Lean Basics Overview

EMC
2011 Training

Topics

- Lean Six Sigma defined
- Why Lean Six Sigma?
- What's a process?
- Interrogating the process by identifying Value & Waste
- Brief overview of some tools that identify Waste
- Key principles of Lean Thinking: Flow & Pull
- Brief overview of some tools that help eliminate Waste
- Next steps

Lean

- **Process improvement methodology** targeting the elimination of waste – any human activity that absorbs resources but creates no value.
- **Lean Thinking** is the method used to combat waste
  - Pioneered by the **Toyota** company in Japan after WWII.
  - Application of Lean in Manufacturing has led to much cost removal via the elimination of wasteful efforts.
  - Lean Thinking provides for change that allows you to do more with less while coming closer to providing customers with what they really want.
- **Lean concepts can easily be used in other business applications and is not just beneficial to manufacturing**

So what is LEAN?

Simplify the process Waste Removal	➲ Identification of value and elimination of waste to improve the process.
Key Principles of Lean Thinking Methodology	➲ Value: what customers are willing to pay for ➲ Value Stream: all the steps in our processes that deliver value to our customers ➲ Flow: organizing the Value Stream to be continuous ➲ Pull: responding to downstream customer demand ➲ Perfection: relentless **continuous improvement** culture; A continuous journey
Key Lean Performance Goals Strategy	➲ On-demand: when the customer wants it ➲ Defect-free: how the customer wants it ➲ One-by-one: exactly the quantity the customer wants ➲ Lowest total cost: business cost for you and the customer

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Six Sigma

- Business management strategy developed by Motorola in the 1980's.
- Seeks to **improve the quality of processes by identifying and removing causes of defects and minimizing variability** within in process.
- Six Sigma is a statistical term indicating a high level of quality
  - 99.99966% of the products are expected to be free of defects
  - Can also be stated as 3.4 defects per million
- **Six Sigma tools and concepts can easily be used in other business applications and is not just beneficial to manufacturing.**

What is Six Sigma?

Level of Process Performance Statistical	➲ 3.4 Defects per Million Opportunities
Consistent, Rigorous Approach to Problem Solving Methodology	➲ Define — The right people working a well scoped problem ➲ Measure — Clearly understand and measure the “As Is” Process ➲ Analyze — Analyze failure modes to understand the causes and effects ➲ Improve — Experiment with and improve process based on data ➲ Control — Monitor critical outputs to prevent repeat failure
Philosophy Strategy	➲ Executive Ownership ➲ Business Profitability & Customer Satisfaction – Moving the Mean – Variation Reduction ➲ Data-based decisions ➲ Hard, Soft and Strategic Benefits

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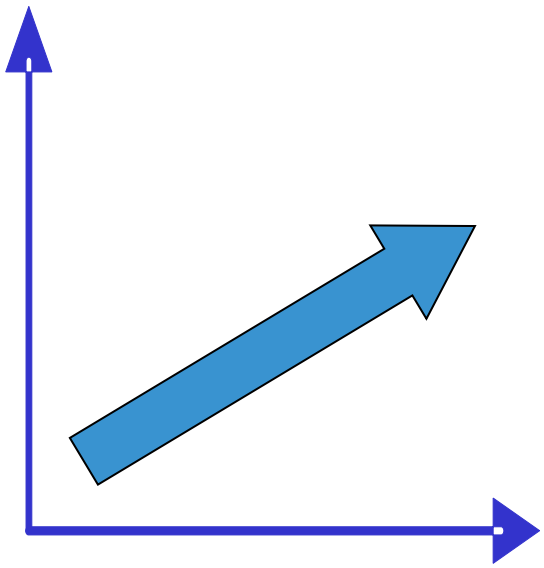
Why Lean Six Sigma?

Drives down costs by eliminating waste and process variability

Lean

N (Simplify)



E (Control)

NE (Simplify & Control)

Total Customer Experience

Six Sigma

Lean Six Sigma …combines the strengths of both approaches

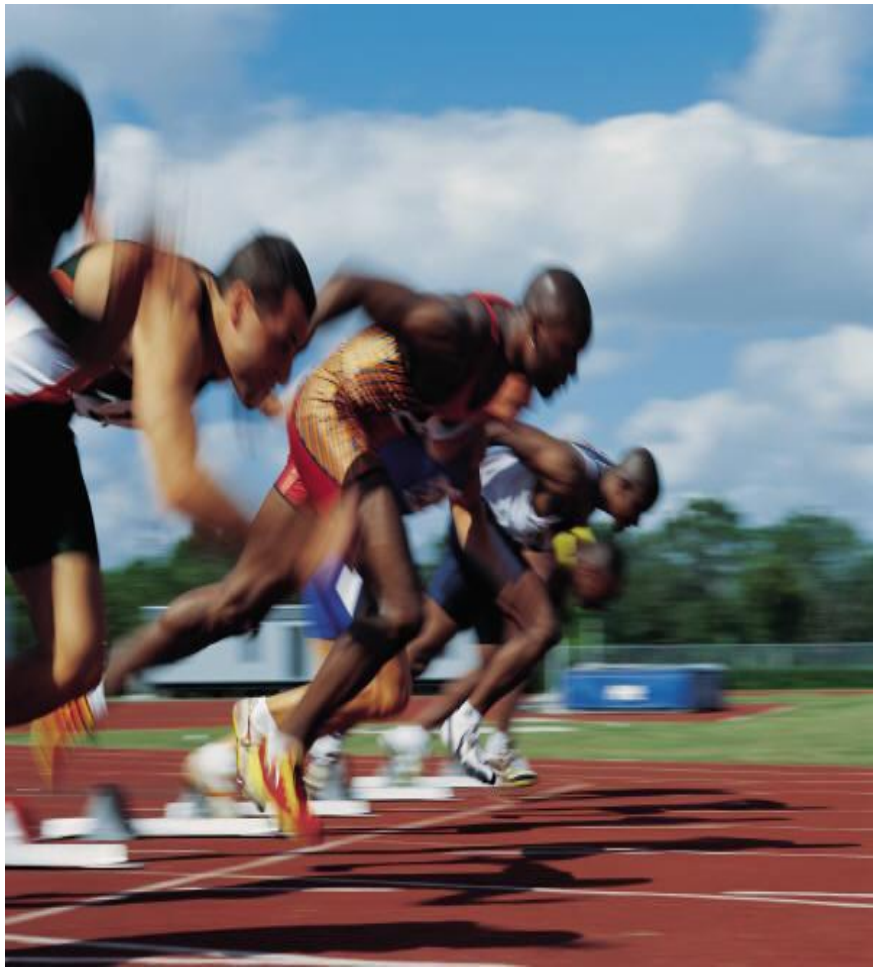
- A structured problem solving methodology used to:
  - Define (Scope)
    - Get the right people on a well scoped problem
    - Set a SMART goal on what's critical to the customer
      - SMART? Specific, Measurable, Achievable, Relevant, Time-bound
  - Measure (Baseline)
    - "As Is" process around the problem
    - Data, variation not just the average
  - Analyze (Cause &Effect)
    - Drives cause and effect conversations around the "As Is" process
    - Look for variation in the critical metric throughout the process
    - Look for waste with Lean tools
    - Prioritizes where to work

