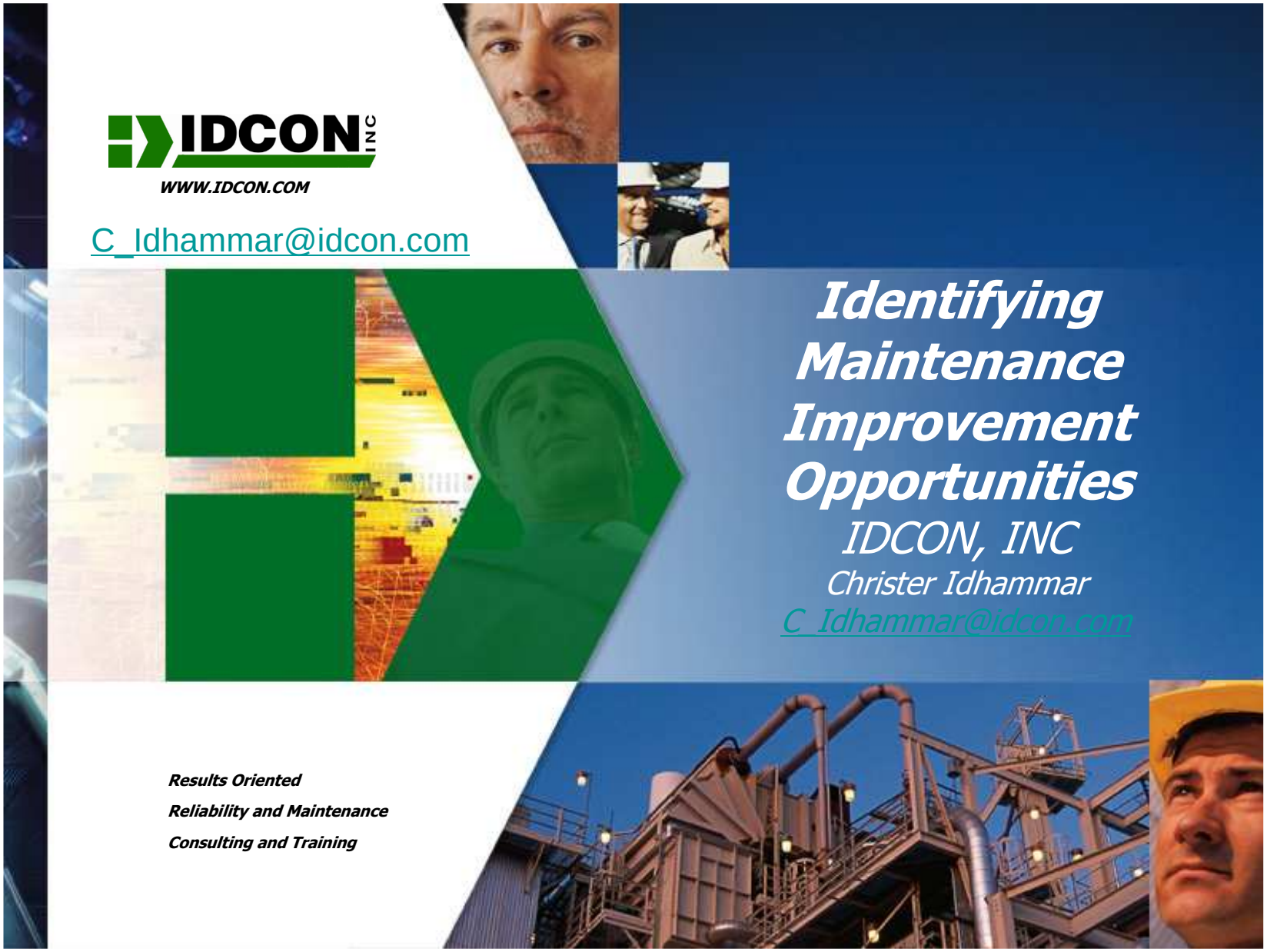

IDCON INC
WWW.IDCON.COM
C_Idhammar@idcon.com
Identifying Maintenance Improvement Opportunities
IDCON, INC
Christer Idhammar
C_Idhammar@idcon.com
Results Oriented
Reliability and Maintenance
Consulting and Training

