



SMRP 06

14th Annual Conference
Sheraton Birmingham Hotel
October 22-25, 2006



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Lean Six Sigma Maintenance

**Presenter(s): Mike Chambers, CMRP
Stanley King, Sr.**



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Background

Stanley King, Sr.

- **Aluminum Ladder Company (Florence, SC)**
 - Team Coach with 10 years experience ... recent lean training

Mike Chambers, CMRP

- **Abidian, Inc. (Montgomery, AL & Florence, SC)**
 - CMRP, Six Sigma Black Belt, and Lean Master with 25+ years of Plant and Corporate Experience in Maintenance, Engineering, and Operations Management

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Objectives

- Explain the differences between Lean, Six Sigma (6 σ), and Total Productive Maintenance/Manufacturing (TPM)
- Understand how each toolset interacts with the others
- Gain an understanding as to how all three might be used within Maintenance
- Provide a feel for the types of results seen

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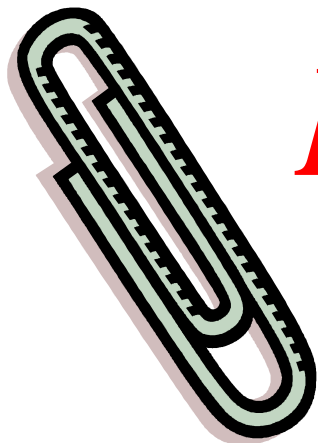
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**The Language of Good Maintenance is
Practicality and Good Common Sense:**

Likewise, complex things are studied ...



***It's the simple things
that work!!***

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A Definition of Lean Maintenance

A systematic, logical method of identifying and eliminating **waste** (non-value-added activities) using continuous assessment and improvement to achieve improved maintenance effectiveness in response to customer demand



Doing more
with less a
whole lot faster!

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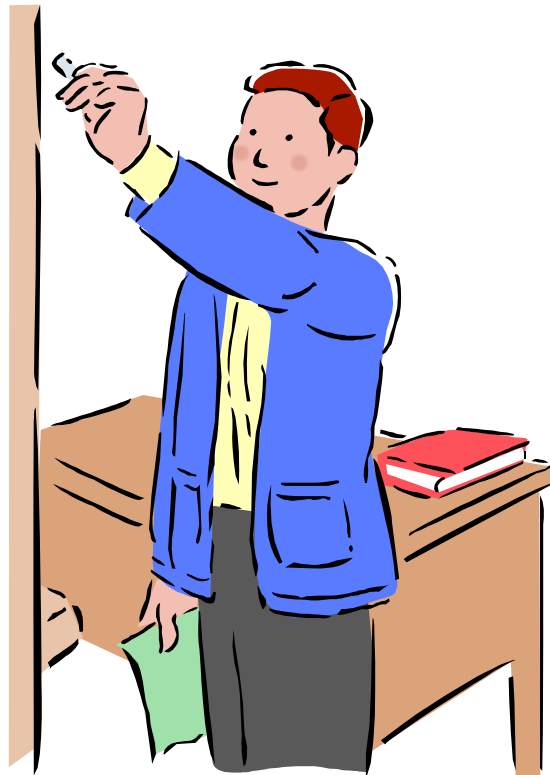


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Let's look at an example ...



... writing our name

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From a Lean Maintenance perspective:

We want to do it only if ...

- 1) The customer care\$
- 2) It physically changes the equipment
- 3) We can do it right the first time



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Lean – Six Sigma – TPM Synergy

- The goal of **Lean** is to eliminate the Non-Value Added parts of the process ... i.e., *waste*
- The goal of **Six Sigma** is to optimize the remaining Value Added parts by reducing *variation*
- The goal of **TPM** is *perfection* ... generate 0 injuries, 0 defects, and 0 breakdowns



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P/PM & Repairs	Work Order Processing, Approvals, Purchasing, Transport, Storage, Waiting, Rework, Staging, Inspection, Trial Runs, Breakdowns, ...
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Non-Value Added!!!



Typically, 95% of Problem Identification to Start-Up Time is Non-Value Added!!!