Lean Six Sigma …combines the strengths of both approaches

- Structured problem solving methodology continued:
  - Improve (Communication)
    - Improves the process based on waste removal and mistake proofing
    - Improves the process based on data
  - Control (Control Plan)
    - Develop a control plan to maintain the gains and have an early warning system on the critical metric

How does Lean Six Sigma help us compete?

- **Profit = Price – Cost**
  - **Price** controlled by **market**
  - **Cost** controlled by the **seller**
- Greatest competitive edge is cost reduction
- Reduce cost by Waste elimination
  - those things customers do not want or need
- Reduce cost and improve quality by removing Variability
- Increase customer satisfaction at lower costs by:
  - identifying their needs (values)
  - eliminating process variation
  - providing what the customer needs when they need it



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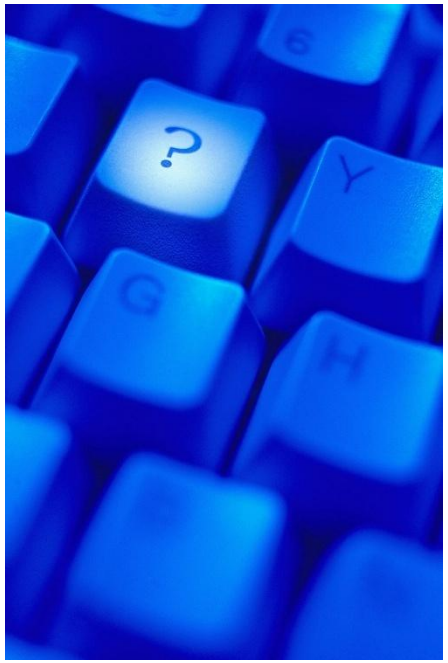
Any questions about Lean, Six Sigma, or Lean Six Sigma?



Process improvement requires that we know our process …what's a process?

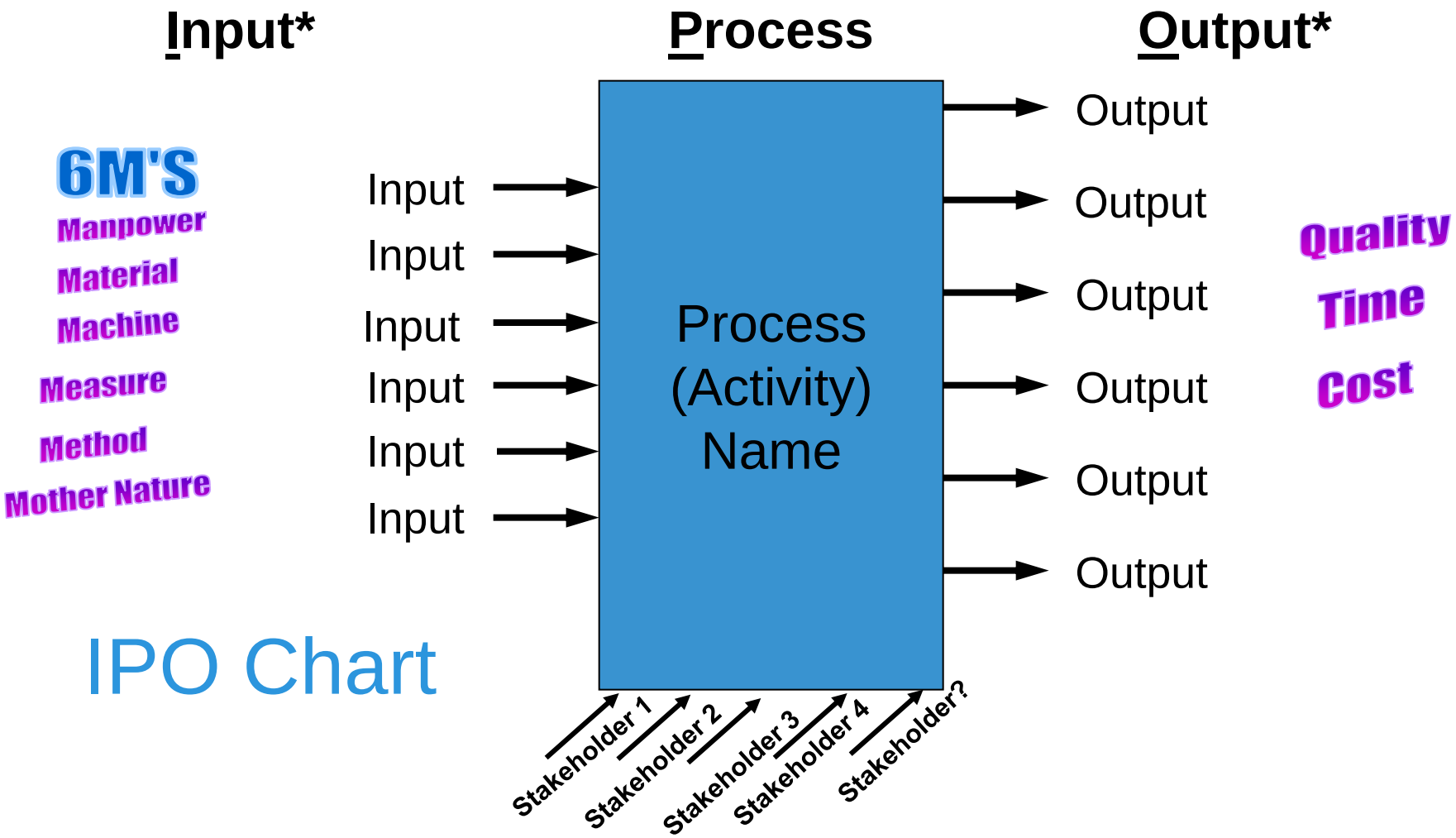
- A set of common tasks that creates a product, service, or plan that will satisfy a customer or group of customers.
  - Processes can have "internal" customers and "external" customers
- A sequential series of steps leading to a desired outcome

