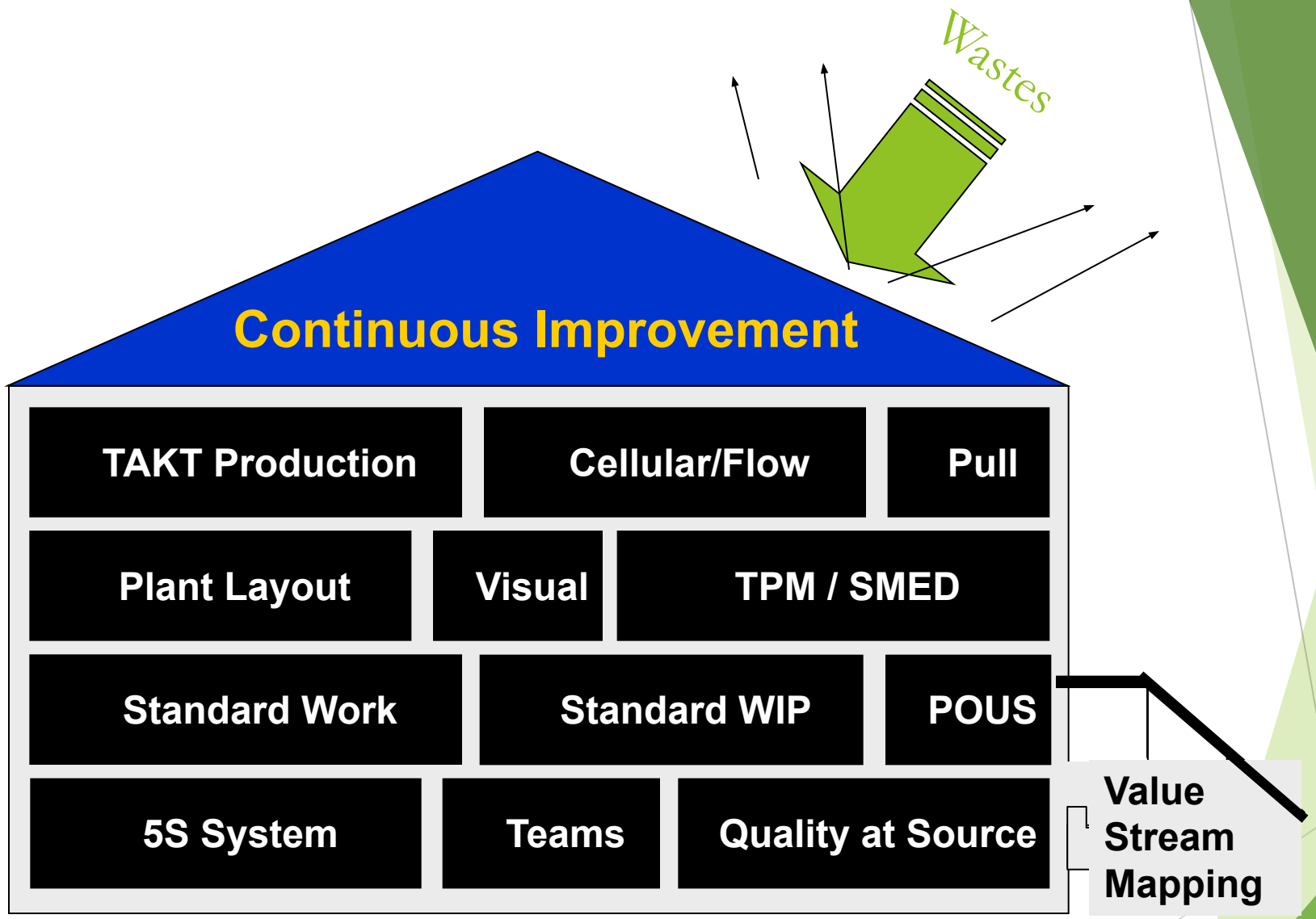


Assembly Line



Optimal




Wastes
Continuous Improvement
TAKT Production
Cellular/Flow
Pull
Plant Layout
Visual
TPM / SMED
Standard Work
Standard WIP
POUS
5S System
Teams
Quality at Source
Value Stream Mapping