Introduction

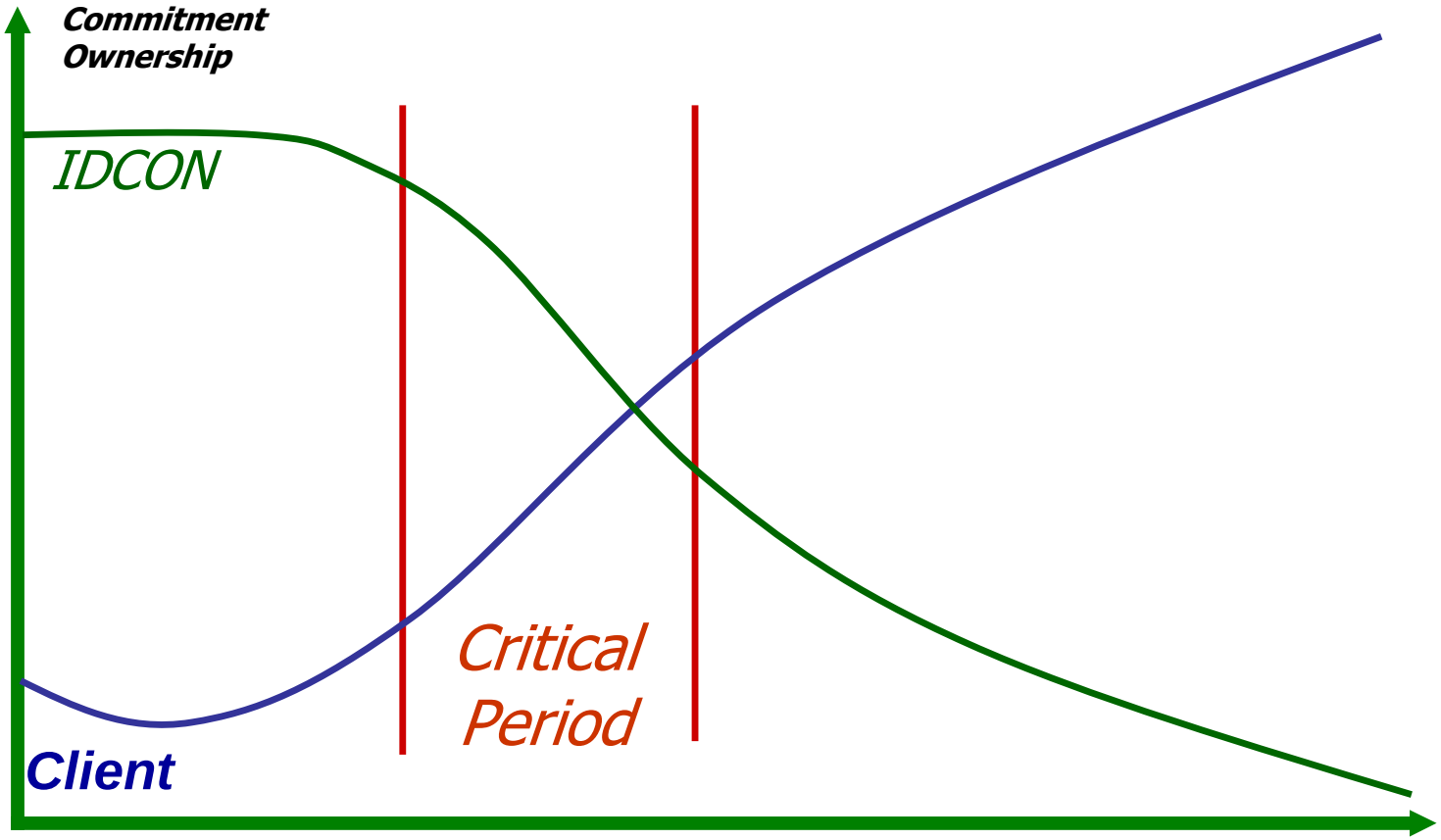
Established in Sweden 1972
USA 1985.