If you can't describe what you are doing as a process,

you don't know what you're doing.

W. Edwards Deming

What's a great tool that we can use to get an overview of a process in just 1 page?



IPO Chart

* Input and Output Variables that are **Measurable**

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Any questions about what's a process? IPOs?

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Interrogate the process

- Where's the Value?
- Where's the Waste?

Value

- Value Add
  - **Customer** believes it is important; willing to pay for this task
  - Physically changes the thing adding desired function, form, or feature
  - Work is done right the first time
- Non-Value Add
  - Task adds no value as viewed by the customer
  - Examples include: correcting/reworking, expediting, multiple signatures, counting, handling, inspecting, set up time, downtime, transporting, moving, delaying, storing…etc.
- Necessary Non Value Add
  - Process would break down if this task was not performed
  - Required by law or regulation
  - Task reduces financial risk

Truths About Seeing Waste

- *WASTE* isn't a judgment on how well people work; it exists in all processes
  - Processes are wasteful, people are not
  - Don't take it personally; let's improve the processes
- Our solutions have to eliminate waste
  - Waste elimination improves performance
  - Improved performance creates secure companies
  - Secure companies create secure Jobs
- As we learn to see waste, we need to work on not being judgmental about it

It is what it is… and it wasn't created intentionally

Transportation:

Physical movement of materials or work from where it was produced to where it is needed

Inventory:

Any excess material within a process that the customer does not want or need based on actual demand

Motion without productivity:

If motion is part of the process and not used to add value, it is waste

Waiting:

People or parts that wait for a work cycle to be completed

Over-production:

Producing items for which there are no true customer orders or more work than the next operation needs or can absorb

Over-processing:

Any non-value added activity that customers neither want, request or will pay for…

Defects:

A defect is a component or unit which the customer would deem unacceptable

Safety Risks are a Waste

Safety risks are in processes that enable injuries to happen in the workplace.

Injuries cost through:

- lost work days
- higher insurance costs
- product delivery delays
- slowing the process

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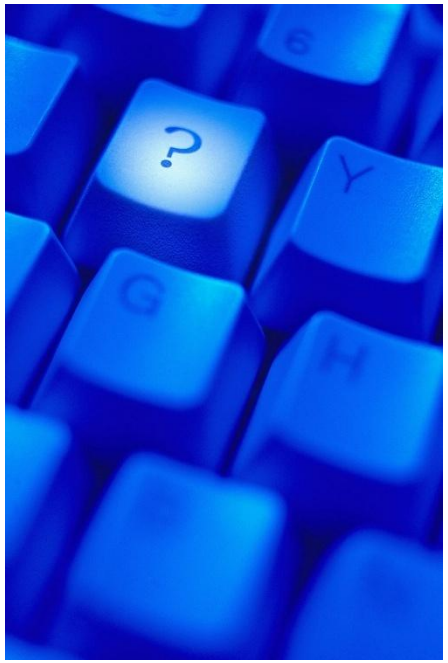
8 Forms of Waste (TIMWOODS)

Waste Category	Production Example	Administration Example
Transportation Excesses	Moving material between disjointed production stages in separate locations	Walking around to get approval signatures on a travel authorization
Inventory Build-up	Large WIP (work in progress) inventory during production stages	Multiple copies of a document stored in every desk
Motion Without Productivity	Operator must bend over to pick up circuit board to start production sequence	Looking for poorly filed documents by searching every filing cabinet
Waiting for Materials	Waiting for raw material replenishment to begin production setup	Waiting for approval signature of a document
Over Production	Producing more than production schedule requirements	Generating project status reports that are not reviewed or used
Over Processing	Reworking of defective components from the first stage of production	Capital projects plans needing reviews and signatures from 18 people
Defects	Producing one bad unit out of 10 during final assembly	An inaccurate report that must be redone due to incorrect information
Safety Risks	Injuries that result in personal suffering, lost work days, increase insurance costs and delays in product delivery	Injuries that result in personal suffering, lost work days, increase insurance costs and delays in product delivery