Lean Manufacturing Implementation Success Story

Garrett Metal Detectors

TMAC
TEXAS MANUFACTURING ASSISTANCE CENTER

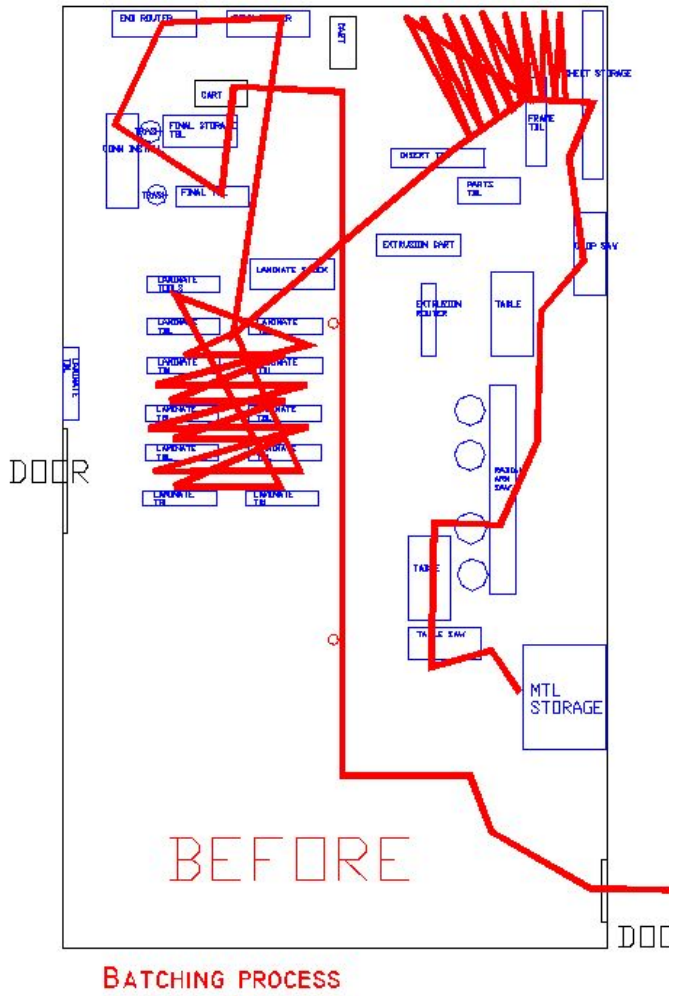
GARRETT
METAL DETECTORS
Proudly made in USA

Garrett Walk Through Metal Detectors

BEFORE LEAN

- Cabinet shop assembly was built in groups of 10 units before moving units to the next operation.
- The cycle time for one unit to travel from the first operation until it was ready for shipping was around 8 hours.
- A sample of production showed that it took 7 people around 9 hours to build 10 units.
- One unit per hour.