23 Consultants and Associates

Mission

To help our Clients improve Overall Reliability and Lowering Manufacturing and Maintenance Costs.

IDCON Support Phases out as Client's Organization Takes over Ownership.



IDCON, INC Approach

The role of a Consultant is to be:

- **An Educator**
- **A Catalyst**
- **A Trainer**
- **A Mentor**
- **In some select cases "do the work"**

- **Ownership of improved practices must be transferred to Client's organization.**

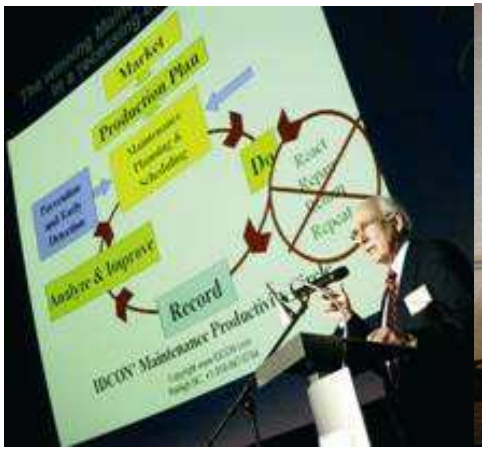
What Do We Do?

Reliability & Maintenance for process industry

- *Advice*
- *Leadership Organization*
- *Assessments*
- *Planning & Scheduling*
- *Preventive Maintenance*
- *Root Cause Problem Elimination*
- *Spare parts Management*
- *Technical Database*

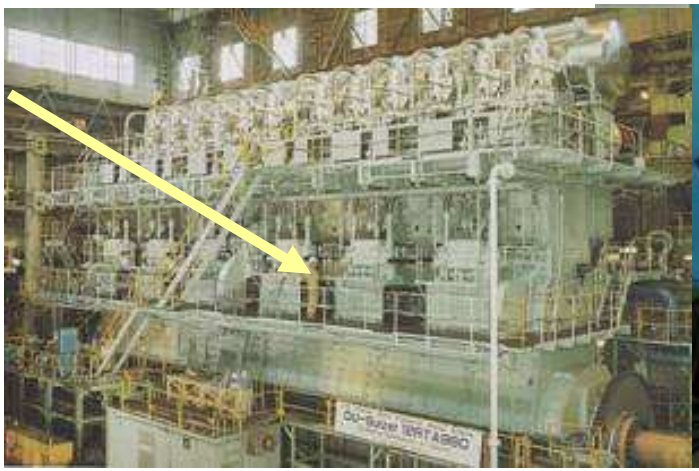
In Plants

Open Training Seminars



Christer Idhammar

1960 – 1968 Apprentice, Mechanic, Engineer, Chief Engineer on board Merchant marine ships.

