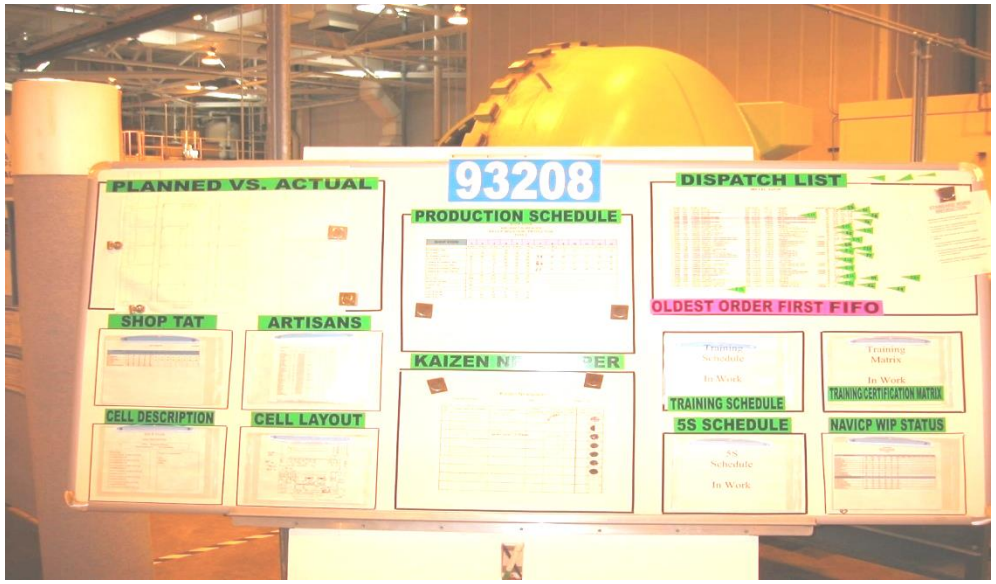
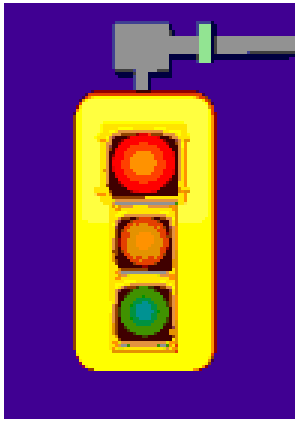
Visual Controls

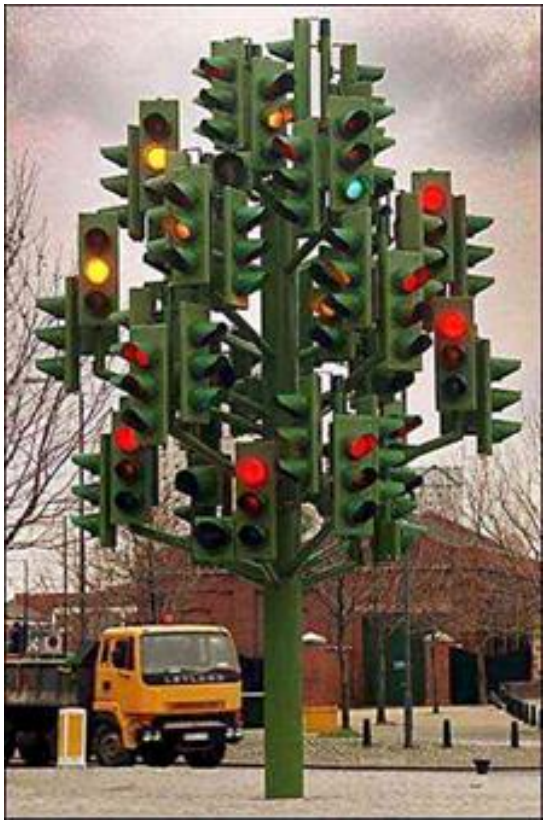


What is a Visual Workplace?

- When anyone can walk into a workplace and visually understand:
  - The current situation.
  - The work process.
  - Ahead, behind or on schedule.
  - When there is an abnormality.



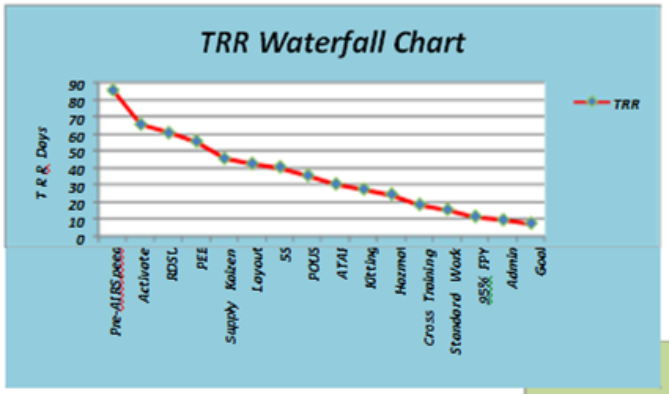
- Use signals, lights, diagrams, charts and signs to:
  - Clearly **define** the **normal** condition or a **required action.**
  - **Expose** the **abnormal** undesired condition **in real time.**

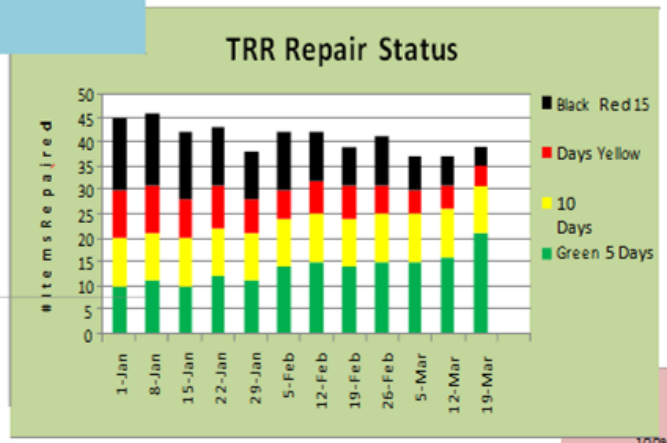


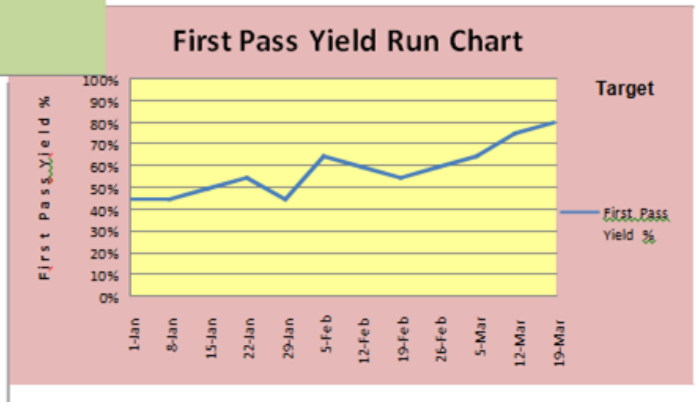
Examples of Visual Controls

- Shadow boards for tools, supplies and safety equipment.
- Color coding such as Green / Yellow / Red.
- Lines on the floor to delineate storage areas, walk ways, work areas, etc.
- Marks to indicate correct machine settings.
- Andon lights.
- Standard work instructions, standard operating procedures (SOPs).
- Kanbans to control production.

Examples of Visual Controls – Management Reports







Visual Controls – Final Thoughts

- A signal that does not come on is meaningless.
  - Must come on to identify & expose waste or a required action.
- The number of times that a signal goes on is not important, but how long it takes for the signal to go off, is!

Standard Work

- To standardize a method is to choose out of the best method out of many, and use it.
- Today's standardization, instead of being a barricade against improvement, is the necessary foundation on which tomorrow's improvement will be based.
- Standard Work eliminates the possibility to do anything but follow established best practices.

"If you think of 'standardization' as the best that you know today, but which is to be improved tomorrow, you get somewhere. But if you think of standards as confining, then progress stops."

– Henry Ford

Why Standard Work Is Important?

- Lowers Process Time.
    - Reduces variation - Work is performed the same way every time.
    - Decreases learning curve for rotating workforce.
    - More time is spent performing Value-Added activity.
    - Reduces time and cost across the Value Stream.
    - Supply knows what to Supply and when.
    - Tools, IMRL, paper work, and etc. are also known.
    - Support organizations are more responsive.
- Critical in guaranteeing success every day.
- Increases quality and first-pass yield.
- Critical for effective Point of Use System (POUS) & 5S.

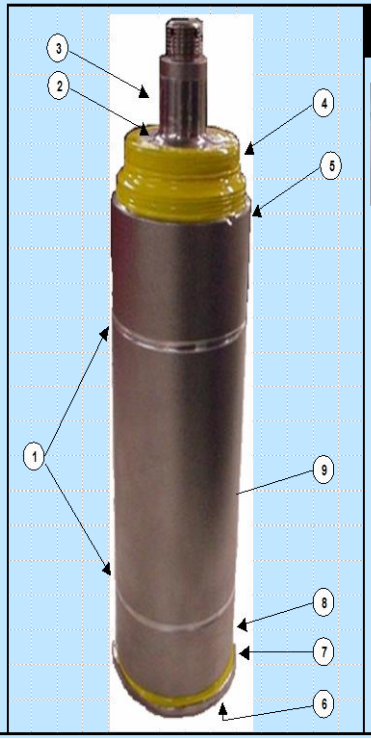
Standard Work Instructions

EXAMPLE:

Checklist, Masking for chrome plating

Standard Work Diagram

Operation Name:	Page:	Prepared by:
Masking	1 of 2	Doug Wickman
Part Description:		**Revision Date:**
89 Horizontal Pin		20-Oct-04



Detail Photos

Material Required

SEQ	DESCRIPTION
1	Aluminum tape, 3/16"
2	Lead tape, 1"
3	Lead tape, 1"
4	Yellow tape, 1"
4	Lead tape, 1/2"
5	Lead tape, 1/2"
6	Aluminum tape, 3"
7	Yellow tape, 1/2"
8	Lead tape, 1/2"
9	Red lacquer, brush
10	Solvent, rag or paper towel

Standard Work Diagram

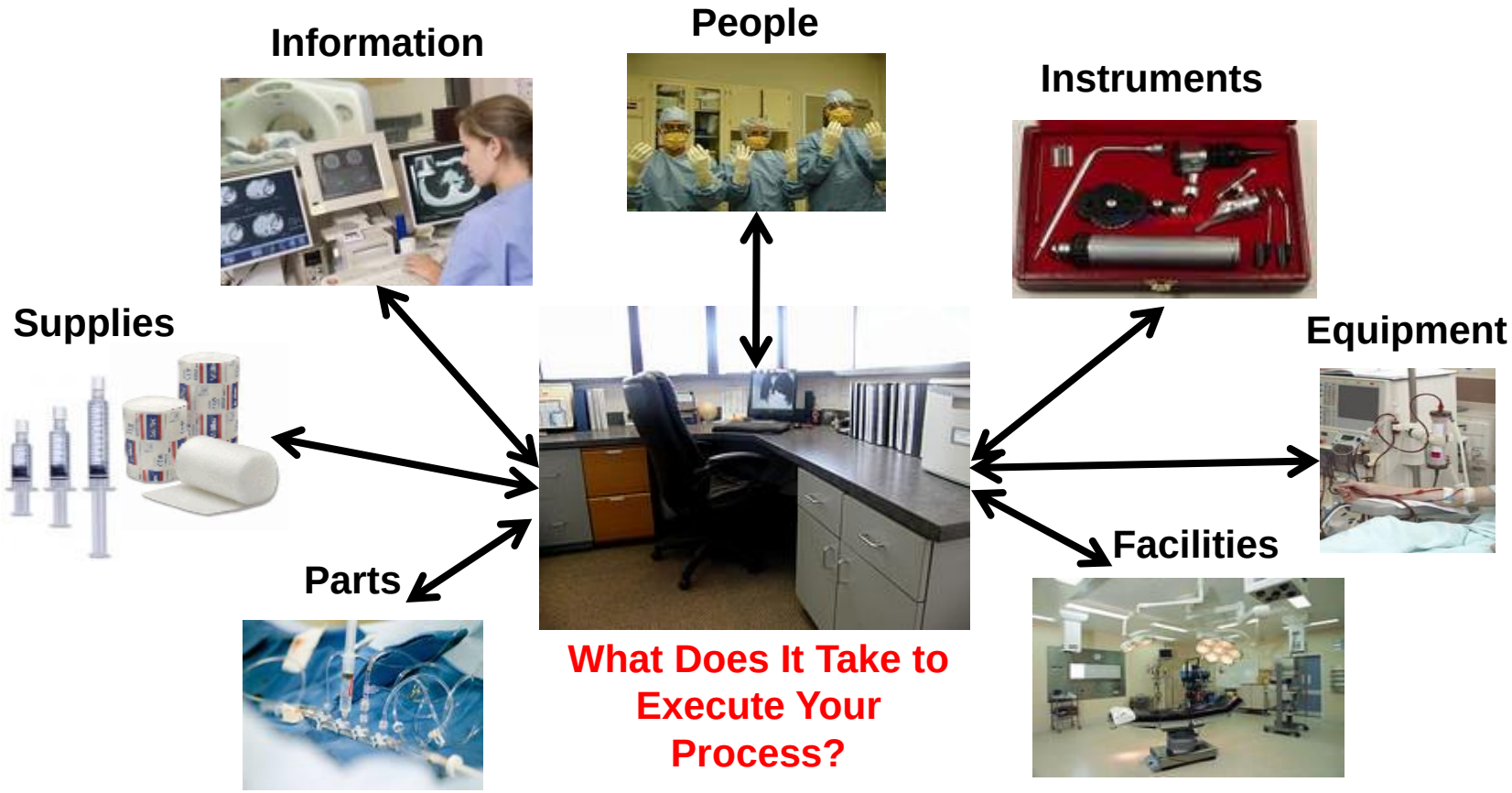
Operation Name:	Page:	Prepared by:
Masking	2 of 2	Doug Wickman
Part Description:		**Revision Date:**
89 Horizontal Pin		20-Oct-04

1	Cut strip of aluminum tape 3/16". Place in the two narrow grooves, rub well into place. Outer edges of the "groove" should be slightly visable.	8	Using 1/2" lead tape, apply to bottom edge of journal so it will overlap the yellow tape from step 7. Rub the lead tape into the groove. Trim off excess tape from journal.
2	Cut 5 pieces of 1" Lead tape. Cover the top area, overlapping at the "stub" and outside edges.	9	Paint keyway with red lacquer. Remove any excess paint from journal with reducer.
3	Cut a piece of 1" Lead tape. Wrap tape around the stub, overlapping the tape from step 2.	10	Check your work. Remove excess glue residue.
4	Wrap the threaded area with 1" yellow tape from the bottom corner of the threads to over the top edge, overlapping the lead tape from step 2. Secure the yellow tape by tying or overlapping with 1/2" lead tape.	11	End of task
5	Using 1/2" Lead Tape, cover around the edge of the journal so it will overlap the yellow tape from step 4. Rub into the corner and outer edge of journal. Trim excess lead tape from journal.	12	
6	Apply 3" Aluminum tape to cover bottom of part. Trim off excess tape from journal.	13	
7	Apply 1/2" yellow tape to the cover flange and overlap tape from step 6. Secure with 1/2" lead tape.	14	

Point of Use Systems (POUS)

POUS is a practice that ensures that the right information, parts, tools, equipment & people are available where & when needed.

Are your workers treated like doctors in an operating room?