Facility Layout



BATCHING PROCESS

Each unit traveled =578 feet

Garrett National Drive Location


WORK IN PROCESS


Inventory between stations
NO SMOKING

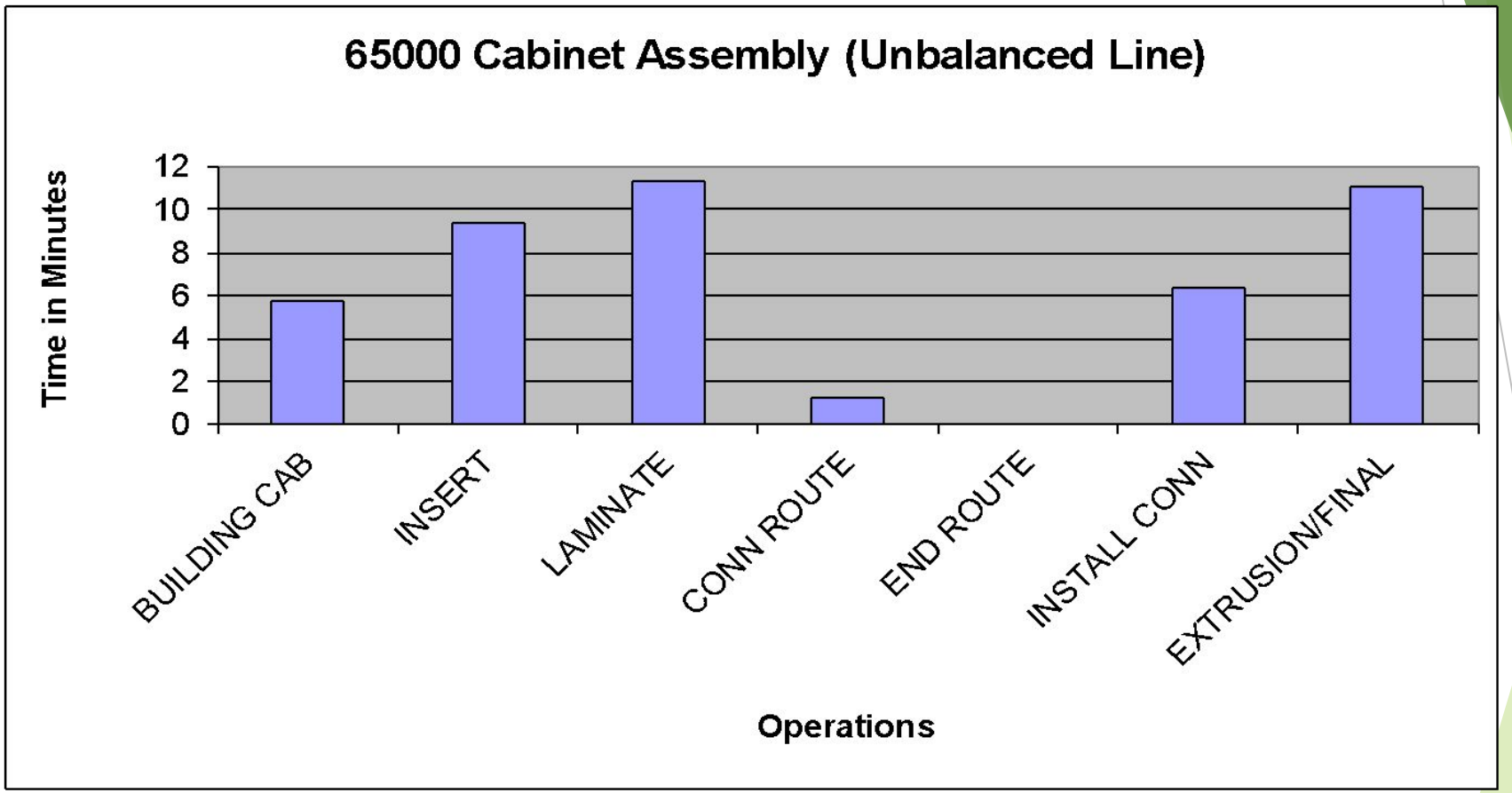

Batching 10 units at a time.

Wastes Identified

On the completion of a half day lean manufacturing class the shop identified many non-value activities that needed to be removed including:

- traveling over 120 feet to set aside defective laminates
- stacking and un-stacking cabinets throughout process
- walking over 150 yards to set up the 10 tables with laminates
- over processing when checking for raised nails
- unbalanced operations ranging from 3 minutes to 14 minutes-resulting in waiting