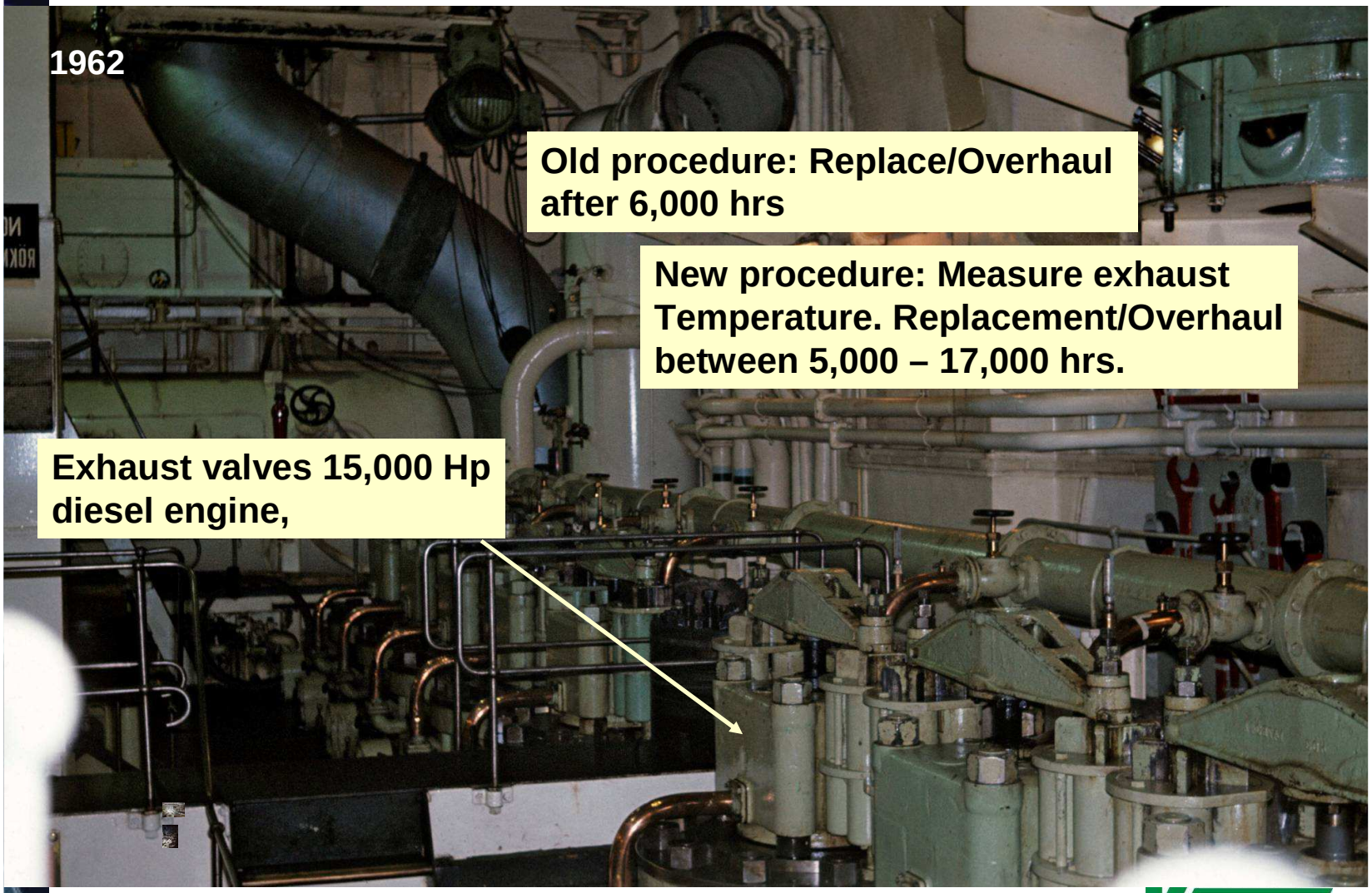


1968 – 1985 Reliability and Maintenance consultant based in Sweden.

1985 – Reliability and Maintenance consultant based in USA.

Chemical, Steel, Mining, Automotive, Power, Pulp, Paper, Food, Wood……in 48 countries.

They all believed they were unique.