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The “Seven Deadly Maintenance Wastes”

- **Motion ... loading/unloading, multiple trips**
- **Processing ... unnecessary steps/approvals**
- **Waiting ... for service or parts ... mechanics idle**
- **Transportation ... mechanics and parts**
- **Overproduction ... overhauling vs. repairing needs**
- **Inventory ... spares (right parts, right amount)**
- **Correction/Rework ... repair quality/completeness**

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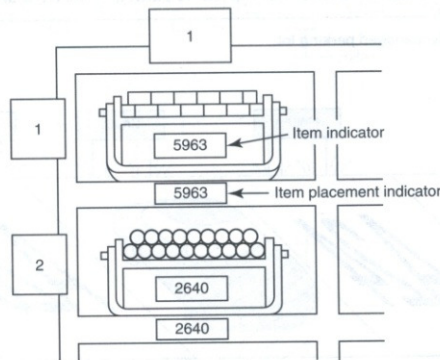
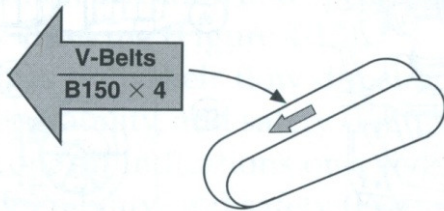
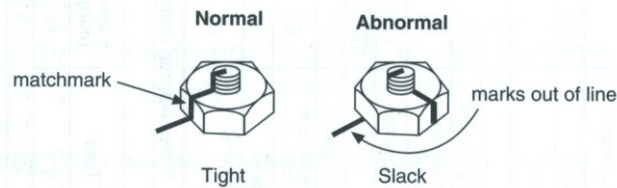
Lean Maintenance Tools

- **Value Stream Mapping** ... graphically identifying opportunities
- **Planning and Scheduling** ... kitting
- **Smart Changeover** ... retrofitting for quick access and easy replacement/repair
- **Visual Workplace** ... prompts and reminders
- **Mistake Proofing** ... ensuring human and machine errors don't turn in to equipment/process failures
- **5S+1** ... improved organization and safety with needed tools, information, and materials less than "3 steps" away

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Lean Maintenance Tools and Practices

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Aluminum Ladder	One Point Lesson	Date <u>8/29/06</u> Originator <u>R&W Kaizen</u>
Workstation 6S & Organization		
<ul style="list-style-type: none"> • Extra stuff, or clutter, at our workstation, slows us down • Usually, we'll want wire cutters, tips, gloves, shields, mask, clamps, tape, striker, drill, grinder, small ladder, hand tools, safety equipment, cleaner, calculator, hammer, square, sharpie, and shared torch and radio • Personal items should neatly stored • If we borrow something, ask or leave a note! • Jigs are helpful ... share as appropriate and keep them organized and available • Incoming buggies should be staged in front of workstation and usually outside of red work area • Finished work should be placed along the center aisle • If something needs maintenance attention, bring to the attention of the coach • It's a good idea to "reorganize" after each job • At the end of the day and 2:30 on Friday, the workstation should be returned to "6S" conditions 		
A place for everything and everything in its place!		



Before



After



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What is Six Sigma (6σ)?

- Metric
- Benchmark
- Vision
- Philosophy
- Method
- Tool
- Symbol
- Goal
- Value

- Business strategy designed to help companies gain a competitive advantage
- Philosophy recognizing there is a direct correlation between the number of product defects, wasted operating costs, and the level of customer satisfaction
- Disciplined, statistically based methodology for reducing variation and defects
- A statistical metric that indicates how well a process is performing ... the higher the sigma score, the better the performance

6σ → Manufacturing and Maintenance Excellence



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Six Sigma Maintenance Tools

- **Voice of the Customer** ... cooperatively learning the desires and needs of our customers
- **Root Cause Failure Analysis** ... preventing a failure from occurring a second time
- **Gage R&R** ... validating the accuracy of our measurement and instrument systems
- **Design of Experiments** ... statistically isolating various influences to determine the best “metallurgy”

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Total Productive Manufacturing (TPM)