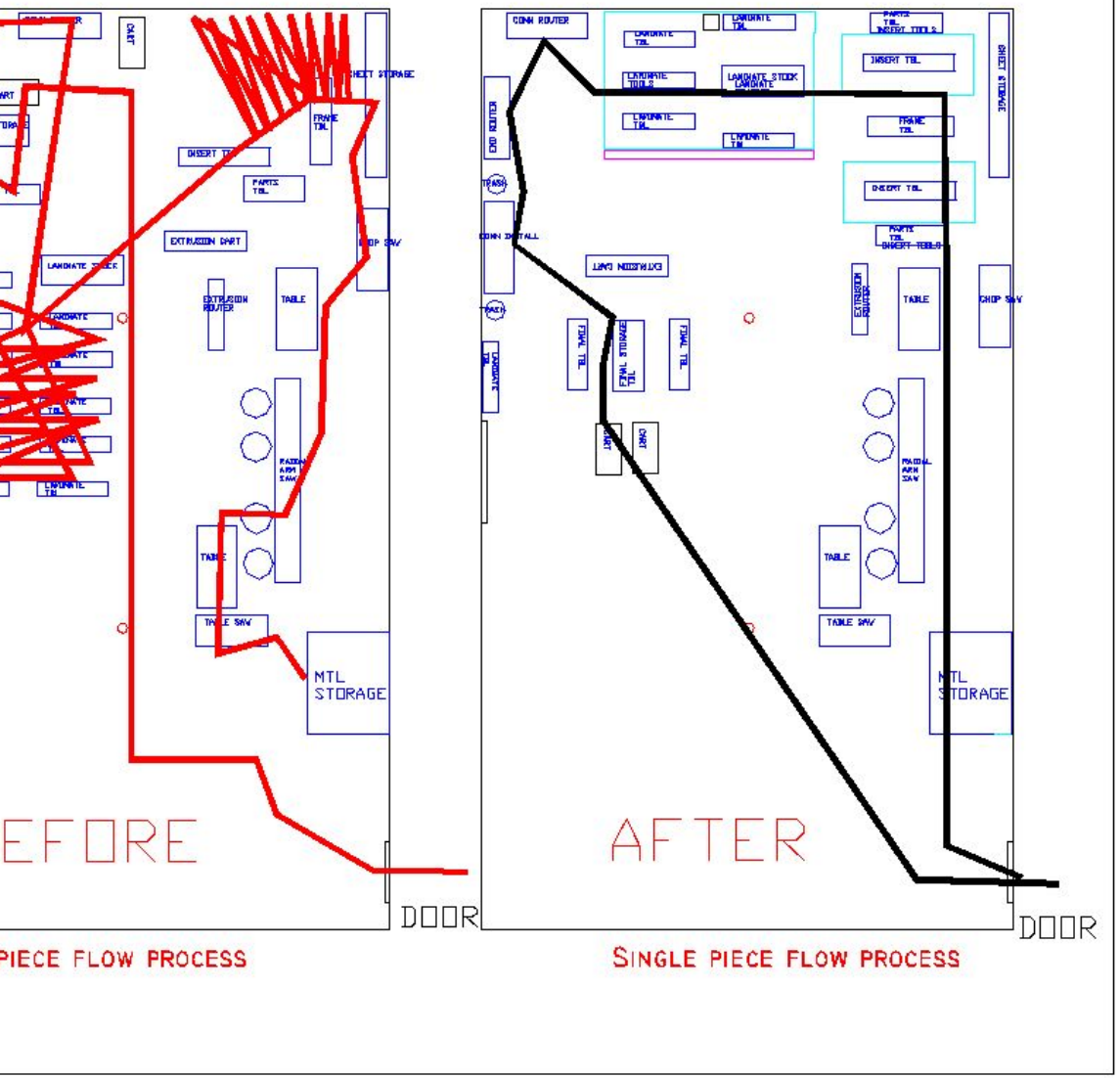
TMAC
TEXAS MANUFACTURING ASSISTANCE CENTER


65000 Cabinet Assembly (Unbalanced Line)
Time in Minutes
12
10
8
6
4
2
0
BUILDING CAB
INSERT
LAMINATE
CONN ROUTE
END ROUTE
INSTALL CONN
EXTRUSION/FINAL
Operations