Short Reliability and Maintenance History

All known predictive maintenance technologies was known and used in the 1970's

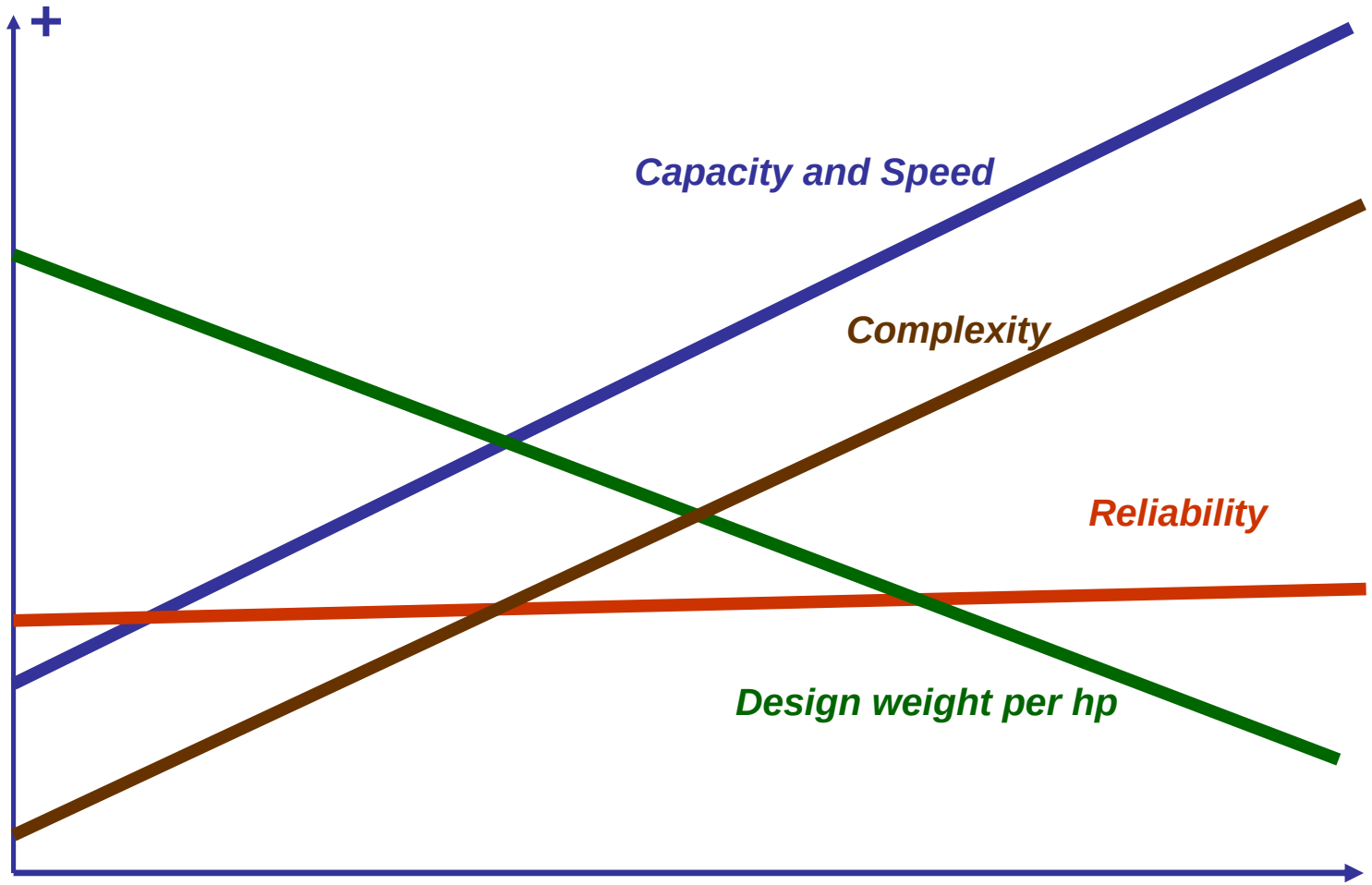
Technologies such as Vibration Analysis, Wear Particle Analysis, Infrared, Ultrasonic, Electric Motor Testing, Acoustic Emission, Fiber Optics, Computer Systems etc. have become much better and more affordable.

The basic reliability and maintenance processes are the same.