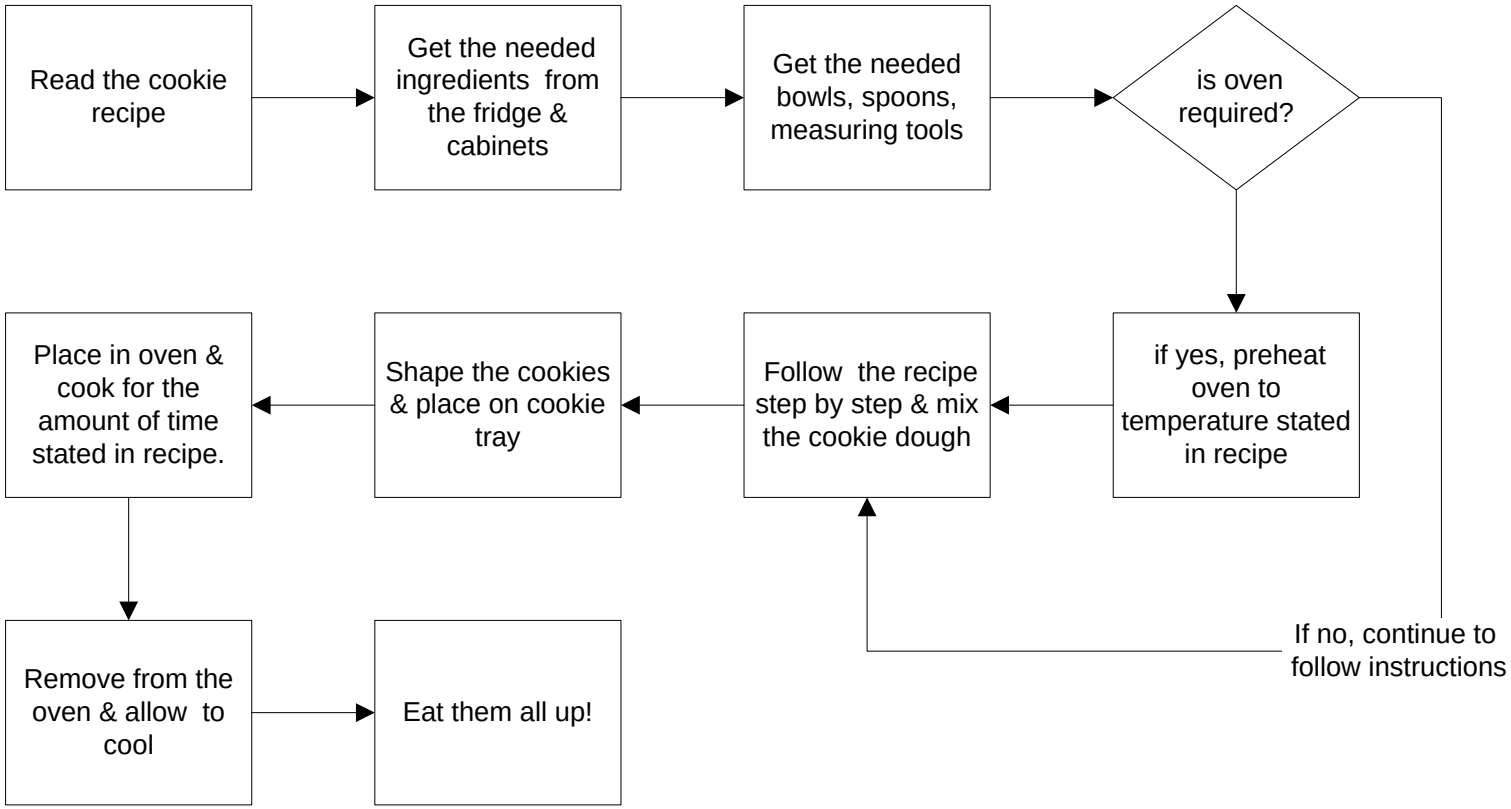
Any questions about
Value?
Waste?



What tools identify waste?

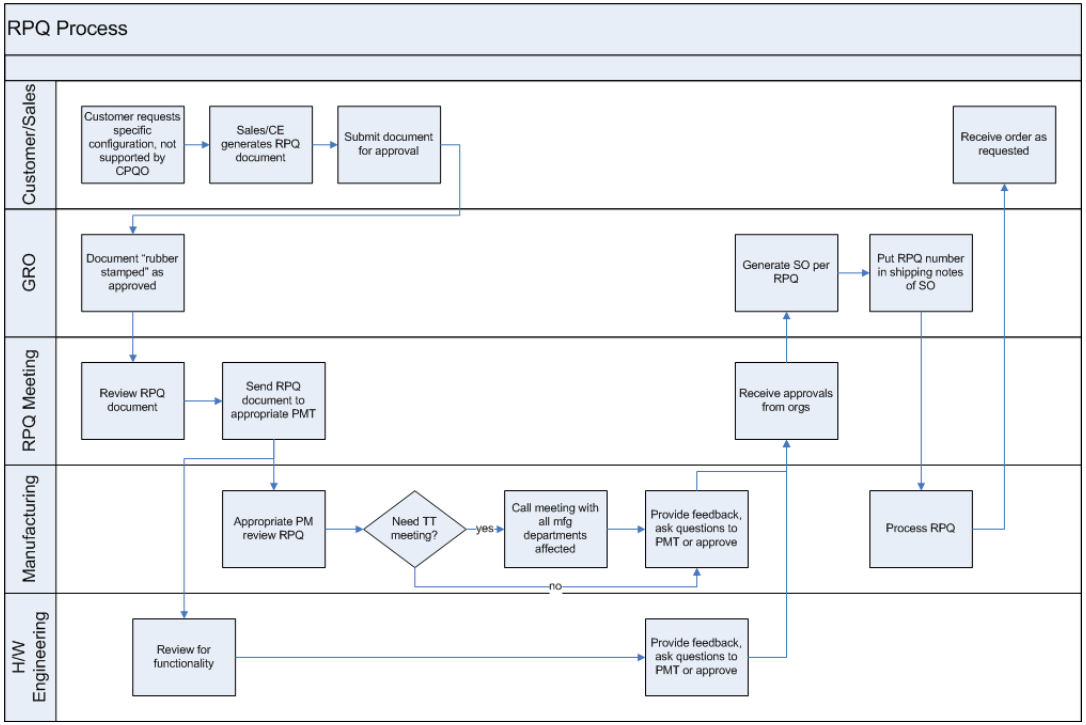
Strategic Tool	Waste Identified
Value Stream mapping	Inventory, Over production
Takt time	Inventory, Over production, Waiting
Spaghetti diagram	Transportation, Motion
Time Observations	Waiting, Motion, Transportation, Over processing, Defects, Inventory, Over production
Flow Charts	Over processing, Motion, Transportation
Load Charts	Waiting
Standard work sheets	Defects, Inventory, Over production, Waiting, Transportation, Over processing
Production Control Boards	Defects, Inventory, Over production, Waiting