POUS/Kitting Examples

Time Components of Standard Work

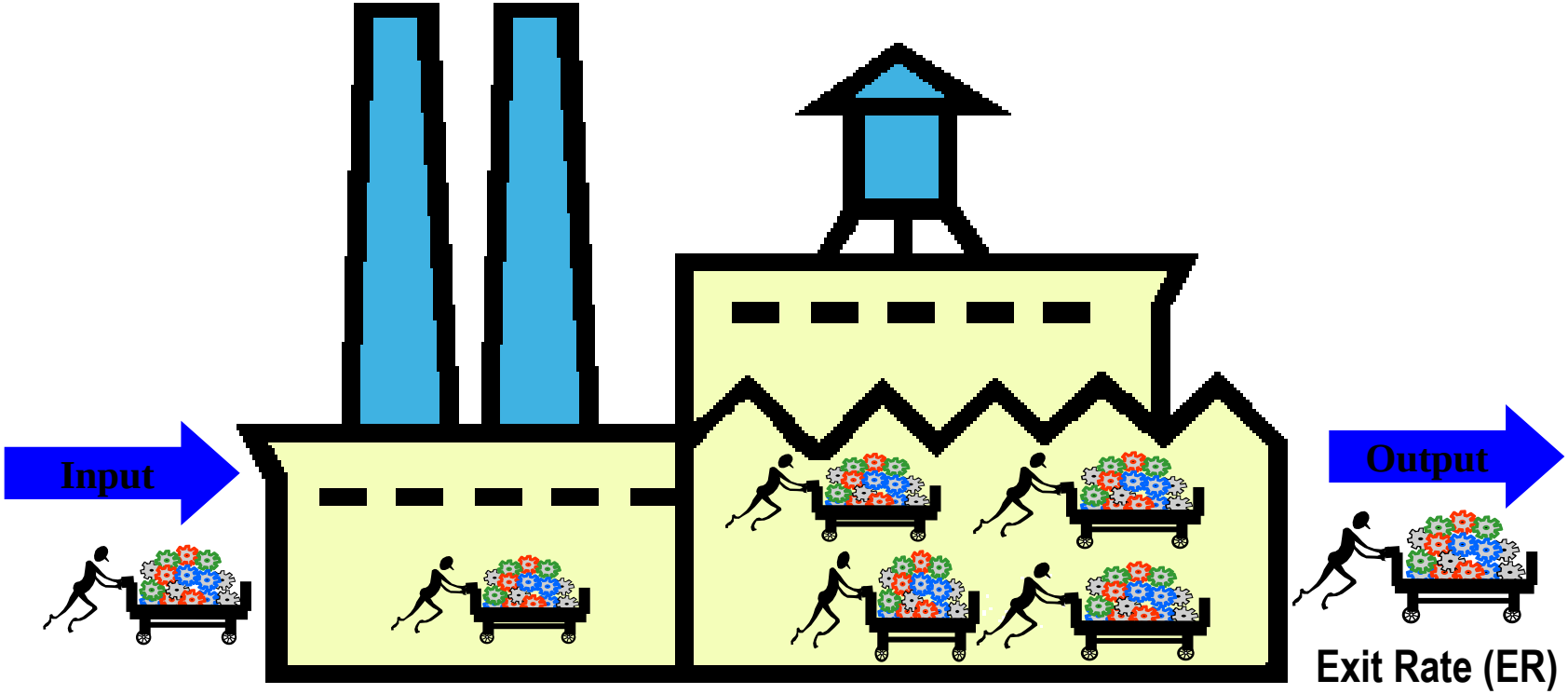
- Process Lead Time
- Cycle Time
- Takt Time

Process Lead Time

- The time required to complete an entire process.
- Typically from customer request to delivery.
- Can be measured or estimated.
- Examples:
  - Time to produce an item.
  - Time to complete an approval process.
  - Time to complete a report.

Process Lead Time Estimation

Little's Law Example



Work in Process (WIP) = 75 Widgets

Exit Rate (ER) = 15 Widgets per Day

$$LeadTime = \frac{Work\ In\ Process\ (WIP)}{Exit\ Rate\ (ER)} = \frac{75}{15} = 5\ days$$

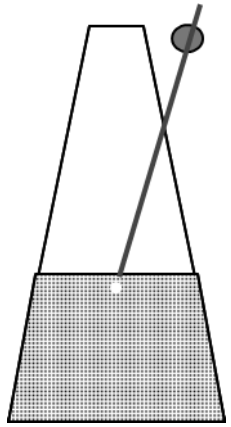
Cycle Time

- The average time it takes between the completion of two individual units of production.
- Example
  - The cycle time of leave requests approved at a rate of 10 per hour would be 6 minutes per request.

Takt Time

- The rate at which a product or service needs to be provided to meet customer demand.

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



Takt Time

- 250 Available Workdays per Year.
  - (assuming 5-day work week)
- Customer requires 30 Units per Year.

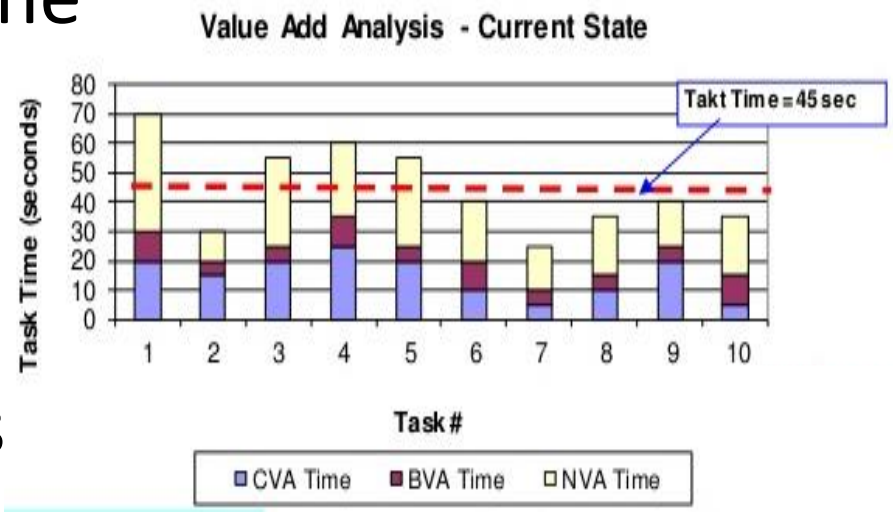
$$\text{Takt Time} = \frac{(250\ \text{days})}{(30\ \text{Units})}$$

$$\text{Takt Time} = 8.3\ \text{days per Unit}$$

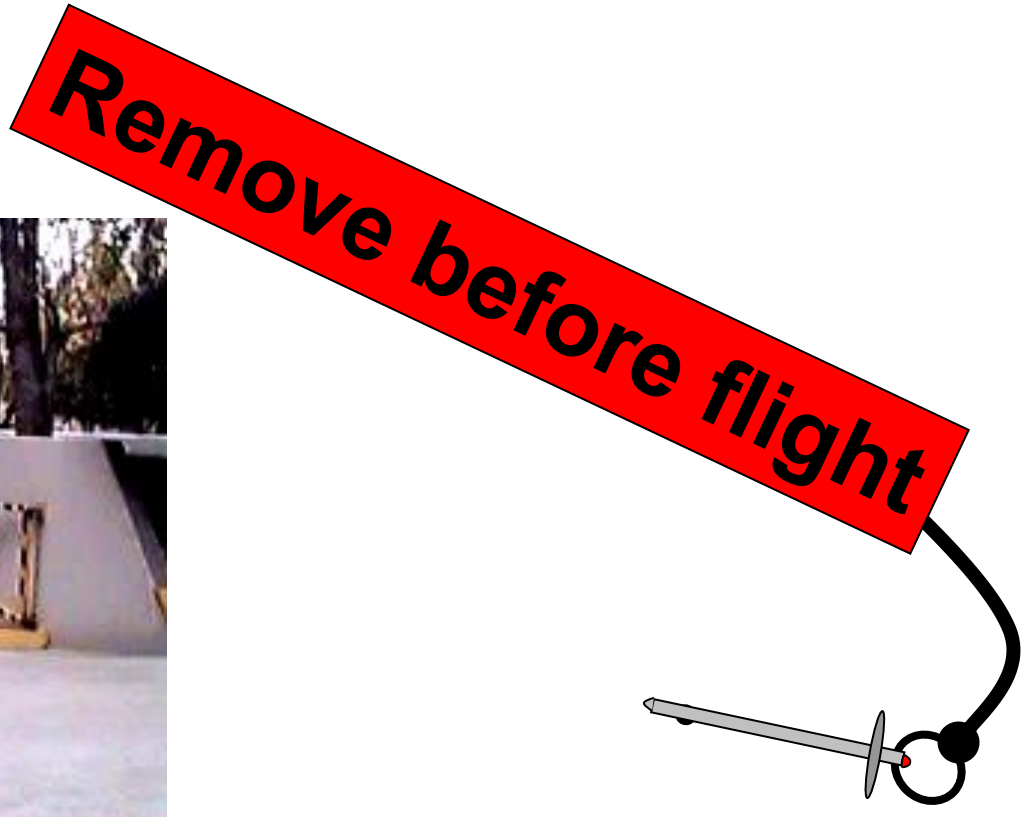
- With a Takt Time of 8.3 days, you must induct and sell a unit every 8.3 workdays in order to meet the Customers annual demands.

Workload Balancing

- Workload Balancing is the balancing of a process between several staff positions.
- Cycle Time must be less than or equal to Takt Time.
- Wait Time is commonly added to Standard Work to synchronize sub-jobs across staff positions.



Mistake Proofing



"Anything that can go wrong, will go wrong!"

That is why we need mistake-proofing.

What is Mistake Proofing?

- Technique to prevent mistakes before they create defects.
  - Devices which prevent mistakes from happening.
  - Methods to prevent errors and to detect errors quickly if they occur.
- Also known as Poka Yoke, Japanese term for “avoiding inadvertent errors” which was formalized by Shigeo Shingo.
- Less expensive than the cost of rework.
- Based on simplicity and ingenuity.

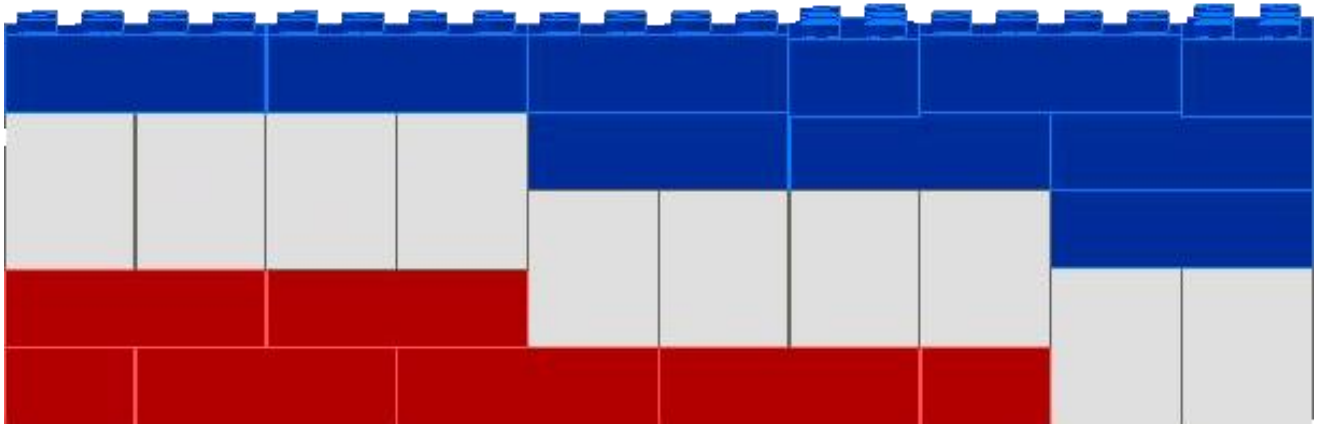
Everyday Examples

Why is Mistake Proofing important?

- Enables continuous work flow & reduces cycle time
- Builds quality into the process, reducing the number of in-process inspection interruptions.
- Is a critical element of perfecting standard work.
- Enables quick detection of defects to prevent passing to the next process or customer.
- Reduces defects which reduces operating expenses.

Accept no defects, make no defects, pass no defects!

Yellow Belt



Lean Thinking Exercise

Economic crisis!

Click

- Due to the recent economic crisis, it has become apparent that our current system of numbers is no longer working.
- To address this crisis, a new set of symbols has been created to replace the current numbers 1 – 10.
- It is imperative that we learn these new symbols as quickly as possible.
- Our world as we know it, depends on each of us to do our best!

Let's do it!

Now wait for 45 seconds.

36 seconds left

1. -
2. -
3. -
4. -
5. -

That was easy!

6. -
7. -
8. -
9. -
10. - X

Click once when ready.

Take 45 seconds to memorize these new symbols for the numbers 1 – 10.

Write down as many of the new symbols as you can remember?

Click when ready To check answers

Check your answers

1. - 

2. - 

3. - 

4. - 

5. - 

6. - 

7. - 

8. - 

9. - 

10. - X

Click to discuss when ready

Discussion

Click

- How many people got all 10 symbols correct?
  - 9?
  - 8?
  - 7?
  - 6?
  - 5 and below?
- Were you distracted by the countdown on the left?
- Are there ever distractions when we are trying to learn?

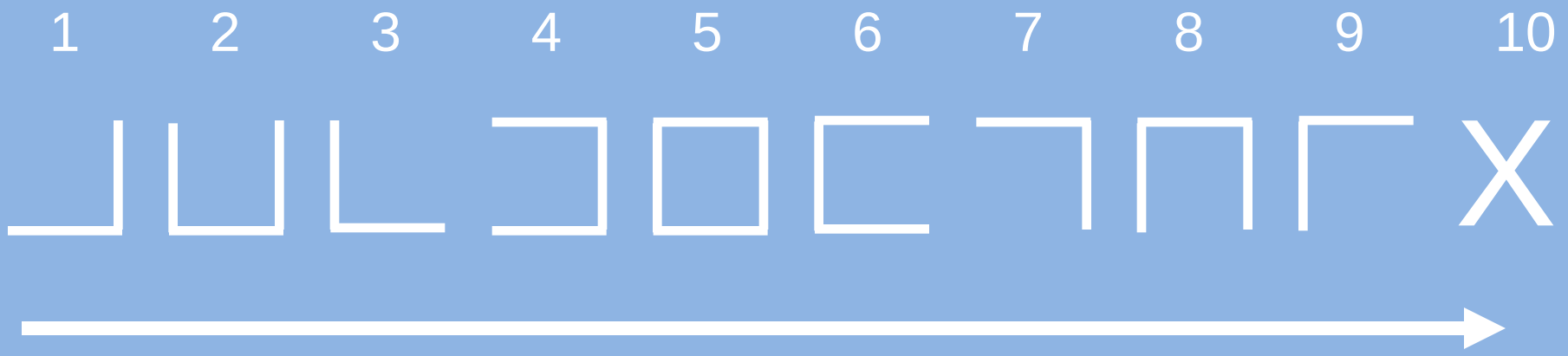
Click

Discussion continued

- Which symbols do most people get right?
  - 1 – due to repetition.
  - 10 – Its different and it represents the Roman numeral “10”.
  - 5 – Its different.
  - 7 – Its similar to the number 7.
- Most people look for a pattern and have difficulty finding it in a short amount of time.
- We are looking at the pieces rather than the whole.
- This is sometimes referred to as “Silo Thinking”.

Click

Now, for you linear thinkers…



Does this help?

When ready, click

Click

Let's think lean!