Goal: 30 Cabinets a Day

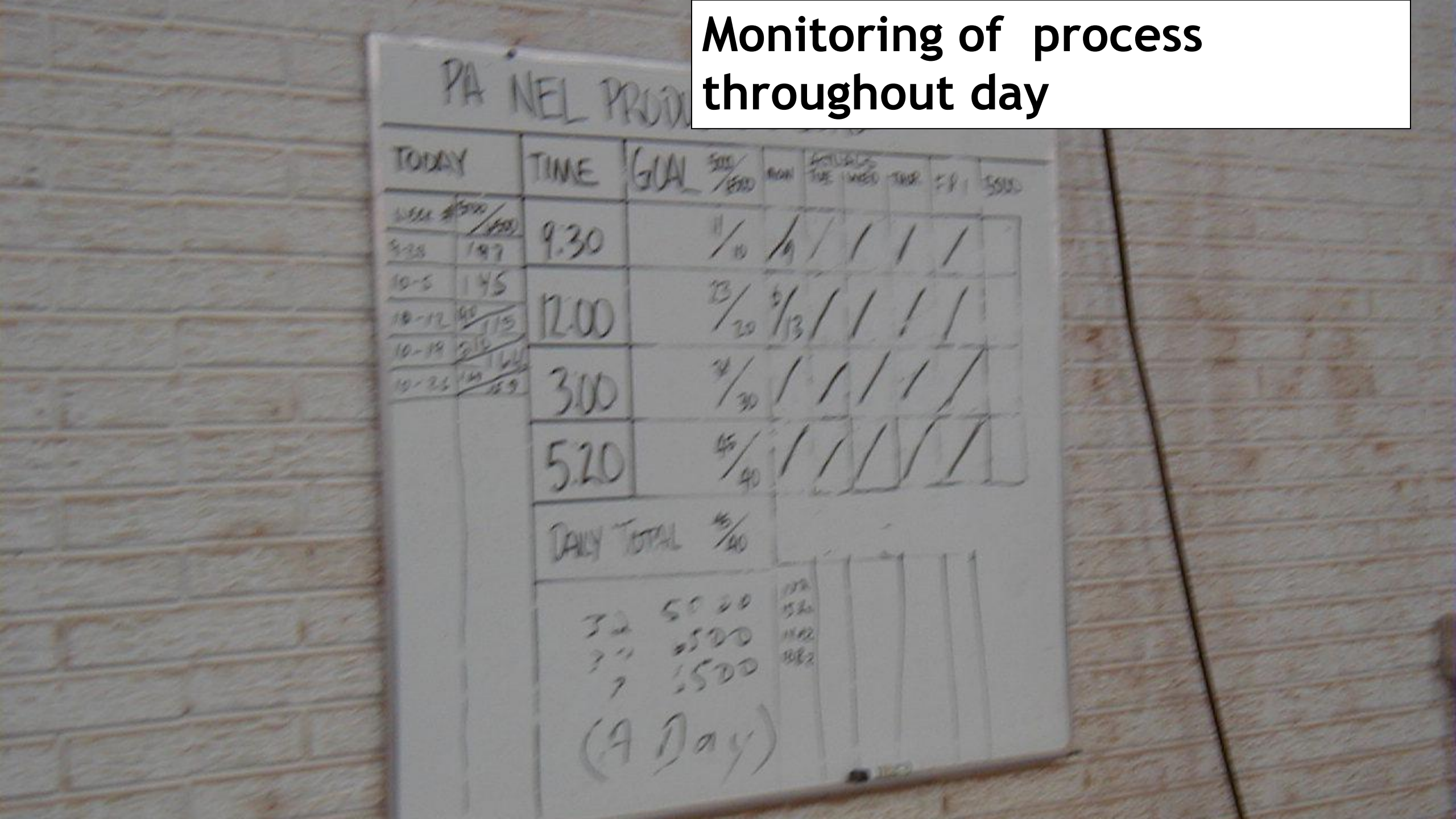
- Work time available
- 8.5 Hours per day X 80% Efficiency=6.8 Hours/day=408 Minutes/day
- Takt time=408/30=13.6 minutes per unit
- MIN # of people=Total cycle time from above (31.2 Minutes)/13.6=2.3
- Min # of people =2.3 people + 1 people to prepare materials and restock
- Total # of people=3.3