Cookie Making Process



Flow Charts/Process Flow Diagram

- Definition: a diagram commonly used to indicate the general flow of processes
- Can be completed at different levels, or in different styles
- Uses:
  - preparation for a time study
  - identify VA/NVA/NNVA
  - look for flow & missing steps
  - see the waste



Value Stream

- ***A value stream is a series of all actions required to fulfill a customer's request, both value added and not. A value stream contains a product or a family of products that have similar material and information flows. ...***
  - Including:
    - Information flow
    - Material flow
    - Inventory (WIP)
    - Value Add and Non Value Add activities
    - Transportation flow
  - A company will have multiple value streams

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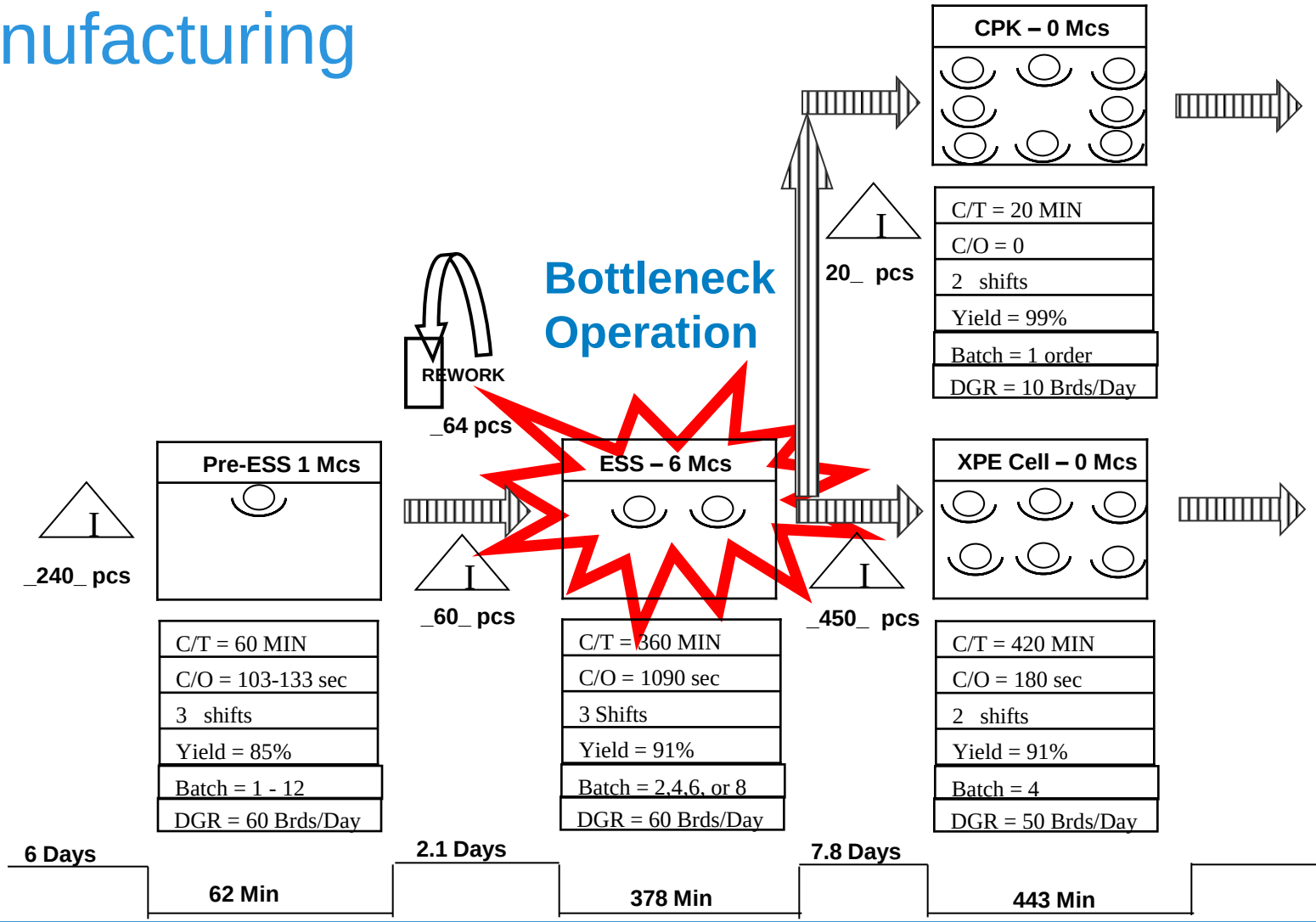
Value Stream Maps (VSM)

- A VSM combines:
  - Process Flow
  - Information Flow
  - Transportation Flow
  - Inventory Balances
  - Cycle Times
- VSMs make it easy to see:
  - Improvement Opportunities
  - Excessive Inventory
- VSMs highlight:
  - Total Inventory
  - Total Process Time
  - Inventory Days of Supply
- VSMs display the entire value-delivery system