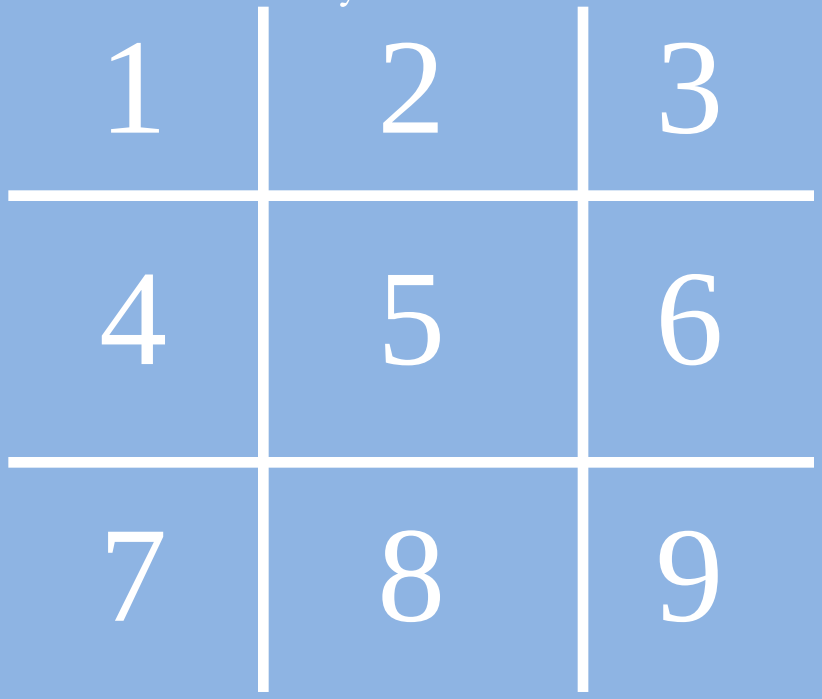
The outline around each number represents the new symbol!

Is this radical thinking?

No, everyone is familiar with this.

So it must be Common Sense!

How many of you thought of this?



10 - X

Systems View

Lean thinking is all about learning to see how things are connected within an overall system.

When ready, click

Benefits of Lean

- Work Smarter **not Harder.**
- Reduces costs by:
  - Reducing delivery time, cycle time, set-up time.
  - Eliminating waste.
  - Seeking continuous improvement.
- Improves quality.
- Increases overall customer satisfaction.
- Improves employee morale and working environment.

Module Summary

- Reviewed the basic principles of Lean Thinking (Value, Value Stream, Flow, Pull, Perfection).
- Reviewed basic Lean tools to assist Yellow Belts in their everyday work environment.
- Prepared to participated on project and events as needed by their command or organization.

Recap

- 4 Purposes of CPI
- 8 Types of Wastes
- 5S + 1
- Takt Time

Are there any comments or questions?

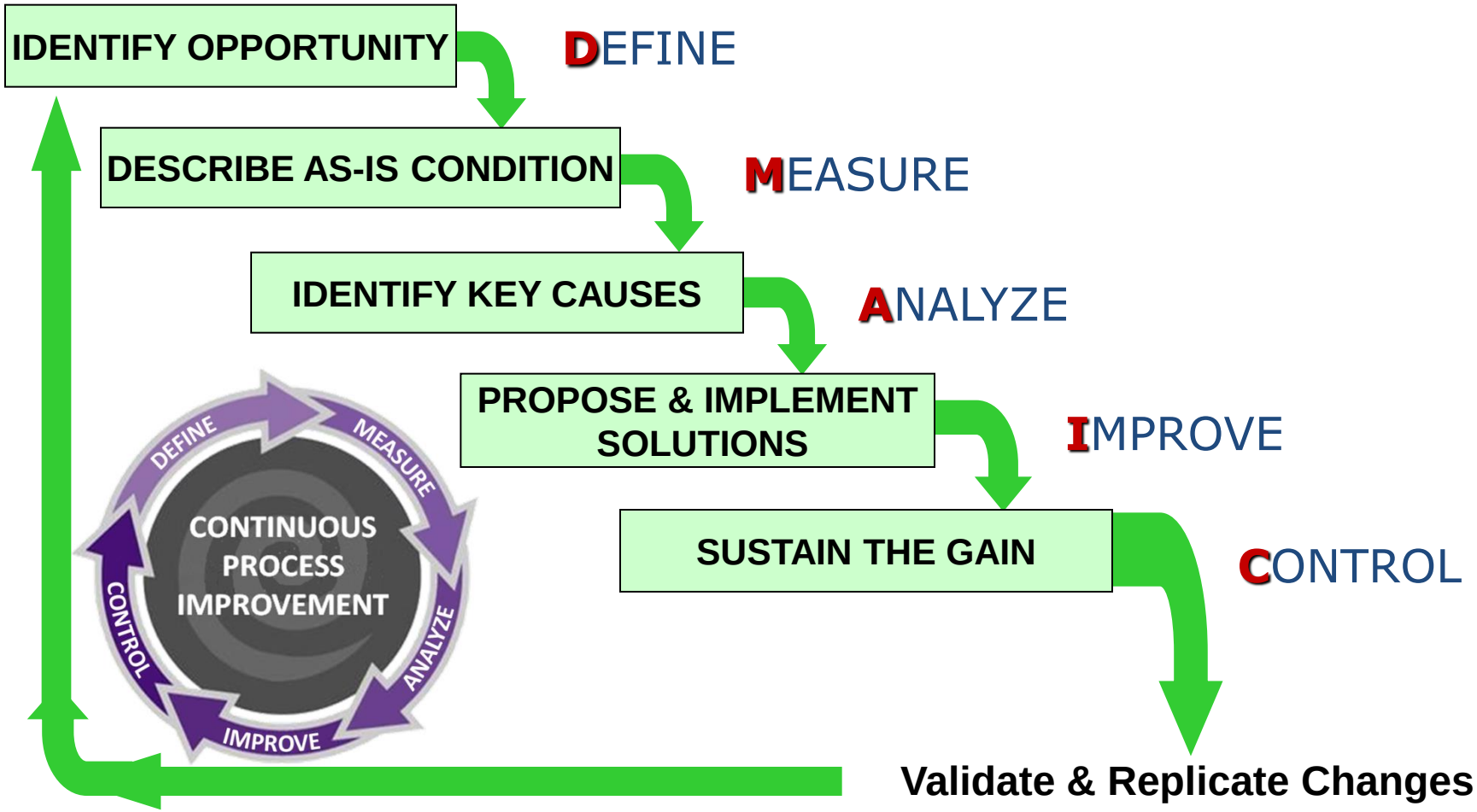
Yellow Belt Training
Six Sigma Module

Learning Objectives

At the end of this lesson you will be able to:

- Be familiar with the objectives, tasks and deliverables for each phase of the Define, Measure, Analyze, Improve and Control (DMAIC) framework.
- Understand how the DMAIC framework is used to address process improvements.
- Be familiar with some of the most commonly used Six Sigma tools.
- Be prepared to apply some of the most commonly used DMAIC tools as a team member on a project or RIE.

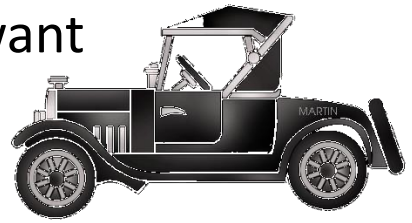
Lean Six Sigma Overview: DMAIC Methodology



History of Six Sigma

Six Sigma / Quality Roots

• Henry Ford Model T: You can have your car any color you want as long as you want it in the color black.



Statistical Process Control

• Walter Shewhart (shoe-heart) of Bell Labs at Western Electric.

• World War II Military Equipment and Logistics.

Six Sigma Basics

• Manufacturing Quality in decline in U.S. Plants.

• Bill Smith, Quality Manager for Motorola helped revive their quality.

• 1991 the paradigm went to MAIC as pattern to solve manufacturing quality problems.

• Maytag: Six Sigma- Six Sigma Plus- LeanSigma.

What is Six Sigma?

Tools and Methodology to:

Eliminate Defects

WAR ON VARIATION!

Reduce Variation

By using:

Measurement Systems Analysis

Pareto Charts

DMAIC

Statistical Process Control

Value Stream Mapping

Six Sigma Toolbox

Analysis of Variance

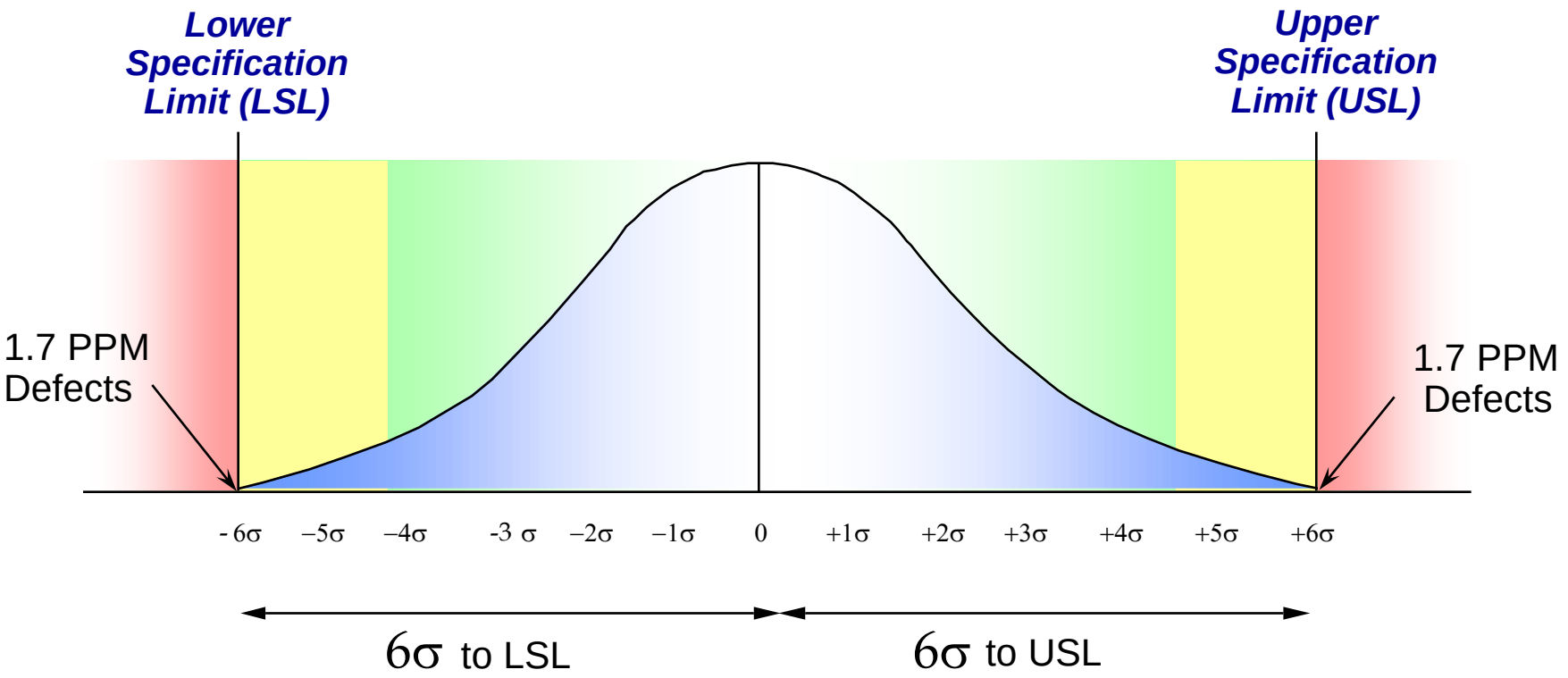
Control Charts

Voice of the Customer

Histograms

Cause and Effect Diagrams

Six Sigma



Six Sigma is a fact based, data driven philosophy of improvement that values defect prevention. It drives customer satisfaction and bottom-line results by reducing variation and waste, thereby promoting a competitive advantage.

The Certified Six Sigma Black Belt Handbook, ASQ 2005

Difference Between 3 and 6 Sigma

Most U.S. companies operate @ 3-4 Sigma

97.7% performance (or up to 25% total revenue in defects).

THREE SIGMA	SIX SIGMA
More than 40,500 newborn babies dropped in hospitals each year.	Three newborn babies dropped in hospitals in 100 years.
Unsafe drinking water about two hours each month.	Unsafe drinking water one second every six years.
Nearly 1,350 incorrect surgical operations per week.	One incorrect surgical operation in 20 years.
Five short or long landings at O'Hare each day.	One short or long landing in 10 years in all the airports in the United States.
2.3 Defects per *hundred* opportunities.	**3.4 Defects per *million* opportunities.**

Define Phase

Objectives:

- Identify what adds value to the process from both the business and customer perspective (VOB, VOC).
- Develop the business processes, define the critical customer requirements.

Activities:

- Create a project charter.
- Assemble a project team.
- Develop high-level process map (SIPOC).
- Define project goals.
- Leadership approval (Review).

Define Phase Tools

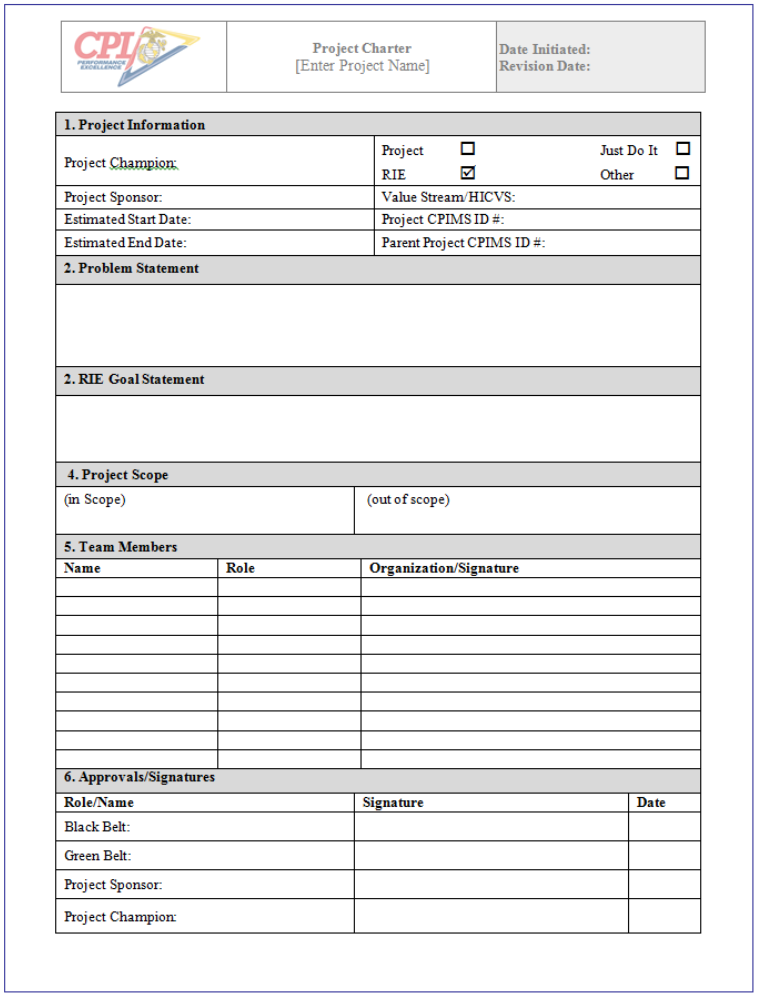
- Tools
  - Project Charter
  - Supplier-Input-Process-Output-Customer (SIPOC)
  - Voice of the Customer (VOC)
  - Communication Plan
  - Framework and Timelines

Types of Improvement Opportunities

Name	Duration	Scope of Change	Size of Team	Time to Implement
Just Do It	1-2 Days	Solution Ready to Implement – Problem Well Defined	Project Sponsor	Immediate
Kaizen/Rapid Improvement Event (RIE)	3-5 Days	Short Term, High Intensity Effort to Address a Specific Problem	2-8 (Full-Time During Event)	Immediate to Short Term
Project	3-6 Months	Complex Problem, No Apparent Root Cause	3-15 (Part-Time)	Mid to Long Term

Project Charter

- The team's commencement document.
- Defines the team's project plan and mission.
- The charter does not solve the problem.
- Charters are living documents that are subject to change.
- Charters cover 3 critical elements:
  - Problem / Opportunity Statements
  - Goal Statements
  - Scope Statements



CPI	Project Charter [Enter Project Name]	Date Initiated: Revision Date:

1. Project Information		
Project Champion:	Project ☐ RIE ☑	Just Do It ☐ Other ☐
Project Sponsor:	Value Stream/HICVS:	
Estimated Start Date:	Project CPIMS ID #:	
Estimated End Date:	Parent Project CPIMS ID #:	
2. Problem Statement		
2. RIE Goal Statement		
4. Project Scope		
(in Scope)	(out of scope)	

5. Team Members		
Name	**Role**	**Organization/Signature**

6. Approvals/Signatures		
Role/Name	**Signature**	**Date**
Black Belt:		
Green Belt:		
Project Sponsor:		
Project Champion:		

Opportunity / Problem Statements

- Improvement opportunity / problem statements should provide the following information:
  - What, Where, When, Extent and Impact.