Facility Layout After



Each unit travels 203 feet

Garrett National Drive Location



Monitoring of process throughout day

OUTCOMES MEASURED

- Old process required 7 people 9 hours to build 10 units.
- New Lean process required 3 people 2.25 hours to build 10 units.
- Goal reached to produce one unit every 15 minutes resulting in a **300% increase** in production capability from previous method.
- New layout reduced required square feet by **30%.**
- Work in process was reduced by **80%.**

TMAC
TEXAS MANUFACTURING ASSISTANCE CENTER

Lean Game - Water Heaters

Which Lean Practice?

- Put the Water Heater Near the Sink
  - Point of Use
- Insulate tank and lines
  - TPM
- Tankless
  - Pull

Success story: Lasco Bathware

Washington DOE 2006

Lasco Bathware

- **Improved flow of work through packaging & shipping**
- **Improved spray transfer efficiency and reduced variability**
- **Improved layout and mold change-over time in acrylic vacuum forming area**

Spray Variability/Efficiency

- Reduced variability ±13 lbs/unit to ±4 lbs/unit
- Reduced overspray waste
- Potential future decrease in resin use and emissions

Outcomes Measured

- Waste Disposal $6,000
- Energy Reductions $99,000
- Reduced Raw Material Input $16,000
- Labor Savings $40,000
- Annual Savings ~ $160,000

- Over half of employee ideas implemented!

National Workgroup Savings

- Lean Operations – $55 million
- Energy Reductions - $14 million
- Environmental Savings - $15million

Keys to Success

- Prepare and motivate people
  - Widespread orientation
  - Create common Lean Culture
  - Build Trust

Keys to Success

- Employee involvement
  - Push decision-making and system development down to the “lowest levels”
  - Trained and truly empowered people
- Share information and manage expectations
- NO LAYOFFS
  - Common fear of lean

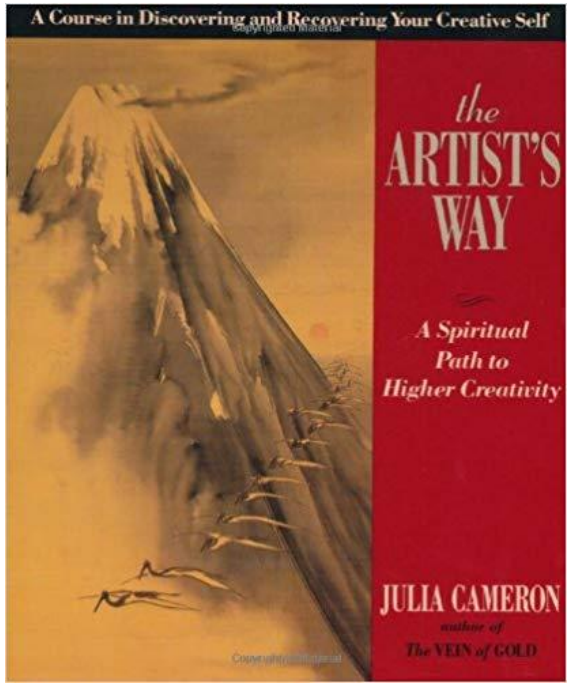
Keys to Success

- Execute pilot projects prior to rolling culture out across organization is also essential (e.g., model lines, kaizen blitzes)
- After early wins in test area, extend across ENTIRE organization

Keys to Success

- Atmosphere of experimentation
  - Tolerating mistakes, patience, etc.
  - Willingness to take risks (safety nets)

Keys to Success



- Creativity Demands Safety

- Perfectionism doesn't believe in practice shots. It doesn't believe in improvement. Perfectionism has never heard that anything worth doing is worth doing badly--and that if we allow ourselves to do something badly we might in time become quite good at it. Perfectionism measures our beginner's work against the finished work of masters.

  Julie Cameron,

  Author,
  The Artist Way

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