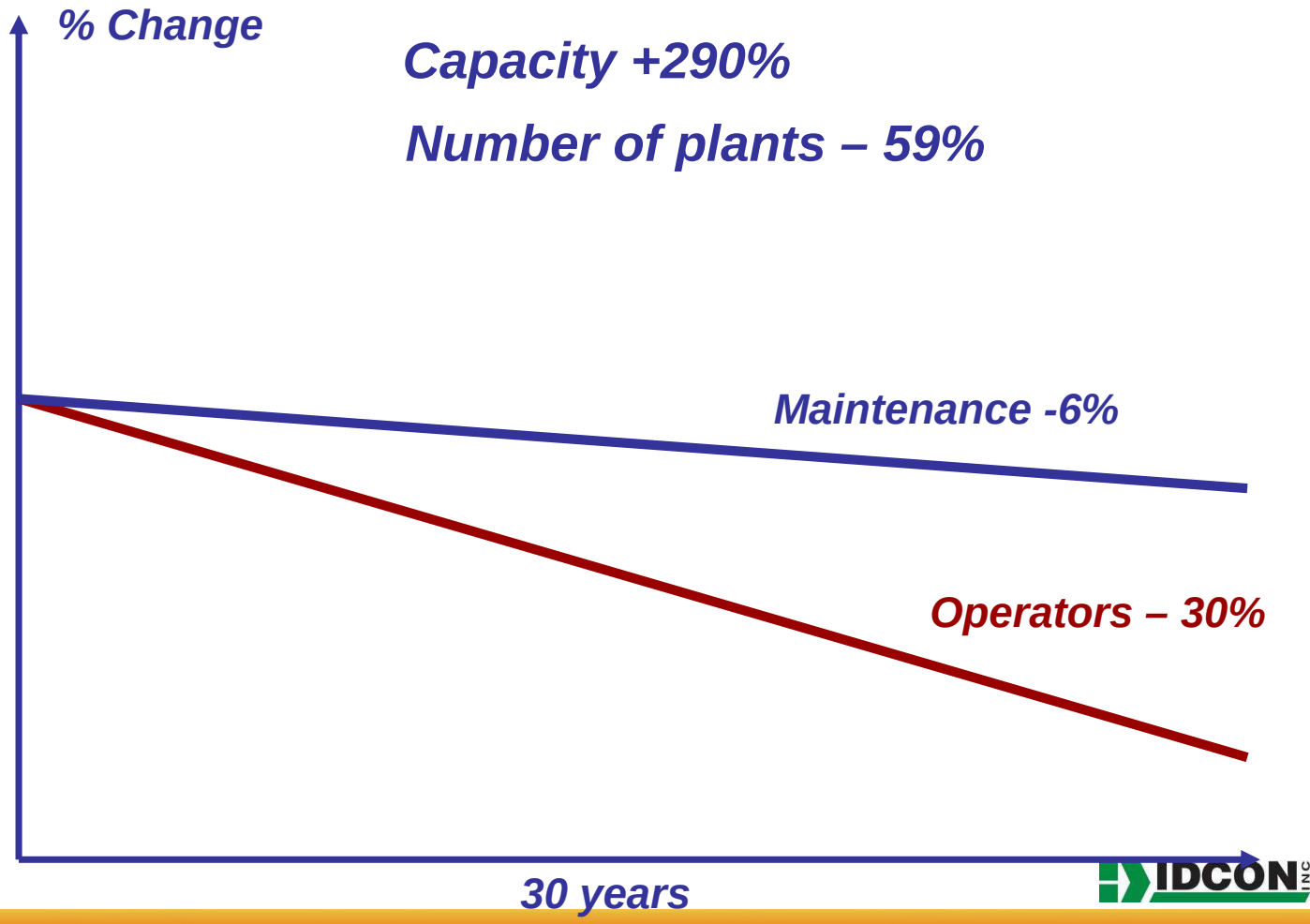
New names* and packaging of the basic concept in combination with mobility of top management have confused and delayed EXECUTION. Initiatives have not lasted long enough to generate achievable results.