Sample of a Value Stream Map in Manufacturing



Tools to Understand the Process plus Identify Waste

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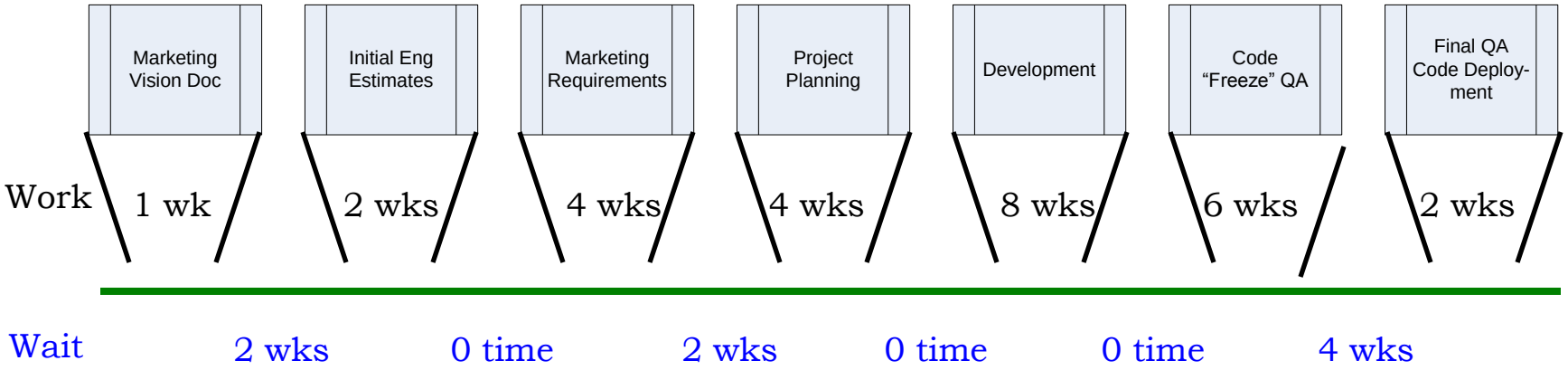
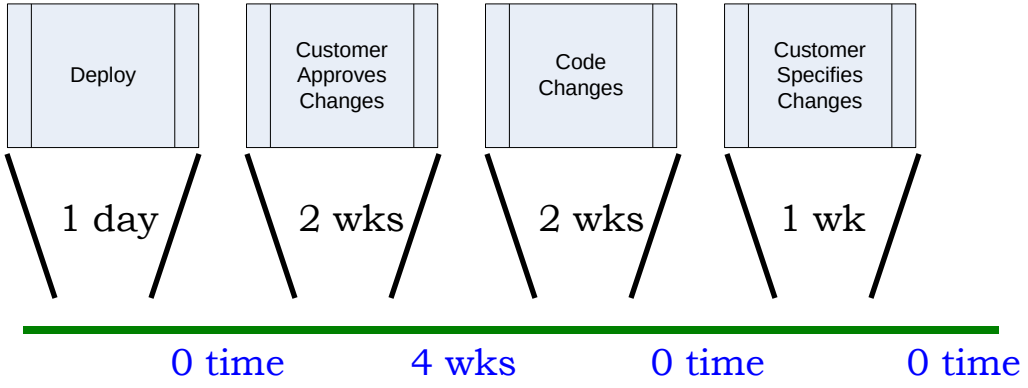
Value Stream Map – Software Development



44 wks + 1 day total process time
of which 12 wks is wait time



* From Kent Beck,
Lean Software Development
by Mary & Tom Poppendieck

Takt Time

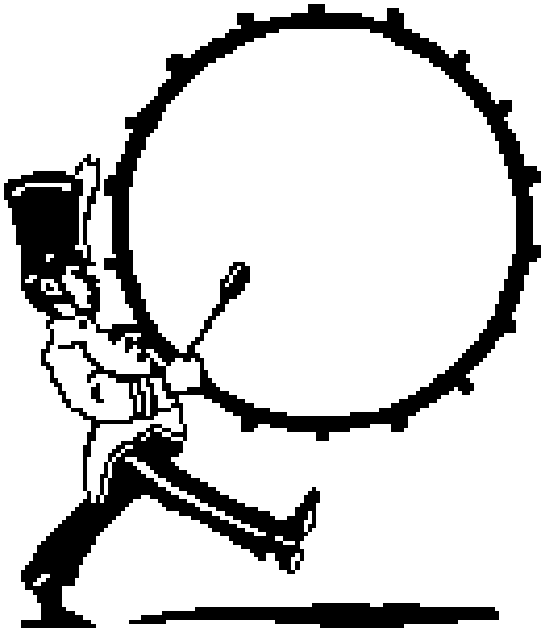
- Takt Time is the required pace of production to meet an average customer demand rate

$$\text{Takt Time} = \frac{\text{Available Time/Day}}{\text{Customer Demand/Day}}$$

- Available Time = 7 hrs or 420 minutes
- Customer Demand per Day = 840 item

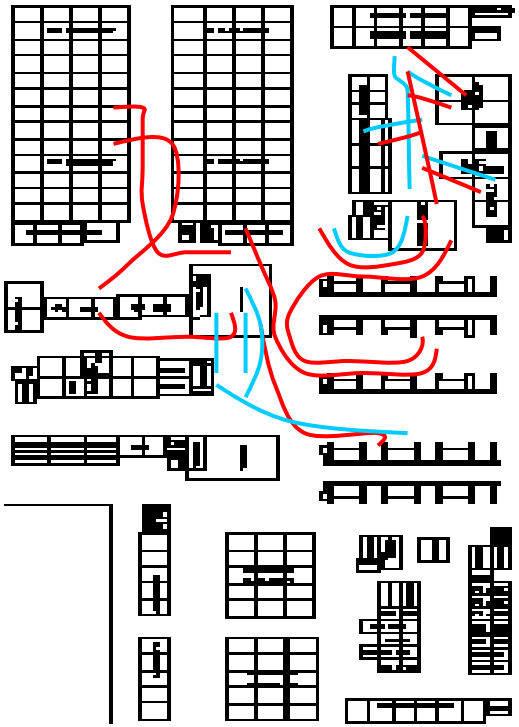
$$\text{Takt Time} = \frac{420 \text{ min}}{840 \text{ item}}$$