- Originally developed by Toyota ca 1970
- TPM recognizes the whole company/plant must be engaged and empowered to realize its full potential
 - Much more than maintenance and production
 - Includes Engineering, HSE, Admin, HR, IT, ...
 - Company/Plant-wide initiative involving all employees
- Goal of “Perfection” ... 0 injuries, 0 defects, and 0 breakdowns

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Lean – Six Sigma – TPM Synergy

When using Lean Maintenance, Six Sigma, and TPM together, we should probe an opportunity with a little different set of questions and assumptions

Traditionally, we might ask:

1. Does this equipment/process need to be improved?
2. What needs to be improved?
3. How will we make the right improvements?

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Lean – Six Sigma – TPM Synergy

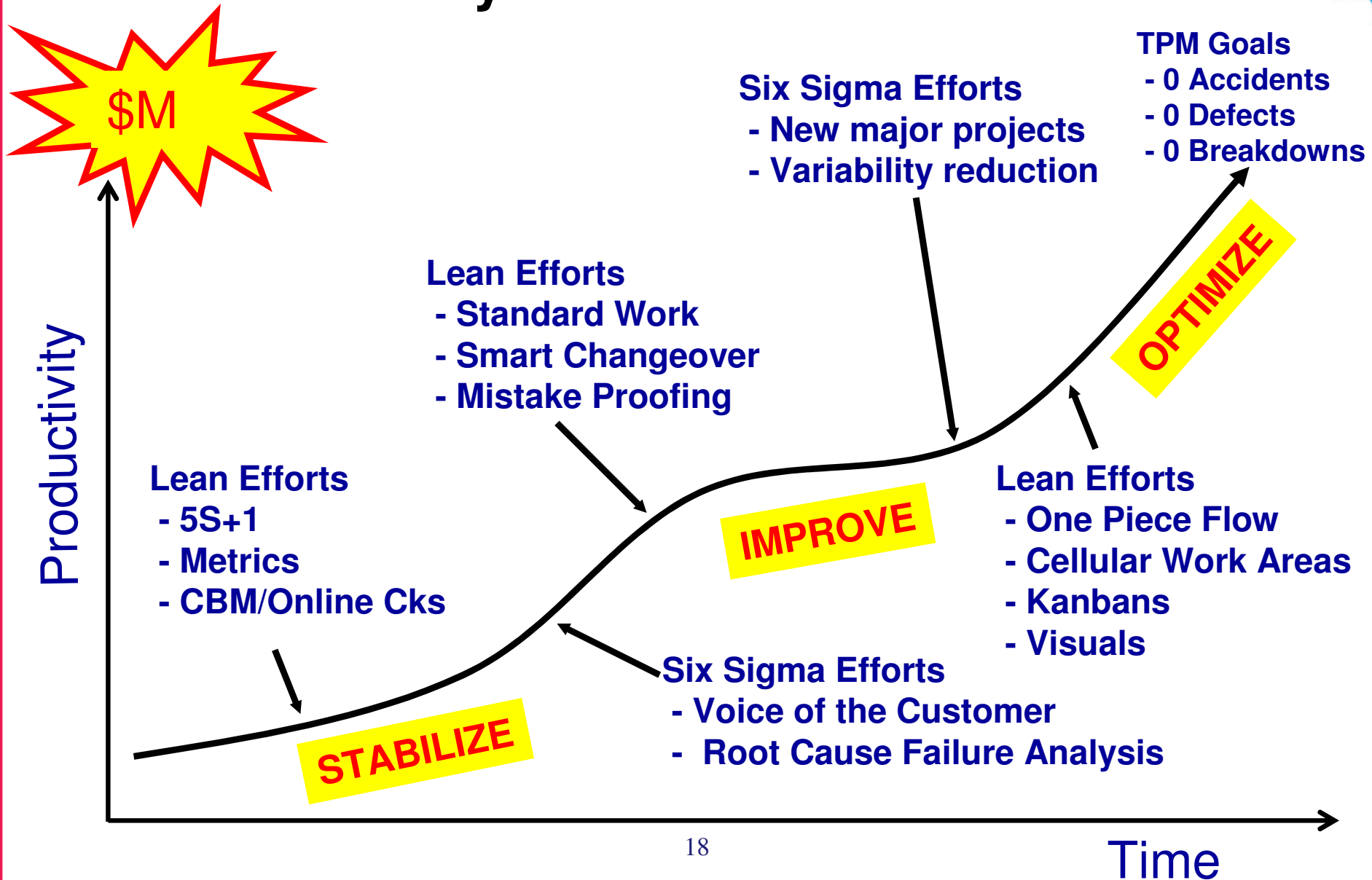
When we incorporate Lean Maintenance, Six Sigma, and TPM, the questions become:

1. Is this process/step really necessary/value-added?
2. If it isn't value added, how can we eliminate, reduce, or combine it with something else?
3. If it is necessary, does this equipment/process/step need to be improved?
4. What *specifically* needs to be improved?
5. How will I determine the right improvements to make, and how to make them?

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The Journey to Maintenance Excellence



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The Kaizen Process & Typical Results

KAIZEN EVENT CHARTER Aluminum Ladder Rigging & Welding Setup

AREA: Rigging and Welding
DATE: 8/28/06 – 9/1/06



Leader: Scott Goodwin
Facilitators: Kathy McKenzie (Co-Facil) Mike Chambers (Lead Facil), Stanley King (Co-Facil)
Members: Terrell Tapp, John Williams, Ronald Jackson, Tom McManus, Samantha "Sug" McGowan, Ryan Britt, Mark Munn

CURRENT SITUATION & PROBLEMS

- Riggers spend time retrieving parts as they start a new job
- To the extent parts aren't close by and on the same buggy, they may wander
- If the parts are large, they may get the services of another rigger
- This detracts from their rigging and welding time
- To the extent the work area is cluttered, it further complicates the above challenges

REQUIREMENTS:

1. Be safe!
2. Focus on our customer specs, value, and costs
3. Full participation
4. Candid, constructive comments
5. Capitalize on each other's strengths and knowledge
6. Work as a team
7. Enjoy ourselves as we work!

KAIZEN TEAM OBJECTIVES:

1. Obtain training in lean and the appropriate improvement techniques
2. Reduce rigging and welding setup time by at least 30%
3. 6S (organize) the area
4. Trial the concept of a setup coordinator

改善

Kai zen

Change Excellent

Our Charter:
Reduce rigging
and welding
setup time by at
least 30%

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Some of Our Improvement Steps

Aluminum Ladder	One Point Lesson	Date <u>8/29/06</u> Originator <u>R&W Kaizen</u>
Setup Coordinator (SC) & Job Layout		
<ul style="list-style-type: none"> • Cutting Saw/Shear Operators to bring buggy over to R&W buggy staging area • Setup Coordinator (SC) to retrieve material from Receiving job racks • SC to gather I Order parts • SC to place needed parts on a buggy ... no more than 3 jobs per buggy ... multiple buggies may be used on large jobs • Ideally, SC to punch, drill, bend, grind, etc., but we realize this is not possible for all jobs • Coach to provide list to SC at end of each day for the following day • Riggers and Welders to notify Coach at completion of job ... a new job will be provided ... SC will be aware upfront of approximate time to relocate buggy • SC will get help from "others" on large items like bent cages • Riggers and Welders will review job folder, drawings, quantities, etc. and start rigging ... ideally, less than 10 minutes elapsed time from their last job! 		

We identified the steps and benefits associated with having a new Setup Coordinator ... we then put these steps in the form of an OPL to share with others



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Some of Our Improvement Steps

We also came up with a plan and a strategy on where to stage our raw material buggies and when to move them ... and freed up a lot of space in the process!