- Goal Statements should follow the SMART criteria:
  - Specific, Measurable, Achievable, Realistic, Time Bound.

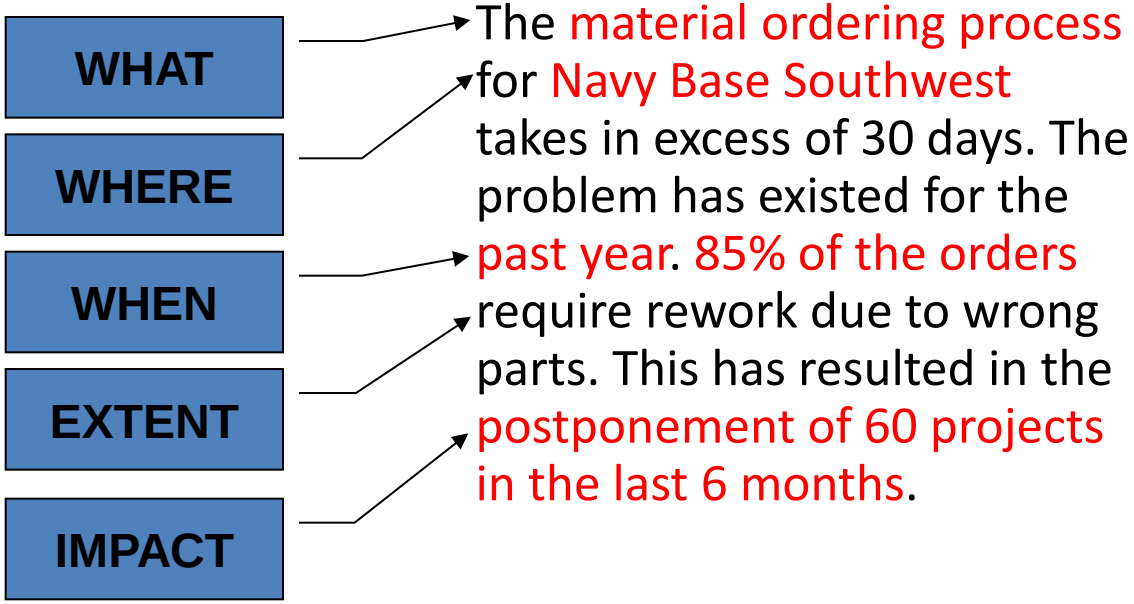
- Scope Statements should provide awareness of specific boundaries of your improvement opportunity.

Examples of Opportunity or Problem Statement

Example of a bad opportunity or problem statement.

It takes too long to process a material order form and wrong parts are ordered.

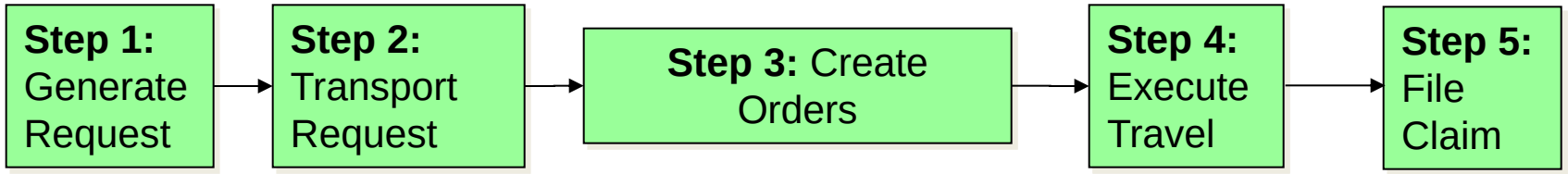
Example of a better opportunity or problem statement.



SIPOC

- SIPOC stands for Suppliers, Inputs, Process, Outputs and Customers.
- A process snapshot that captures information to a project.

Suppliers	*Inputs*	*Process*	*Outputs*	*Customers*
• SUB • NAVSEA • TYCOMS • OPNAV/CNO • NUWC • NRL • JHU • NSWC	• Destination • Transportation Mode(s) • Job Order Number • Travel Dates	• See Below	• Travel Orders • Advances • E-Tickets • Emails • Itinerary • Claim Forms	• Fleet • NAVSEA • Shipyards • NSWC • TYCOMs • Business Office



Voice of the Customer (VOC)

- CPI projects obtain VOC as part of the Define and Measure phase.
- You must:
  - Identify all customers.
  - Prioritize customers.
  - Gather the Voice of the Customer.
  - Translate customer wants into critical customer requirements and prioritize them.
- Capturing Voice of Customer is one of the critical elements of the methodology – understanding what requirements must be satisfied
- **Your Customer defines your success!**
- VOC must be gathered, translated and prioritized.

Translating VOC into Customer Requirements

Customer requirements must:

- Relate directly to the process of producing a service or product.
- Be measurable and specific.
- Cannot be vague and incomplete.
- Not be biased toward a particular solution or approach.

Example:

- Customer comment:
  - "We are unable to depend on delivery time when we need to get our parts"
- Customers Key Issue:
  - There is too much variation in delivery days, and the delivery must fit within a specific window of time.
- Customer requirement:
  - Delivery products no earlier than three days and no greater than five days from the date of the confirmed order.

Communication Plan

Effective Communications

- **Must have the following characteristics**:
  - A consistent formal process.
  - Simple and understood by all.
  - Contain current information.
  - Have a feedback loop built into the process.
- **Will help**:
  - Build and maintain trust.
  - Prevent rumors.
  - Enlist and enroll the participation of employees in the pursuit of achieving objectives.
  - **Manage expectations**

Measure Phase

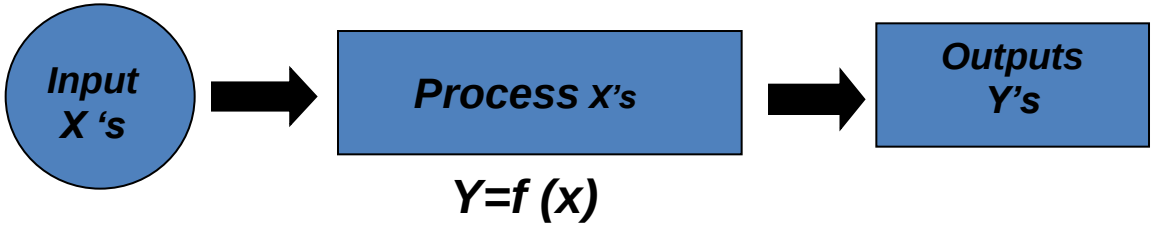
Objectives:

- Identify critical measurements.
- Understand the data calculations.

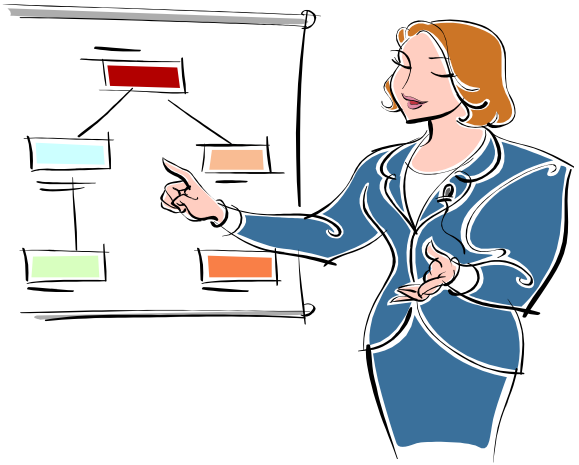
Activities:

- Map process and identify inputs and Outputs.
- Establish Measurement plan.
- Collect baseline performance data.
- Validate measurement system.
- Leadership approval (Review).

Measure Phase Tools

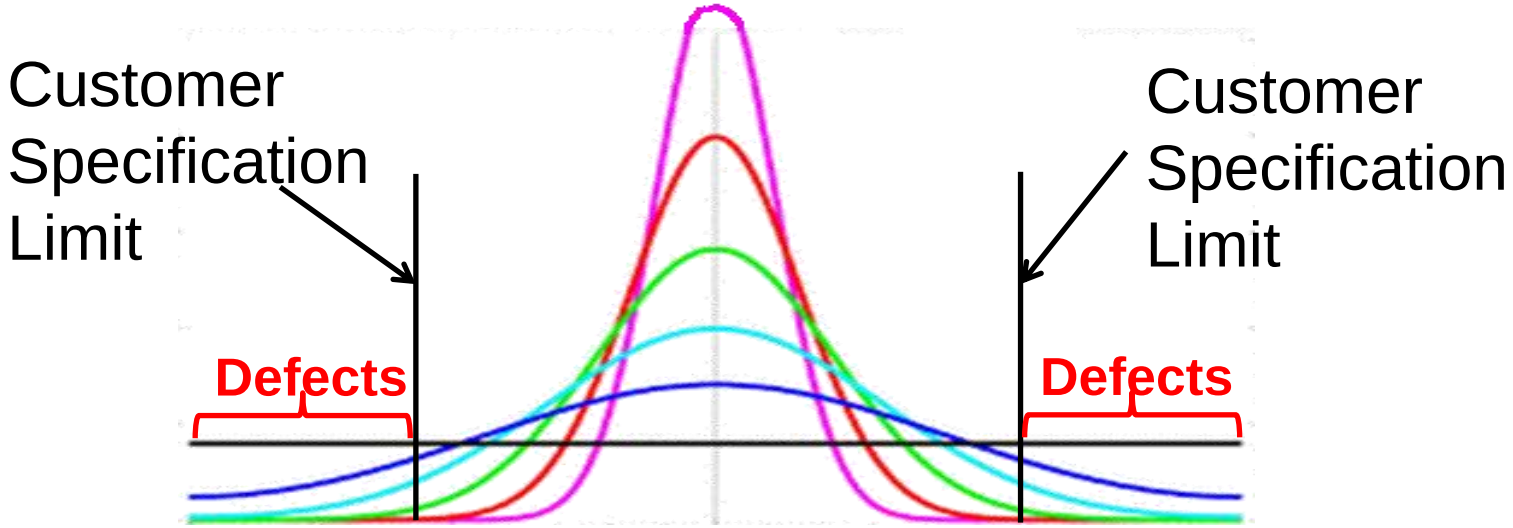


- **Tools**
  - Data collection plan
  - Walk the Gemba
  - Process Maps
  - Spaghetti Diagrams



Understanding Variation

- **Common cause** (inherent) **variation** is always present in a process.
  - A process that exhibits only common cause variation is a stable process.
  - A stable process is predictable.
- **Special cause** (assignable) **variation** is some unusual, uncommon event.
  - A process that exhibits special cause variation is an unstable process.
  - An unstable process is unpredictable.



Data Types

Da•ta (Da' tä, Dä'tä) *pl n.(singular or plural in number)* – Information, usually organized for analysis.

Variable Data

- Data that could be measured on an infinitely divisible scale or continuum. There are no gaps between possible values.
- Examples:
  - Tire pressure (lbs/sq.in.)
  - Cycle Time (minutes)
  - Speed (mph)
  - Length (inches)
  - Response time (milliseconds)

Attribute Data

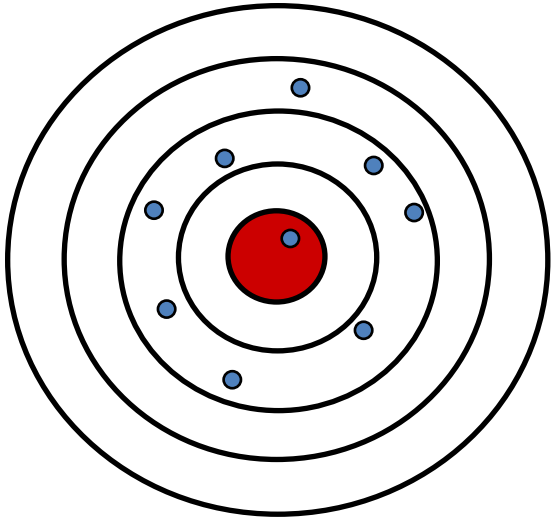
- Discrete data measures attributes, qualitative conditions, and counts. There are gaps between possible values.
- **Examples:**
  - # defects per unit
  - PO's placed per day
  - Number of calls on hold per hour
  - Shoe Size
  - Number of employees

Data Types Quiz

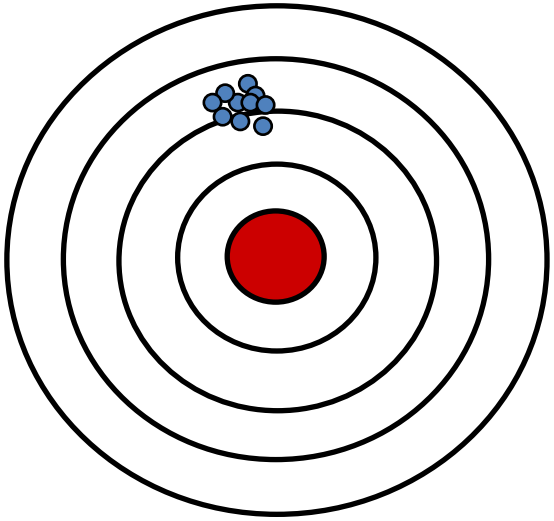
Beside the following examples, write either "Variable" (continuous) or "Attribute" (discrete).