Must produce 1 item every .5 minutes to meet customer demand rate



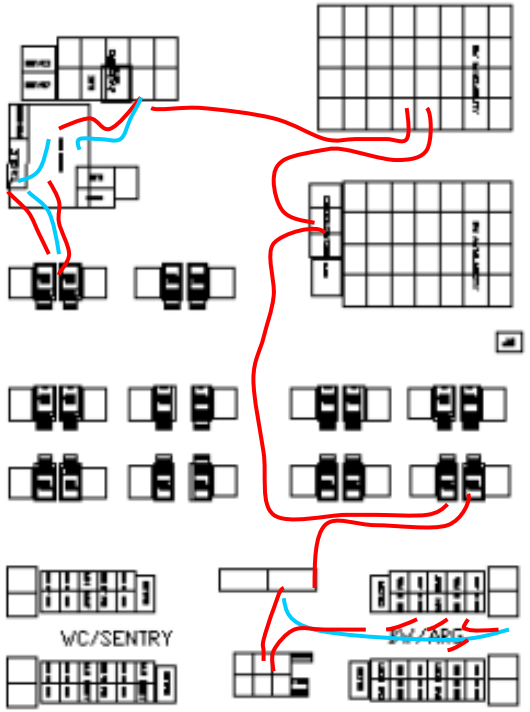
Spaghetti Diagram

Before



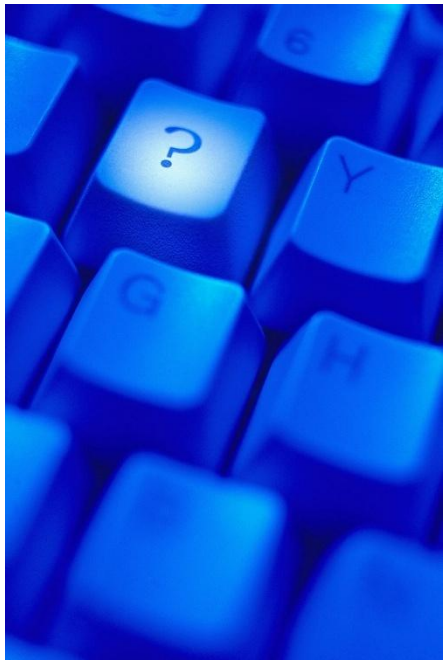
Parts Traffic Dist. = 214 ft
Walking Dist. = 431 ft

After



Parts Traffic Dist. = 139 ft
Walking Dist. = 292 ft

Any questions about these tools that help identify waste plus understand your process?



Key Principles of Lean Thinking: FLOW - Organize the Value Stream to be Continuous

- Objective is for materials to flow non-stop until it gets to the customer
  - Delays or wait times increase the time for delivery and create waste
- May require a new Layout
  - Value-adding steps are arranged one after the other
  - Shrink physical footprint of area to avoid inventory piles
  - Product moves via the most direct route
- Work must be balanced amongst workers so items flow "non-stop"

Flow

Key Principles of Lean Thinking: PULL - Responding to Downstream Customer Demand

- Pull: Producing goods based on actual consumption
  - Process steps in the Value Stream are linked via Pull replenishment
  - No one upstream process produces until the customer downstream signals for it
- Push: Producing goods to a forecast or demand schedule
  - Not linked directly to actual customer demand consumption
  - Often requires managing separate production schedules at multiple points in the process
  - Will lead to all forms of Waste – TIM WOODS

Push is not LEAN. Pull is the desired LEAN Process Method

What tools help eliminate waste?

Strategic Tool	Waste Eliminated
Cellular Manufacturing	Waiting, Motion, Transportation, Over processing, Defects, Inventory, Over production
Kanbans	Impact of Defects, Inventory, Over production, Waiting, Transportation
SMED (Single Minute Exchange of Dies)	Waiting, Motion, Over processing, Defects, Inventory, Over production
5S	Defects, Inventory, Over processing, Motion, Transportation, Over Production
Visual Management	Waiting, Motion, Defects
Jidoka (Automation with a human mind) / Poka-Yoke (Error proofing)	Defects, Inventory, Over processing
Kaizen	Waiting & all other forms of waste can be addressed

Cellular Manufacturing

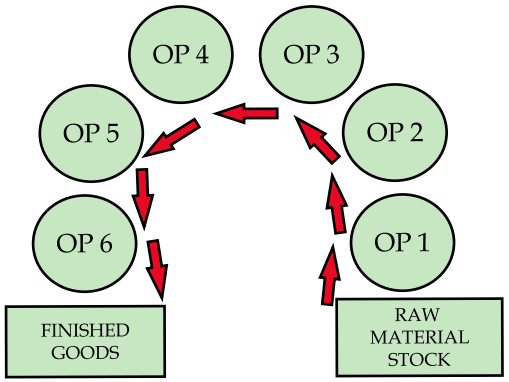
- Cellular manufacturing definition:
  - Machines / operations / process steps are placed side by side with minimal inventory between
  - Continuous flow
- Cell layouts are more robust to machine breakdowns, have common jigs and fixtures in the same area and support high levels of differentiation
- Grouped together according to the families of parts produced
- Advantage: Material flow is significantly improved which reduces
  - distance travelled by materials
  - inventory
  - cumulative lead times

Waste eliminated: Transportation, Inventory, Motion, Waiting, Over processing, Overproduction, Defects

Principles of Cellular Manufacturing

- Key components
  - Continuous flow/single piece flow*
  - Standard work (the one best way)
  - Typically product specific
  - Utilizes kanbans
  - Employs 5S and visual management
  - “U” shaped layout (minimizes people and parts movement)
  - Runs on Takt Time
  - Standard WIP (work in progress)

* Single piece doesn’t always = 1



Kanban and Kanban System

- Kanban in Japanese means “card” or “sign”
  - Visual tool used to achieve JIT (just in time) production
- Kanban is established using fixed quantity bins, containers, or pallets that are produced in an agreed replenishment time
- Kanban Systems can provide direct communication between our customers, through our work cells, and out to our Supplier/Partner
- Kanban Systems have less dependency on forecasts for driving receipts of materials – replace only what is used

Waste eliminated: Impact of Defects, Inventory, Overproduction, Waiting, Transportation

Look familiar?