Aluminum Ladder	One Point Lesson	Date <u>8/29/06</u> Originator <u>R&W Kaizen</u>
<p>Rigging and Welding Buggy Strategy</p> <ul style="list-style-type: none"> • Store incoming buggies at the entrance to the area (by the saw) • Each buggy should have two handles with one on each end • As previously discussed, cages will not be cut until we're starting the job ... Coach and Setup Coordinator will help coordinate • No more than three jobs per buggy • "Extra" parts should be brought to the proper place; i.e., short scrap to scrap bin and surplus parts to Cutting Coach • Job numbers should be visible from a distance; i.e., large numbers on wide tape • Empty buggies should be returned to Cutting and I Order • "Single" incoming work buggy to be located in front of workstation • Finished work should be brought to the center aisle 		

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Some of Our Improvement Steps

BEFORE



Some buggies were blocking other buggies ... all tended to clog up the flow

AFTER



By organizing the buggies, we created room for more buggies ... and freed up a lot of space around our workstations

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We also addressed ...

- The number of jobs per buggy
- Job labeling ... big readable job numbers
- Material arriving too early/late
- Surplus material left from earlier jobs
- Staging the steel to be galvanized
- Endorsing the earlier idea of bringing the cages over only after the job had begun
- Distances walked by the riggers ... 5 miles!
- ... and labeling the Men's rest room door!



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Our Results ...

- Historic 4-Hr job (start to finish) completed in 1 Hour and 20 Minutes
- In most cases, rigging and welding will begin in less than 10 minutes from the completion of the last job
- In general, we expect a long term productivity increase of 10 to 30%
- Many of the ideas generated can be leveraged to other departments

... all in less than two days!!

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Other Results ...

- A Resin Extrusion Process cut their PM time from 12 hrs to 20 min ... while adding additional checks!
- A Printing Industry Converting Process reduced their PM downtime from 10 hours to 15 minutes
- A Waste Incinerator increased turnaround intervals from 4 months to over 2 years
- A Gulf Coast Refiner cut overall maintenance costs by over 30%

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The Bottom Line ...

Classical Maintenance

- Limited Plans/To-Do Lists
- Large JIC Parts Inventory
- Hidden Problems
- Wasted Motion/Efforts
- Poor Communications
- Approximation/Band Aid Repairs
- Fire fighting/Reactive

Overhaul it when it breaks

VS.

Lean Six Sigma

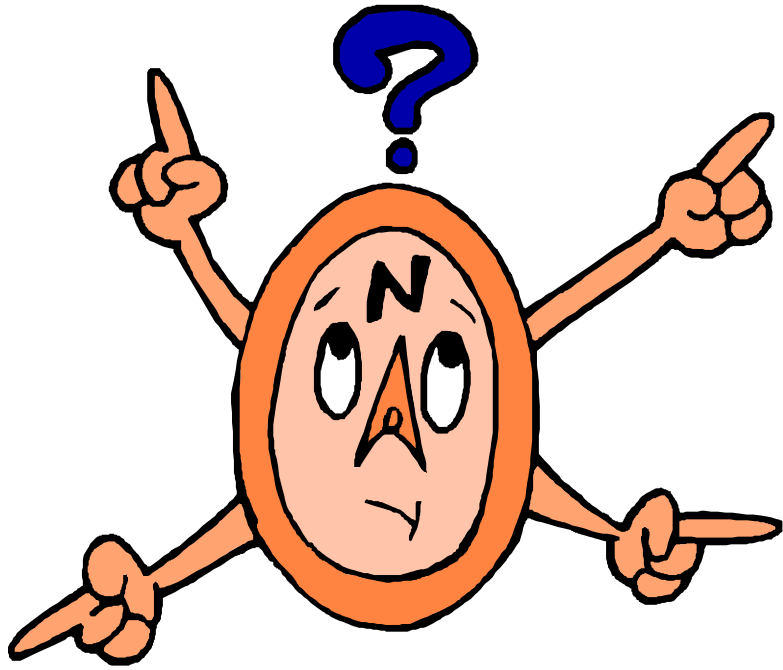
- Plans & Weekly Schedules
- VSP/JIT/Minimal Inventory
- Visible Management
- Value Scrutinized
- Root Cause Failure Analysis
- Good Communications
- Precision/Quality Repairs
- Systematic/Methodical

Repair only those things identified through CBM/Online Checks



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Questions ...

Comments?

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