- Average Labor Hours
- Data input accuracy
- Responsible organization
- Hole diameter using a "go/no-go" gage
- Hole diameter
- Order turnaround time
- Weight of refrigeration charge (grams)
- Cycle Time
- Certification Defects

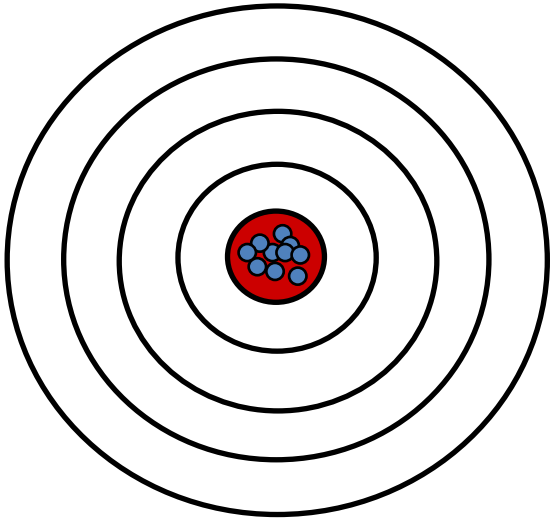
Measurement Properties



Accuracy without Precision



Precision without Accuracy



Accuracy and Precision

Data Collection Plan

- **Key questions to consider:**
  - *What are we measuring?*
  - *How will we gather the data?*
  - *Who will gather the data?*
  - *When / how often will the data be gathered?*
  - *Who needs to see the data?*
  - *What is the desired or required level of performance?*

Objective (Why)	Measures / Data (What)	Data Collection Method (How)	Data Sources (Where)	Timing (When)	Responsible Party (Who)

Walk The Gemba

- Gemba means “real place” or “go see.”
- The work place is where value is created.
- Management has a responsibility to “get the facts” from the work space.

The Five Actuals

1. Go to the actual workplace.
2. Engage the people who do the actual work.
3. Observe the actual process.
4. Collect the actual data.
5. Understand the actual value stream.

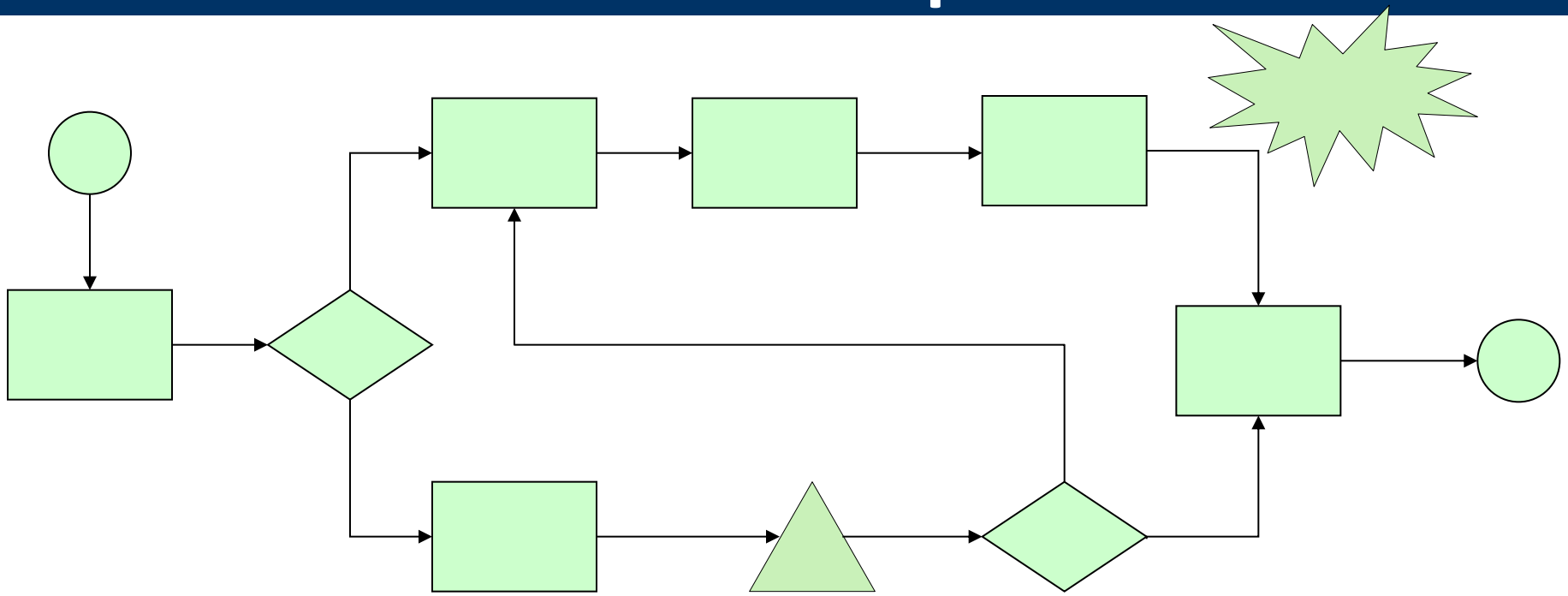
Ohno’s Circle

Direct Observation Leads to Better Understanding.

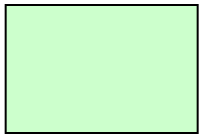
Process Maps

- Used for visualizing a system or process (sequence of events, tasks, activities, steps).
  - Can be used to identify opportunities for improvement such as streamlining or combining operations.
- Drawn with standard symbols representing different types of activities or operations.
- Several Types: Linear, Top-Down, Swim Lane, Value Stream

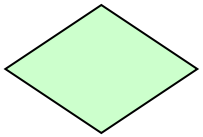
Process Maps



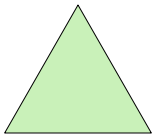
Standard Process Map Symbols:



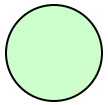
Process Step



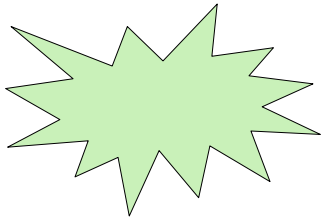
Decision Point



Wait (Inventory)

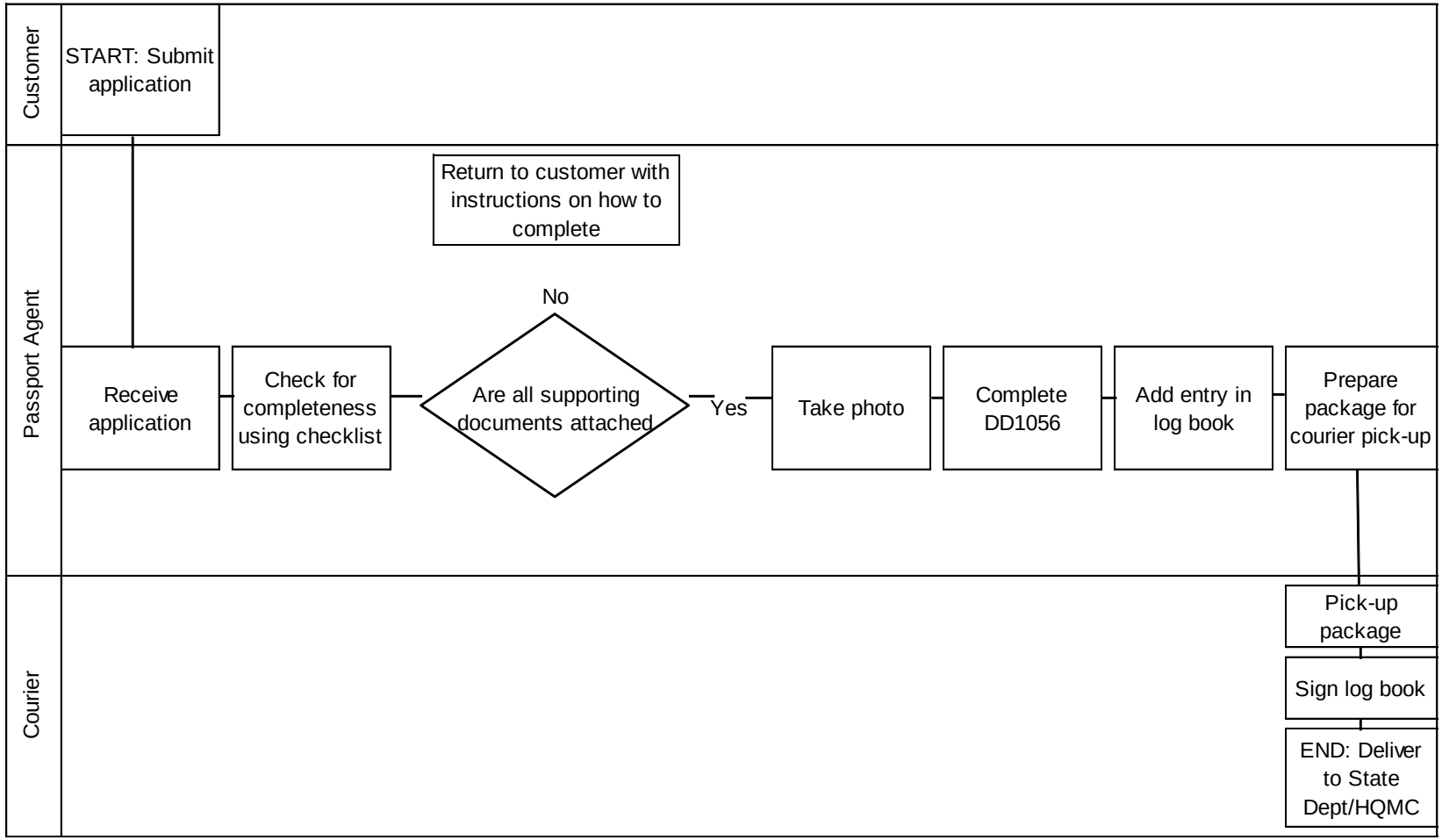


Start/Stop
Redirect



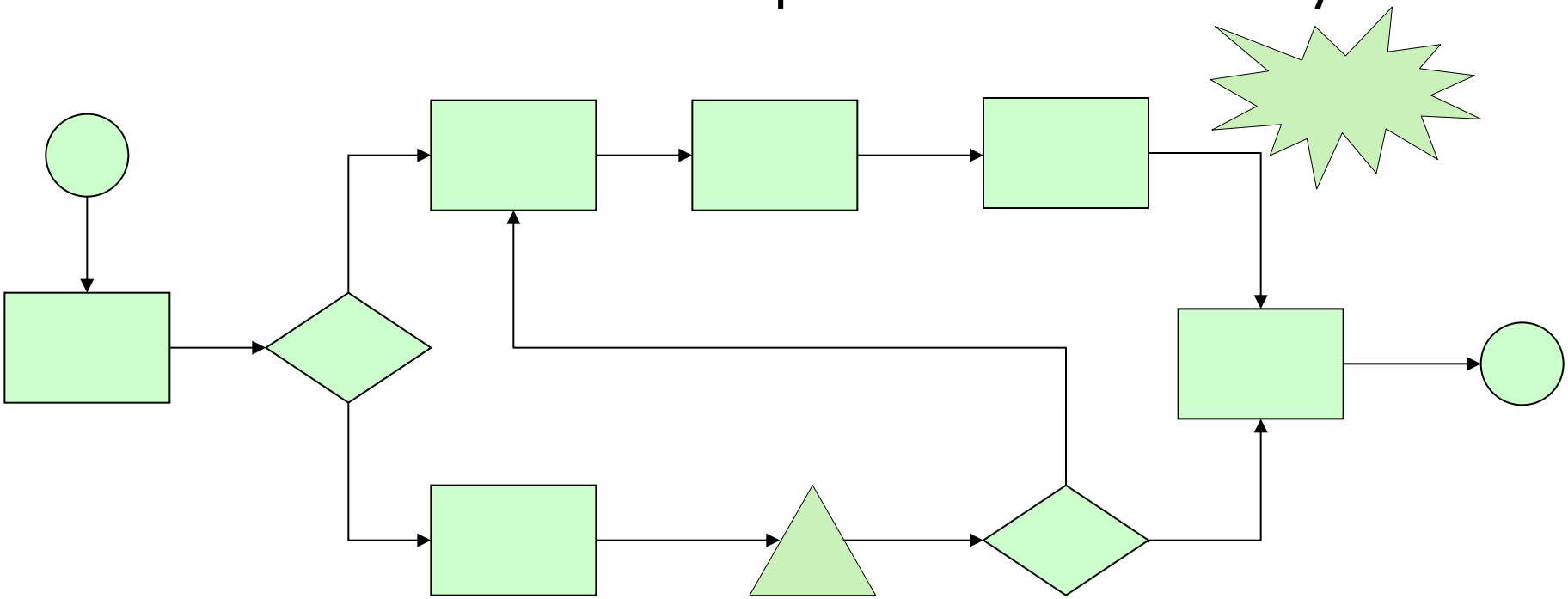
Project Burst

Process Map Example



How to Build a Process Map

- Walk the Gemba (workplace/process), noting process steps, decision points and inventory (wait points).
- Keep track of forms/documents used, and obvious improvement areas with project bursts.
- Use Post-it® to allow for steps to be moved easily.

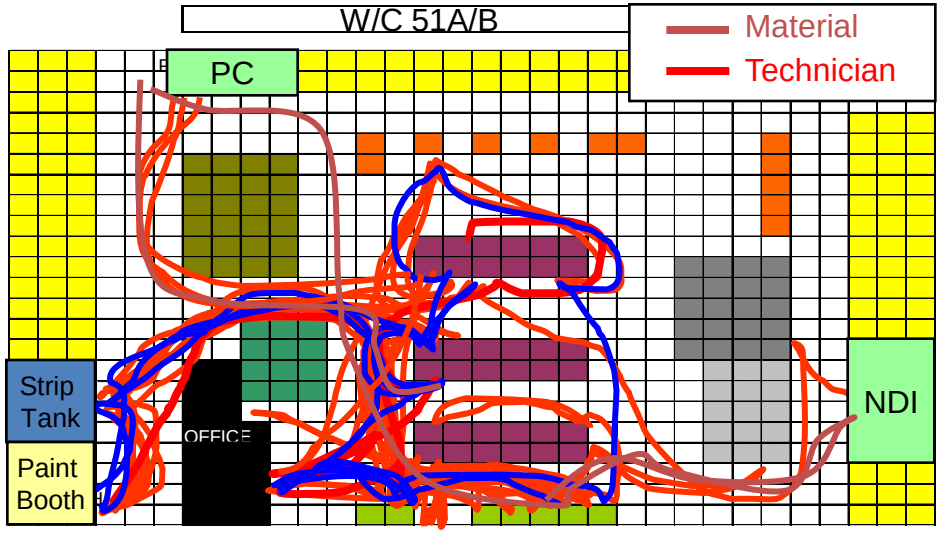


Spaghetti Diagrams

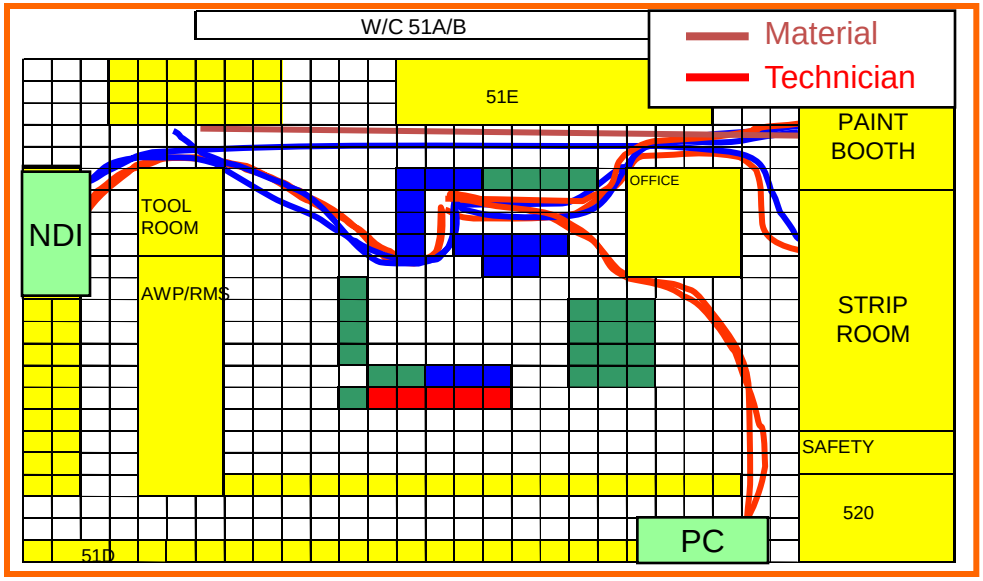
- Graphically describes the production layout, standard in-process inventory, and other factors in standard operations.
- Used to depict where there is wasted product, travel, people movement, queues, etc.
- Shows the physical area layout, flow of product through a series of process steps, or maps where a person walks to complete their process.