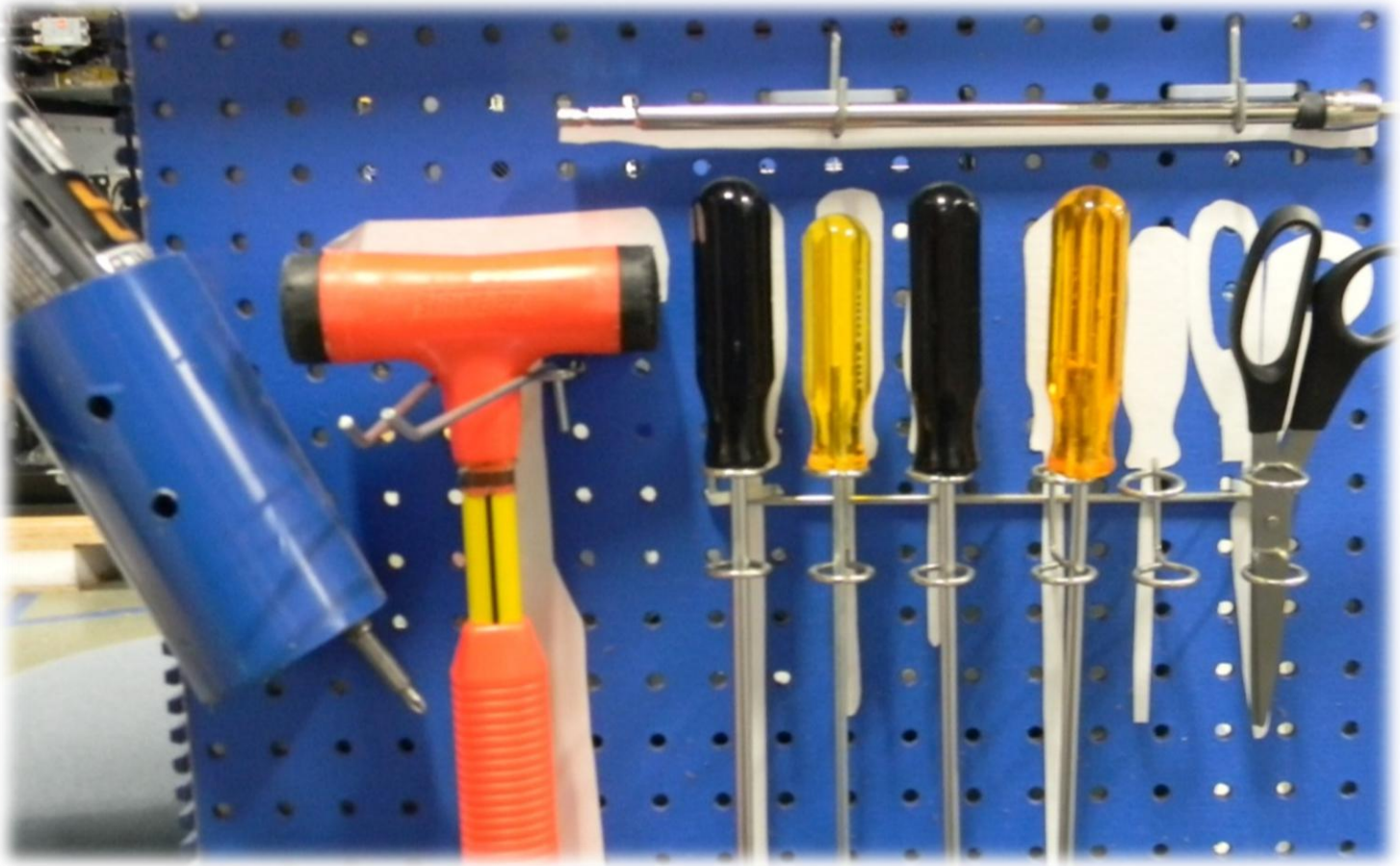
What is 5S?

- Sort – When was this last used?
- Set in Order – get organized!
- Shine – keep it clean!
- Standardize – take ownership!
- Sustain – keep it up!

How is 5S implemented?

- Identify the area to be improved
  - Set bounds and scope work
- Red Tag everything not needed in that area
  - Move to designated location
- Prioritize items frequently used
  - Organize to minimize wasted motion
- Clean what remains
- Set standards and assign responsibilities
  - Take pride in ownership – what accomplishment!

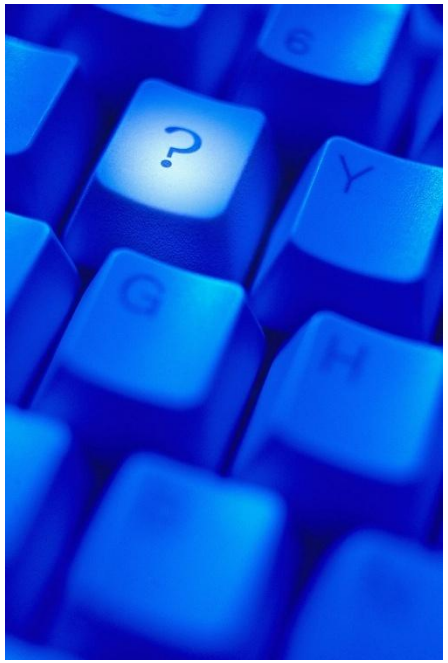
5S - Visual Management



What is Kaizen?

- KAI = Change Zen = Good (for the better)
  - Japanese word for continuous improvement in small, incremental steps
- A Kaizen Event is …
  - a “Tool” from Lean methodology
  - targeted at the improvement or creation of a specific process
  - up to a week in a very focused, structured team environment
  - working together to rapidly implement change initiatives to quickly realize benefits
  - an application of continuous improvement
- Lean has a foundation built on the concept of continuous improvement; Kaizen helps to accelerate change

Any questions about the philosophies or tools used to remove waste?



Lean Basics – Key Points

- Lean is a process improvement methodology used to combat waste.
- It can be used with Six Sigma which helps us remove variation from a process.
- Everything is a process; every process can be improved.
- Only our customers can define value. Everything else is waste and should be eliminated as possible.
- In order to remove the waste in our process, we must be able to see it…Lean provides the needed tools.

Lean Basics – Key Points

- Key components of Lean include:
  - Pull
  - Cellular Manufacturing
  - Continuous Flow / Single Piece Flow
  - Standard Work
- Kaizen is the tool that can take us from our current state to where we want to be quickly.
- Continuous Improvement is essential to success in all Lean programs.

Are you ready to begin your Lean Journey?

Final Questions & Next Steps

Available for mentoring:
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leeann.parrott@emc.com

References to check out

- Read:
  - Lean Six Sigma by Michael L. George
  - Lean Six Sigma for Service by Michael L. George
  - Lean Solutions, How Companies and Customers Can Create Value and Wealth Together by James P. Womack & Daniel T.Jones
- Check out these web sites:
  - www.isixsigma.com
  - www.lean.org

Thank you!