Before/After Spaghetti Diagram

BEFORE



AFTER



Analyze Phase

Objectives:

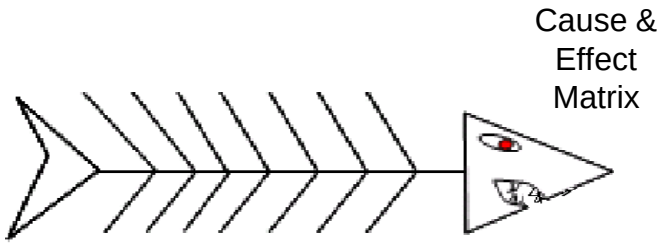
- Data Analysis
- Determine Root Cause

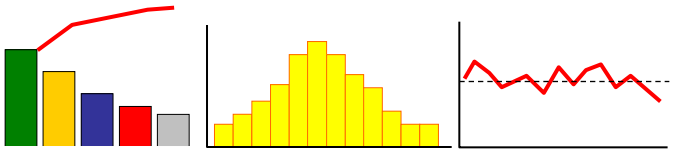
Activities:

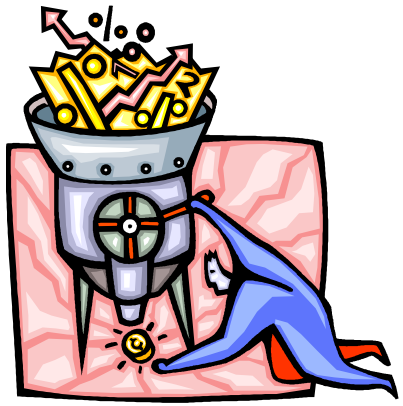
- Identify and validate Root Causes.
- Determine impact of root causes to process output.
- Prioritize root causes.
- Leadership approval (Review).

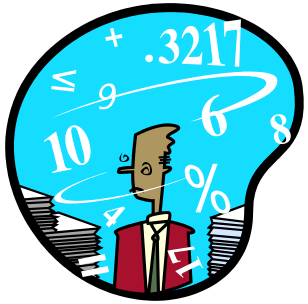
Analyze Phase Tools

- **Tools**
  - Pareto Charts
  - Cause and Effect Analysis
  - FMEA (Failure Mode Effects Analysis)
  - Statistics
  - Process Capability



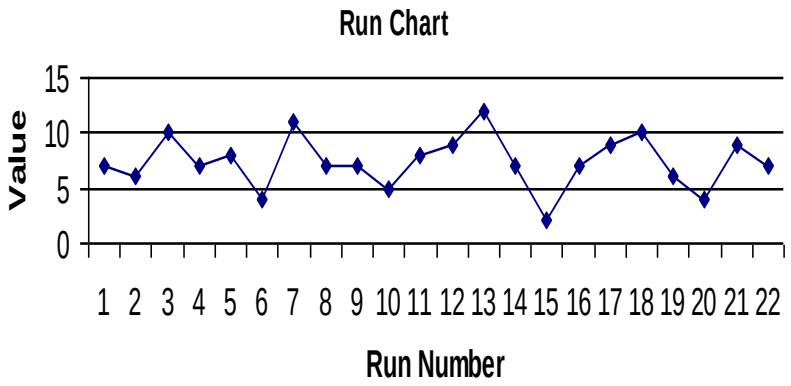




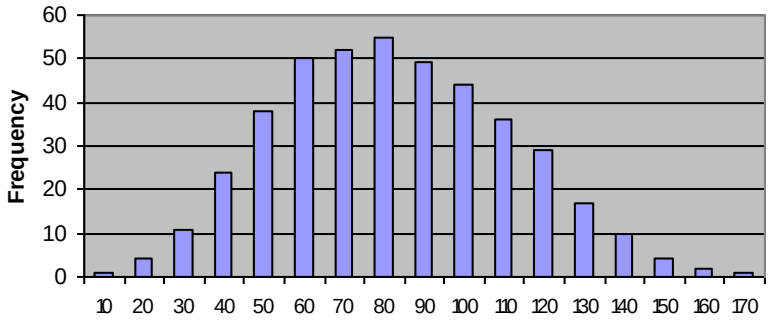


Example of Data Tools

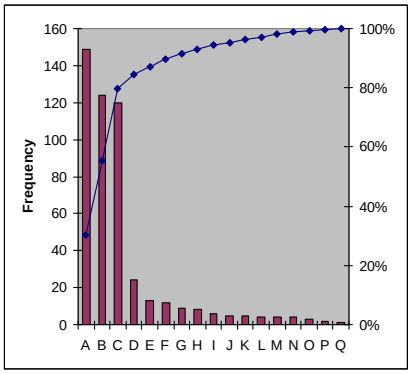
Control/Run/Trend Chart:
Shows change over time.



Frequency Plot/Histogram:
Shows distribution of variation and range.



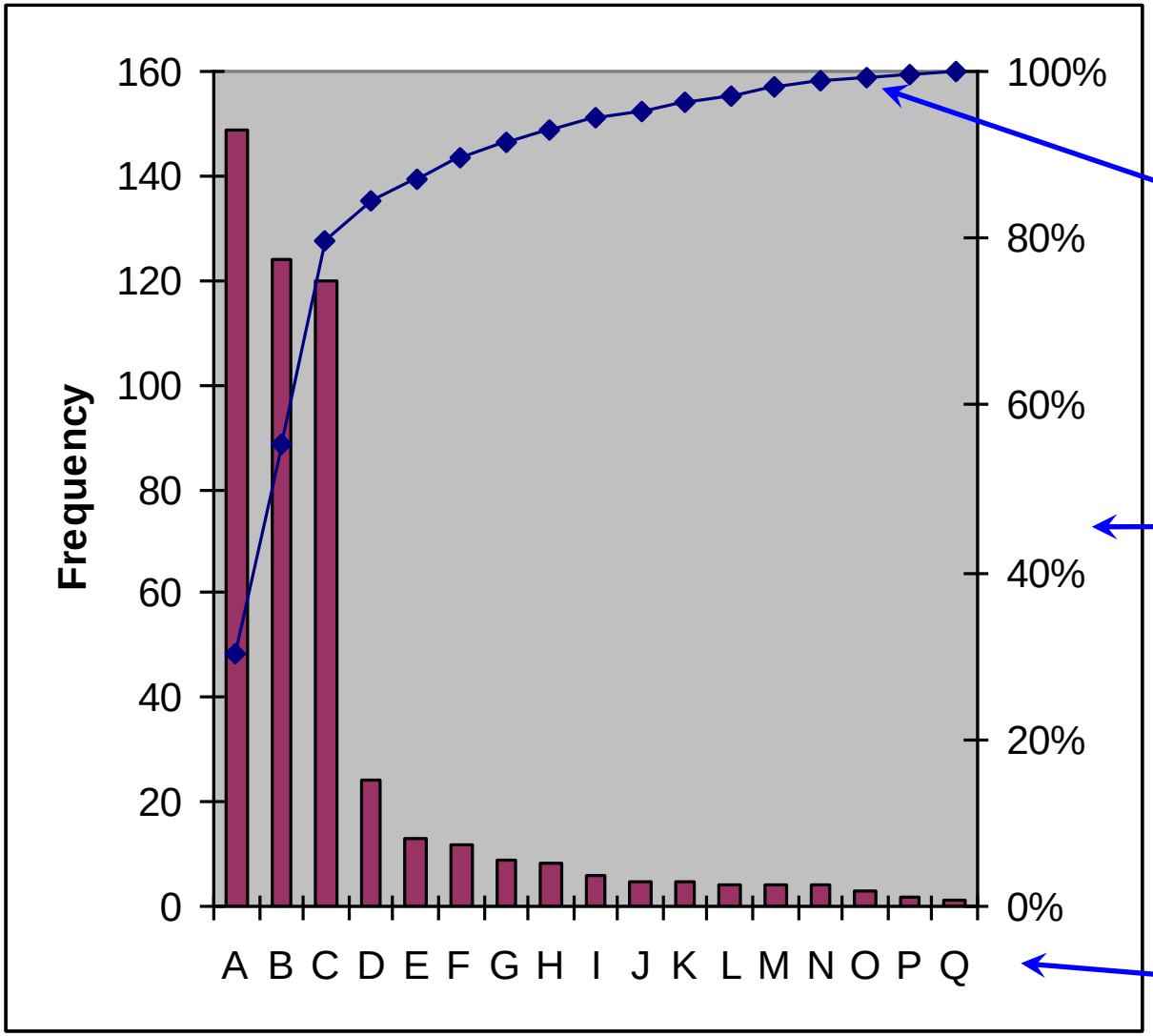
Pareto Chart:
Helps focus on key problems.



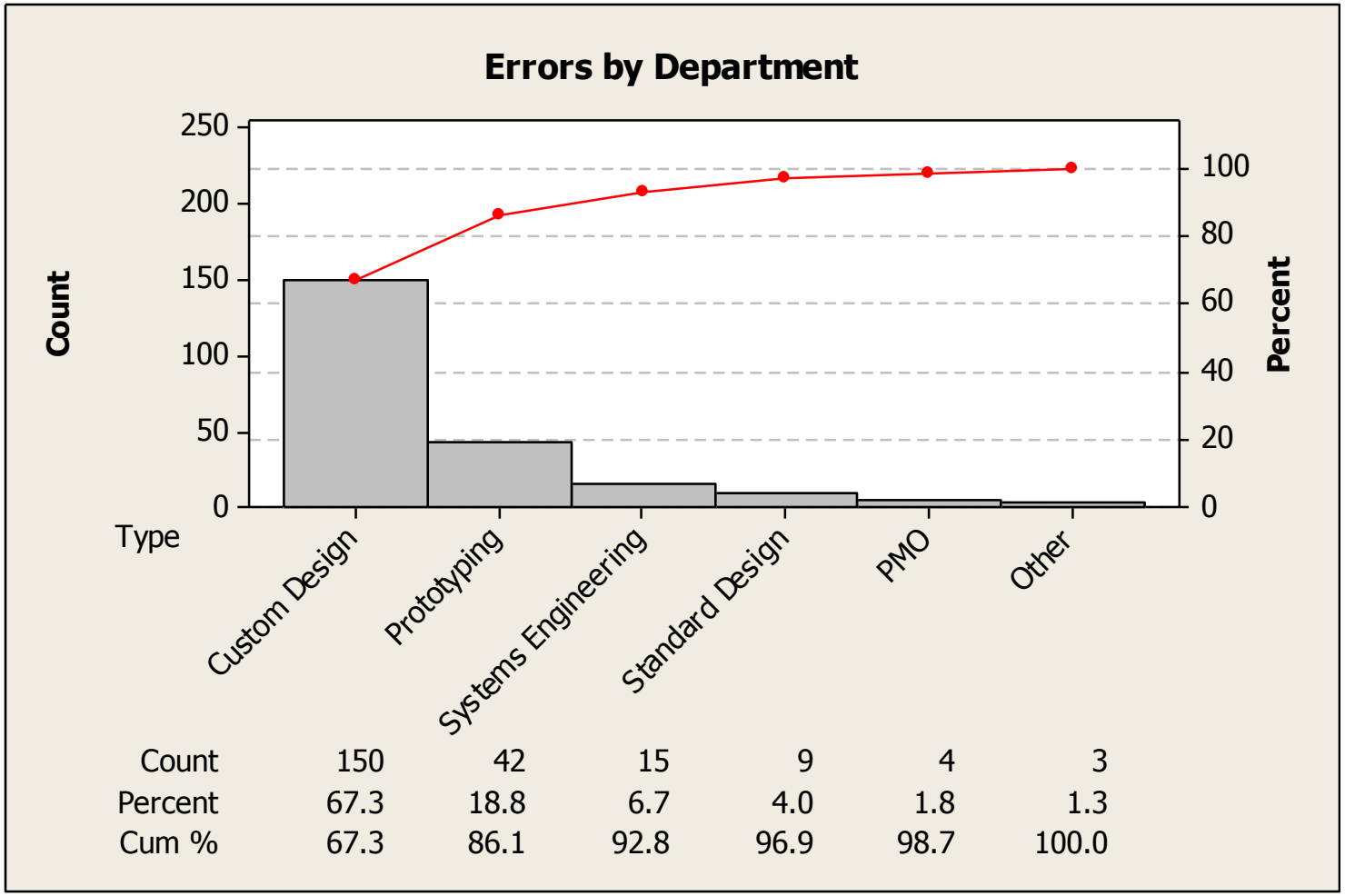
Pareto Charts

- Similar to histograms.
  - Aligns categories in descending order.
- The “80/20” Rule:
  - Pareto charts illustrate the concept that, for any given distribution of the results, the majority of the distribution (80%) is determined by a small part (20%) of the potential contributors or causes.

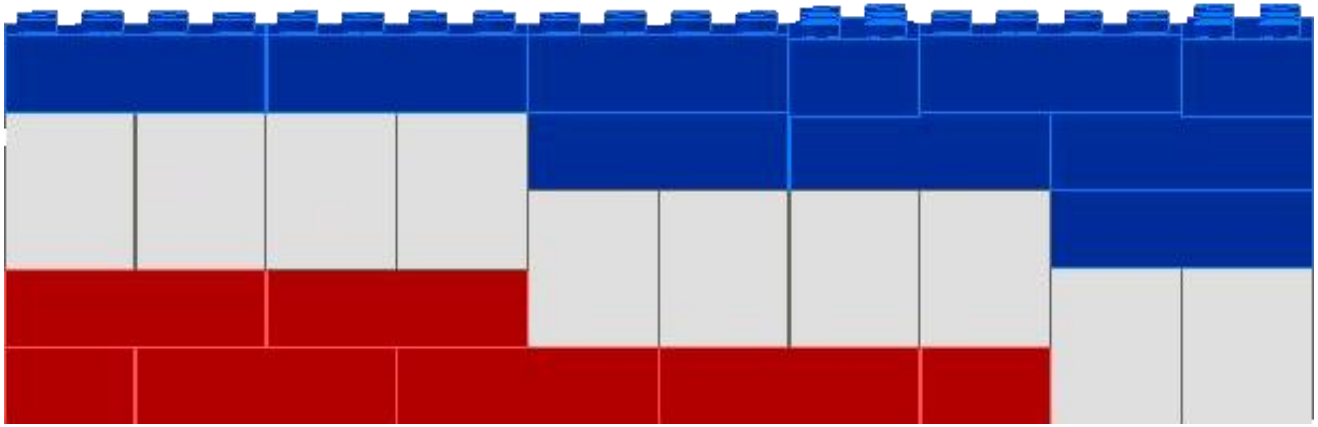
Draw the Pareto Chart



Pareto Charts - Example



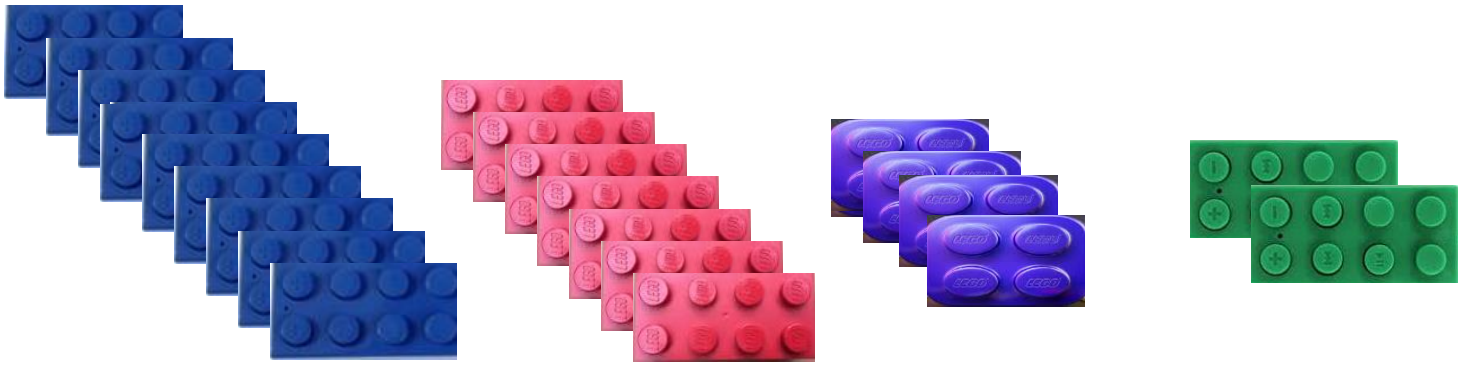
Yellow Belt



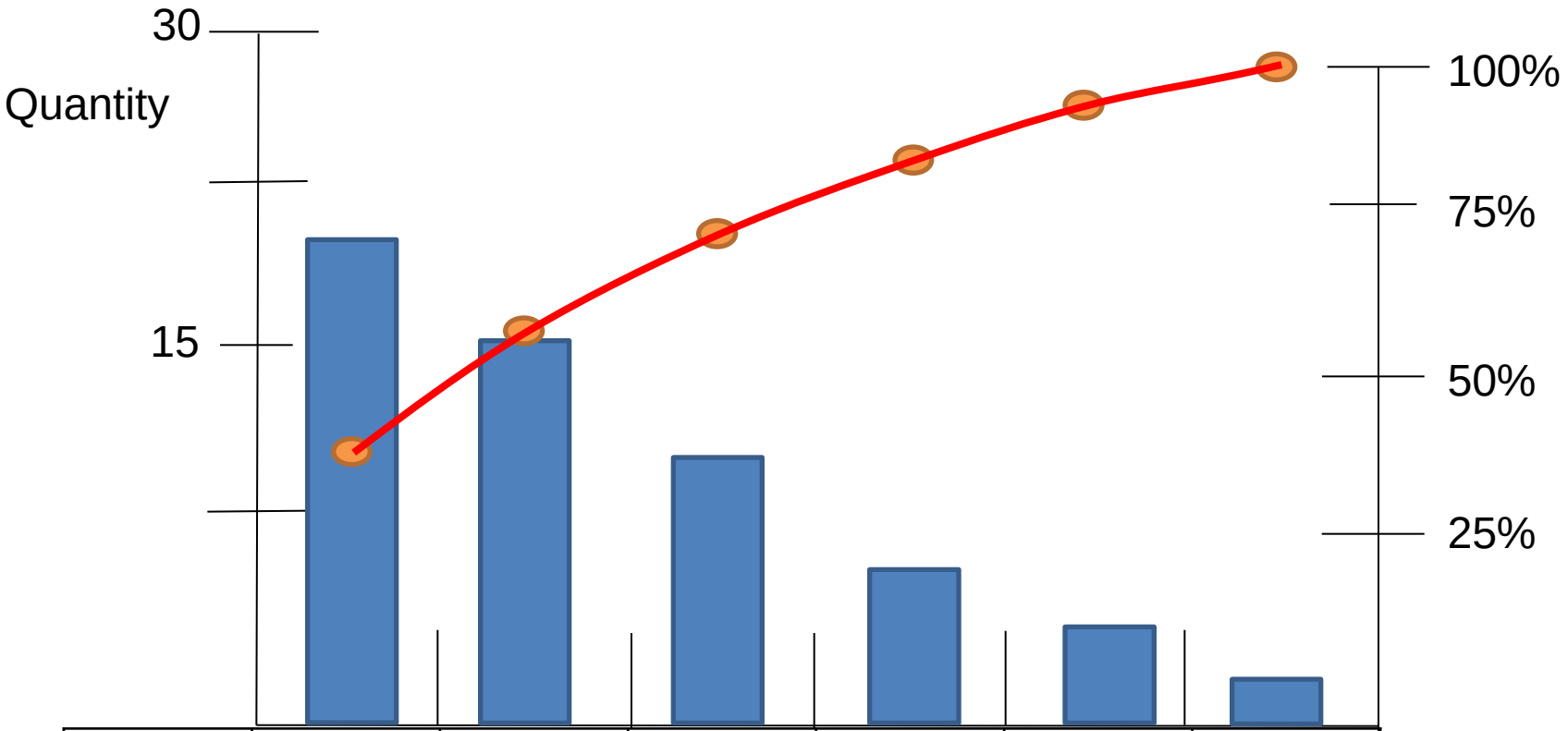
Pareto Chart Exercise

Pareto Chart Analysis Exercise

1. One Lego Bag per team.
2. Open Lego Bag.
3. Sort Lego's by color.
4. Highest number of Lego's on the Left.
5. Next Highest number of Lego's to the right.
6. Continue from highest to lowest until you reach the last color.
7. Plot the number of each color in descending order of magnitude.
8. Plot the number according to each color on the Occurrence Axis, from high to low.
9. Then plot the cumulative percent frequency showing the contributions from 0 to 100%.



Pareto Chart Analysis Exercise



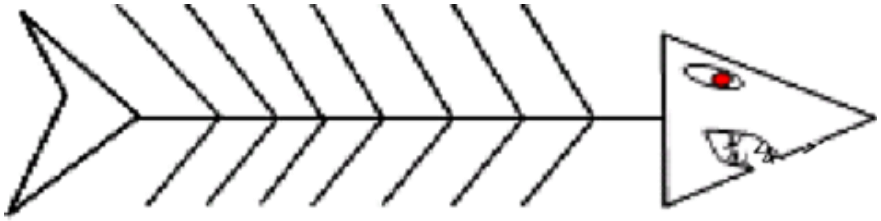
Categories Color of Lego's	Black	Red	White	Brown	Yellow	Green
Lego Qty.	22	15	10	6	4	2
Cum %	37%	62%	79%	89%	96%	100%
% of Total	37%	25%	17%	10%	7%	3%

59

Exercise Review

- What does the chart tell you?
- Comparing your chart with the student next to you, is the chart the same?
- Which chart, you or your neighbor's accurately reflects the true population?

Root Cause Analysis



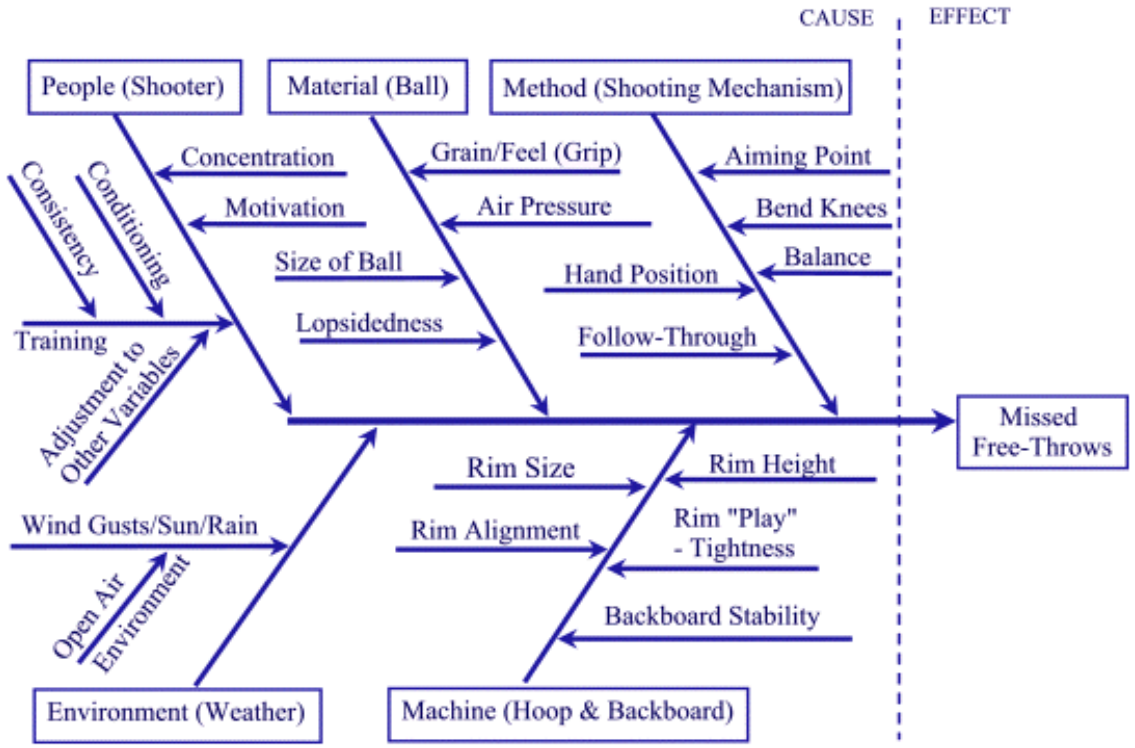
- Root cause analysis is where the *real* cause of the problem is uncovered.

- A root cause is one that, if corrected would prevent a recurrence of the problem.

Fishbone Diagram

- Breaks problems down into bite-sized pieces.
- Displays many possible causes in a graphic manner.
- Shows how causes interact.

Suggested Causes:
- Man
- Method
- Machine
- Material
- Measurement
- Mother Nature



Analysis – Determining Root Cause

Problem: Lincoln memorial deteriorating at a high rate.

1. Why: We wash this memorial more than the others.
2. Why: Bird droppings make it unsanitary for tourists.
3. Why: Birds eat the Spiders that gather in masse.
4. Why: Spiders gather to eat the flying midges that swarm.
5. Why: Midges swarm around the bright, warm lights that are turned on at dusk.

Answer: Delay turning on the lights for one hour.

Statistical Terminology

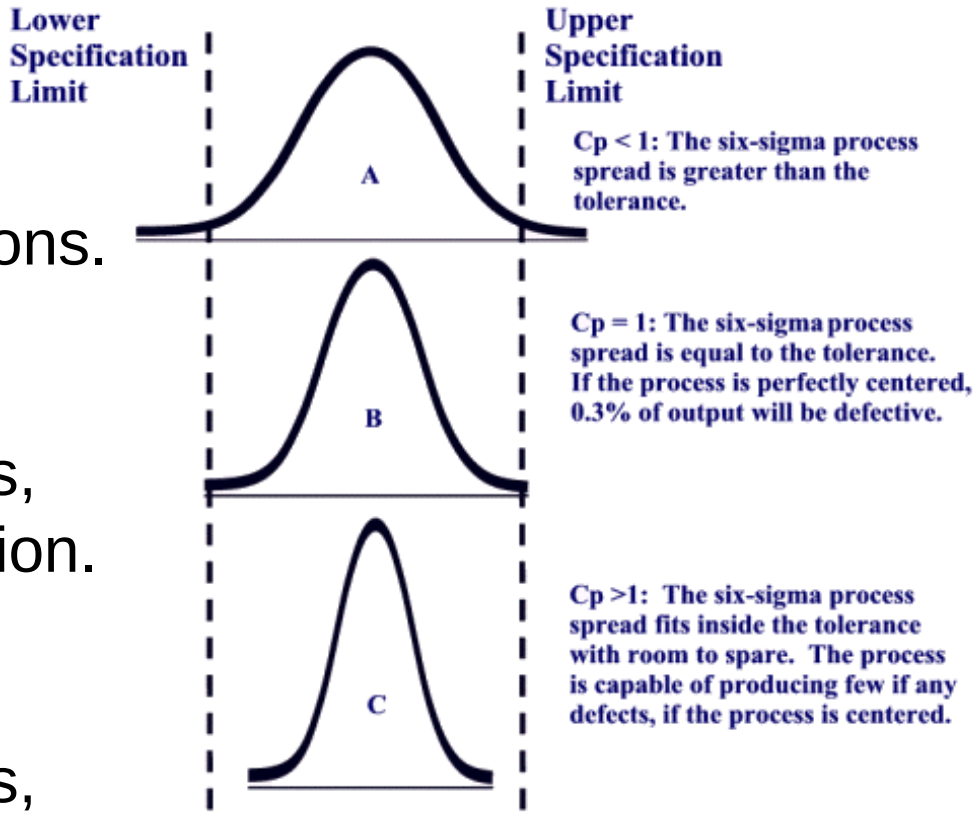
- **Population** - a complete set; all items of interest
  - The number of elements in a population is denoted by ***N.***
- **Sample** - a subset of elements from the population
  - The number of elements in the sample is denoted by ***n.***
- We can characterize a population or sample in 3 ways:
  - Measure of central tendency (location of center or middle).
  - Measure of variation (spread or width).
  - Measure of distribution (what does the set look like when viewed graphically (shape)).

Data Characteristics

- **Central Tendency (location)** – defines the location or center or middle of data.
  - Examples: Mean, Median and Mode
- **Variation** – defines the width of the data.
  - Examples: Range, Variance, Standard Deviation
- **Distribution** – defines the shape of the data, and a visual that can be more descriptive than just numbers.
  - Examples: Histogram, Stem & Leaf plots, Boxplots

Process Capability

- A measure of how close a process is running to its specification limits.
- Process Capability Values
  - Process Capability < 1 indicates a process that is unable to meet specifications.
  - Process Capability = 1 indicates a process that is able to meet specifications, but has no room for variation.
  - Process Capability > 1 indicates a process that is able to meet specifications, and can allow for additional variation.

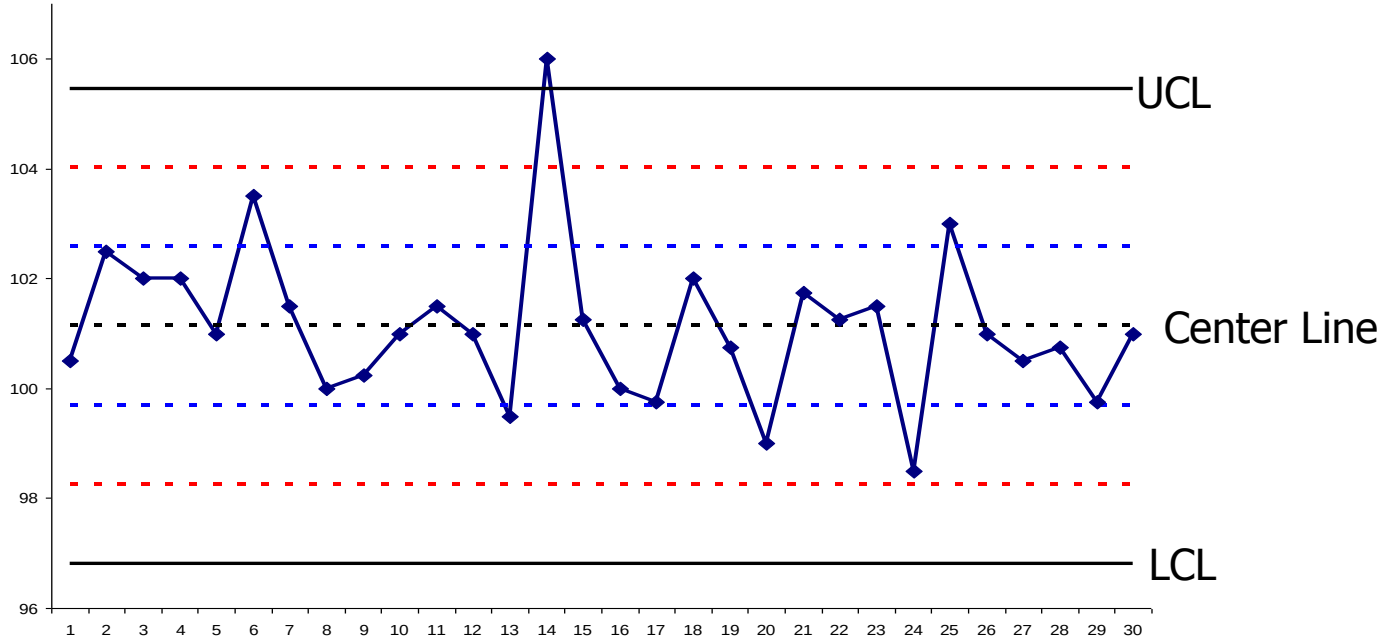


Control Charts

- Control charts are vary similar to Run Charts, but have additional information.
  - Centerline (mean)
  - Control Limits
- Used to analyze variation in a process.
  - Attribute (count) based.
  - Variable (measurement) based.
- Used to determine if variation is inherent to the system (common cause) or caused by an assignable event (special cause).

In Control & Out of Control Conditions

- In control processes demonstrate common cause variation.
- Out of control demonstrate special cause variation conditions including:
  - Extreme Points, Trends & Shifts, Oscillation.



Improve Phase

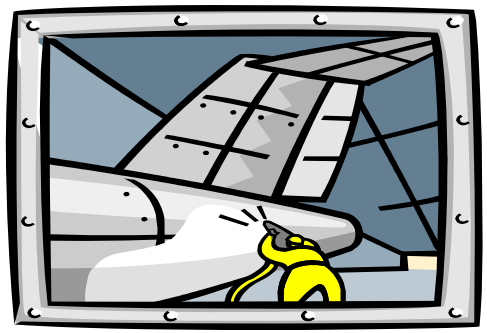
Objectives:

- Identify Potential solutions.
- Map out “TO BE” process.
- Develop an implementation Plan.
- Pilot solution.

Activities:

- Brainstorm potential solutions.
- Evaluate and select best solution.
- Identify solution impacts.
- Produce “to be” process maps and present implementation plan.
- Communicate solutions to all stakeholders.
- Leadership approval (Review).

Improve Phase Tools



- **Tools**
  - Lean
    - 5S
    - Waste elimination (TIMWOOD & U)
    - Improve workplace layout
    - Standardized Work practices
    - Remove non-value added work
  - Reduce Variation (Mistake Proofing)

What is meant by “Standard Work”?

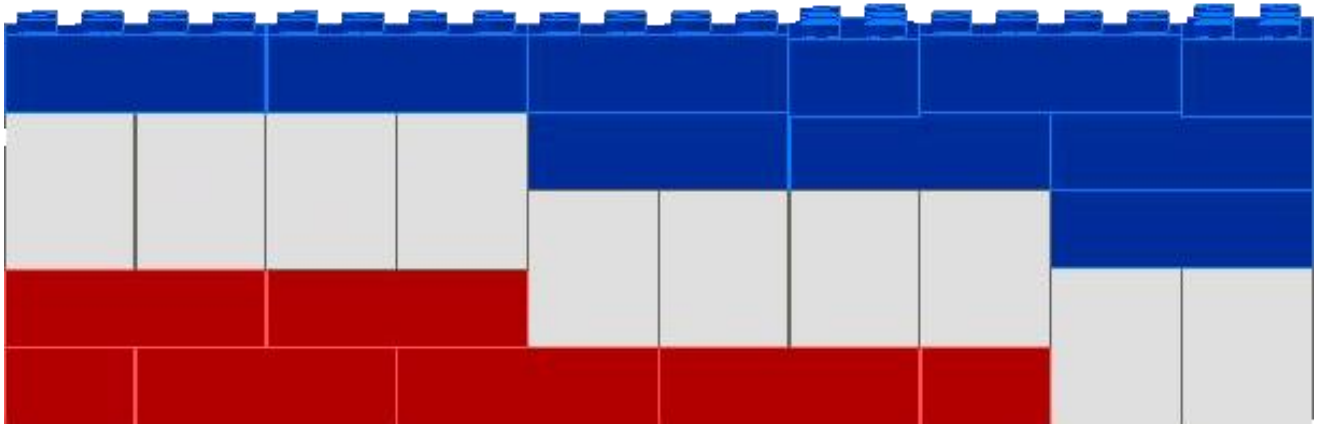
The principles, tools, and techniques used to ensure process standardization in a JIT environment.

- Developed by the people who do the work.
- Focused on efficient use of resources through waste elimination.
- Establishes the foundation for CPI.

“Where there is no Standard, there can be no Kaizen.”
- Taiichi Ohno

Exercise

Yellow Belt



Standard Pig

Pilot

- Piloting helps us understand the impacts of changes to the process.
  - Select your improvements and prioritize them.
  - If jobs are re-assigned make sure everyone understands their new role.
  - Use the pilot to ensure you have identified the root cause of the problem(s).

Control Phase

Objectives:

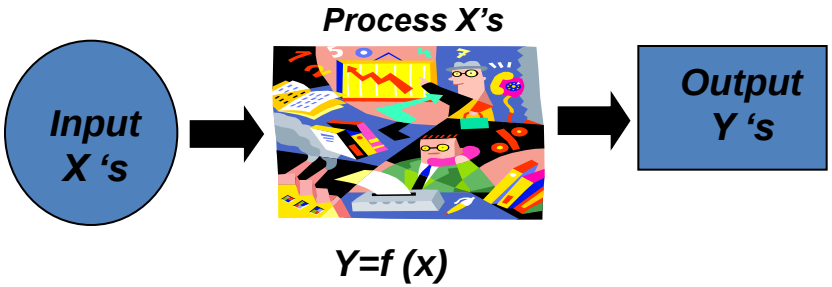
- Establish control plan.
- Verify improvements.
- Transition project to process owner.

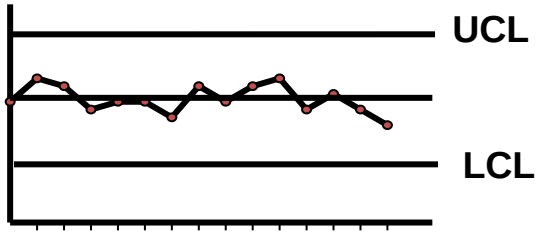
Activities:

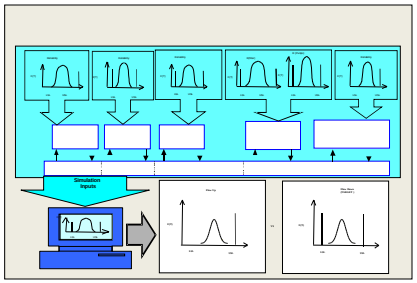
- Identify replication opportunities.
- Update Standard Work Instructions.
- Integrate lessons learned.
- Integrate and Manage solutions in daily work processes.
- Prepare a project transition plan and management review.
- Celebrate your success.

Control Phase Tools

- **Tools**
  - Control Charts
  - Standard work instructions
  - Control Plan
  - Project Turnover Plan
  - Lessons Learned

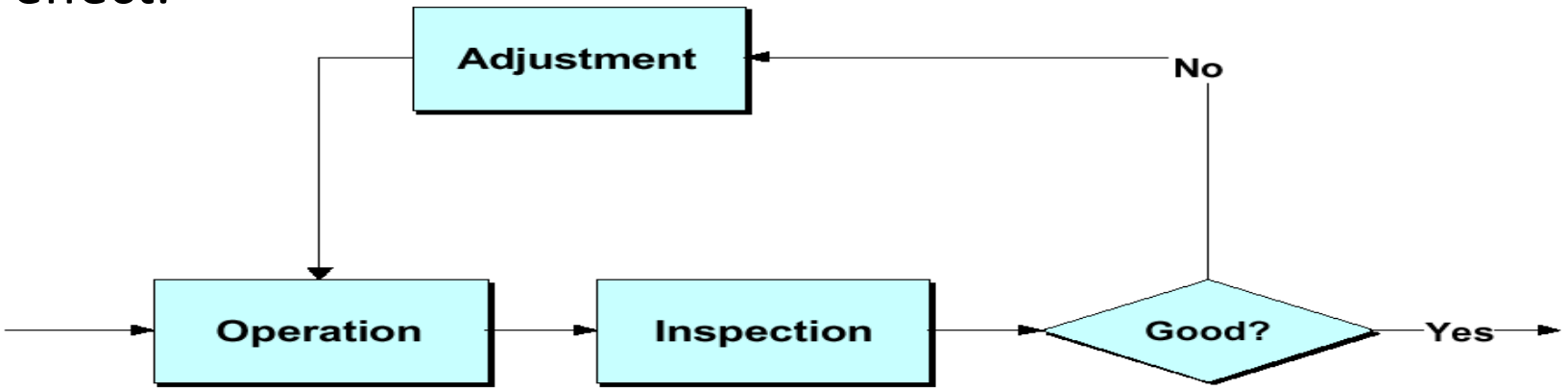






Control Plan

- Control Plans create a structured approach for control of process and product characteristics important to the customer.
- Control Plans assure well thought-out reactions are in place if an out of control condition occurs.
- They provide a method for documentation and communication of control methods.
- Control Plans must be living documents.
- Control Lag is the time from Operation to Adjustment taking effect.



Feedback Sessions & Turnover Plan

- Feedback Sessions provide teams with opportunity to reflect on the success of the project/event.
  - What Worked?
  - What Didn’t Work?
  - What can be Capitalized?
- Project Turnover Plan
  - This where you develop and document the turnover of the project.
  - The Project will be turned over to the Process Owner.

CONTROL TOLLGATE

Complete Report Out

- Complete a Project Financial Metrics Worksheet
  - Project / Event Savings
    - Labor Saved / Avoided (in $).
    - Material Saved / Avoided (in $).
    - Space Saved (in Sq. Ft.).
    - Etc.
  - Project / Event Costs and Benefits
    - Cost of Manpower for Project / Event (in $).
    - Return on Investment (ROI).

Module Summary

- Reviewed the five phases of the DMAIC framework and the objectives, tasks & deliverables for each phase.
- Discussed how the DMAIC framework is used to address process improvements.
- Used the DMAIC framework to address process improvements in a simulated work environment.
- Applied some of the most commonly used DMAIC tools to Define, Measure, Analyze, Improve and Control to improve the products and services.

Recap

- DMAIC
- Variation Types
- Root Cause Analysis
- Types of Improvement Opportunities

Yellow Belt Training Wrapup

Learning Objectives

At the end of this lesson you will be able to:

- Understand the Vision, Keys to Success, and Takeaways of CPI.

Vision

- Use CPI tools to:
  - Achieve Cost Wise Readiness.
  - Ensure that products are “Ready For Tasking”.
  - Improve Quality of your product.
  - Improve your work environment and increase moral.
  - Increase customer satisfaction.
  - **Work Smarter, not Harder!**

Keys to Success

- **Employee Involvement**
- Clearly defined Command goals
- Stable deployment Teams
  - Teams have been proven to be most effective in the deployment and sustainment of gains in CPI projects.
- Identify & Empower Champions
  - Use and reward motivated people, then follow through.
- Visual tools
  - Strive to have visual tools that make it easy to see and understand the process, what the current status is, and any abnormalities.
- Atmosphere of Experimentation
  - Tolerate mistakes, demonstrate patience, etc.

Take-Aways

- CPI is all about reducing our cost of doing business by increasing Productivity and Quality.

- CPI concepts are well-proven, fully demonstrated and exemplify **“World Class”** business concepts.

“YOU Can Make a Difference !!!!!”

What We Have Covered: Course Goals

Discussed the principles and methodology of Lean Six Sigma (LSS) / Continuous Process Improvement (CPI).

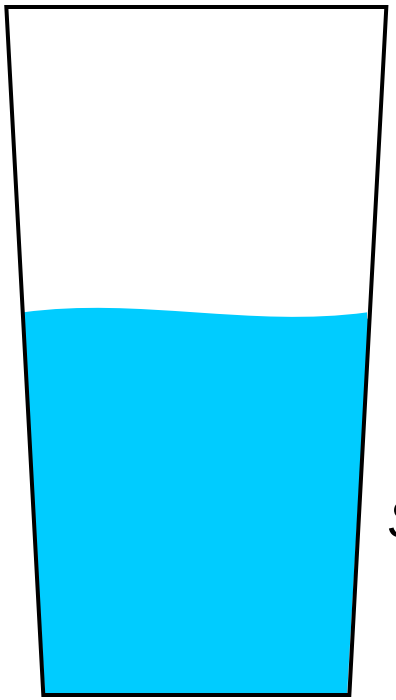
Discussed LSS tools and how they can be applied within a project / event and the workplace.

Defined the roles and responsibilities of being an effective team member.

Advocated and promoted the need to for a CPI culture within the Marine Corps.

THINK CPI

- Optimist says:
  - The glass is half full
- Pessimist says:
  - The glass is half empty



Standard glass of water

CPI THINKER says:

The glass is the WRONG size

Critiques


Everyone Doing Their Part
WAR ON TERRORISM SERVICE MEDAL

Sigma Quality Conversion Table

Yield	DPMO	Sigma	Yield	DPMO	Sigma	Yield	DPMO	Sigma
6.6%	**934,000**	**0**	**69.2%**	**308,000**	**2**	**99.4%**	**6,210**	**4**
8.0%	920,000	0.1	72.6%	274,000	2.1	99.5%	4,660	4.1
10.0%	900,000	0.2	75.8%	242,000	2.2	99.7%	3,460	4.2
12.0%	880,000	0.3	78.8%	212,000	2.3	99.75%	2,550	4.3
14.0%	860,000	0.4	81.6%	184,000	2.4	99.81%	1,860	4.4
16.0%	840,000	0.5	84.2%	158,000	2.5	99.87%	1,350	4.5
19.0%	810,000	0.6	86.5%	135,000	2.6	99.90%	960	4.6
22.0%	780,000	0.7	88.5%	115,000	2.7	99.93%	680	4.7
25.0%	750,000	0.8	90.3%	96,800	2.8	99.95%	480	4.8
28.0%	720,000	0.9	91.9%	80,800	2.9	99.97%	330	4.9
31.0%	**690,000**	**1**	**93.3%**	**66,800**	**3**	**99.977%**	**230**	**5**
35.0%	650,000	1.1	94.5%	54,800	3.1	99.985%	150	5.1
39.0%	610,000	1.2	95.5%	44,600	3.2	99.990%	100	5.2
43.0%	570,000	1.3	96.4%	35,900	3.3	99.993%	70	5.3
46.0%	540,000	1.4	97.1%	28,700	3.4	99.996%	40	5.4
50.0%	500,000	1.5	97.7%	22,700	3.5	99.997%	30	5.5
54.0%	460,000	1.6	98.2%	17,800	3.6	99.9980%	20	5.6
58.0%	420,000	1.7	98.6%	13,900	3.7	99.9990%	10	5.7
61.8%	382,000	1.8	98.9%	10,700	3.8	99.9992%	8	5.8
65.6%	344,000	1.9	99.2%	8,190	3.9	99.9995%	5	5.9

Goal: Quality Level ≥ Six Sigma or as directed by your Command	**99.99966%**	**3.4**	**6**