**** QCM, TPM, RBM, RCM, AM, VDM, TPR .....***

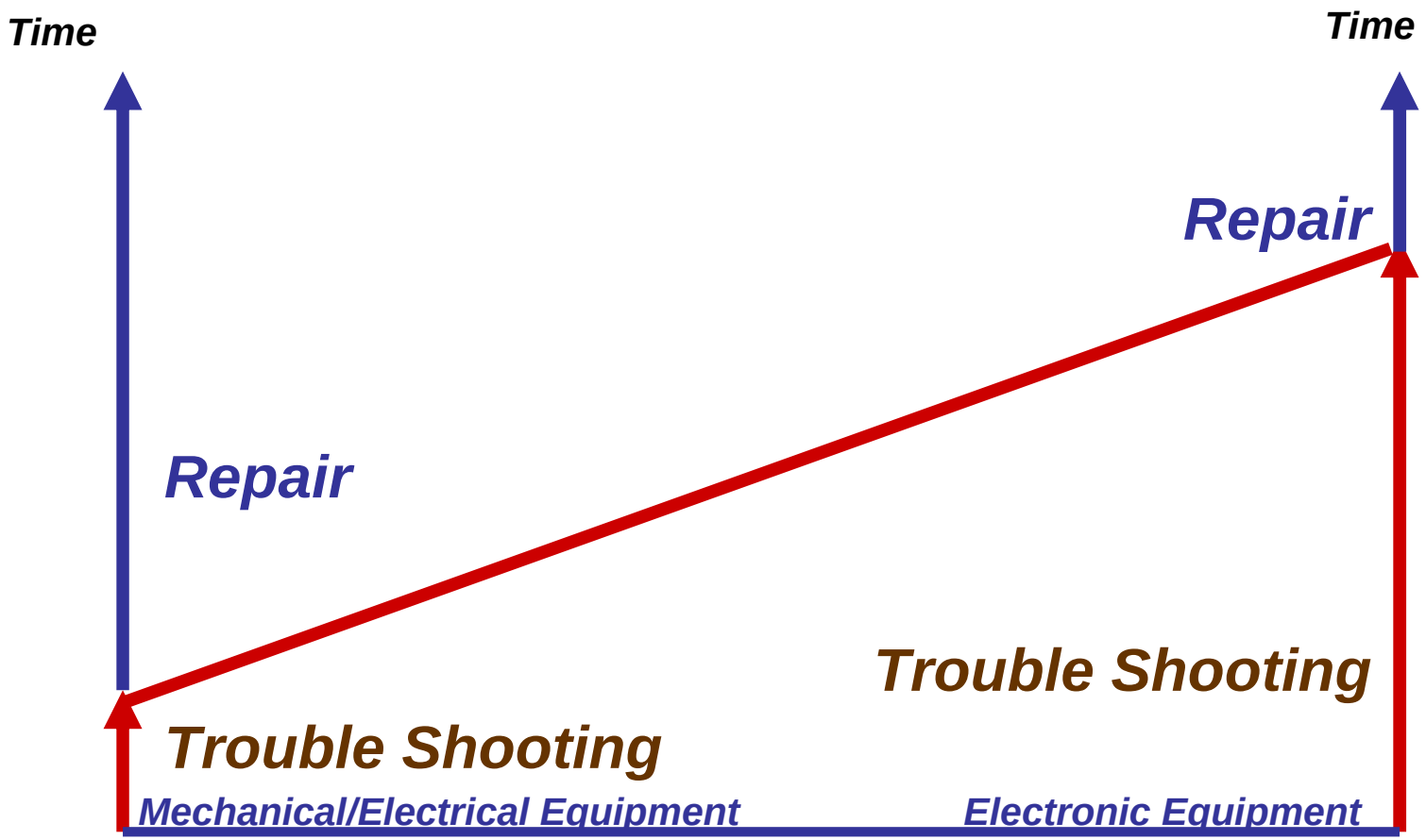
Empirical information



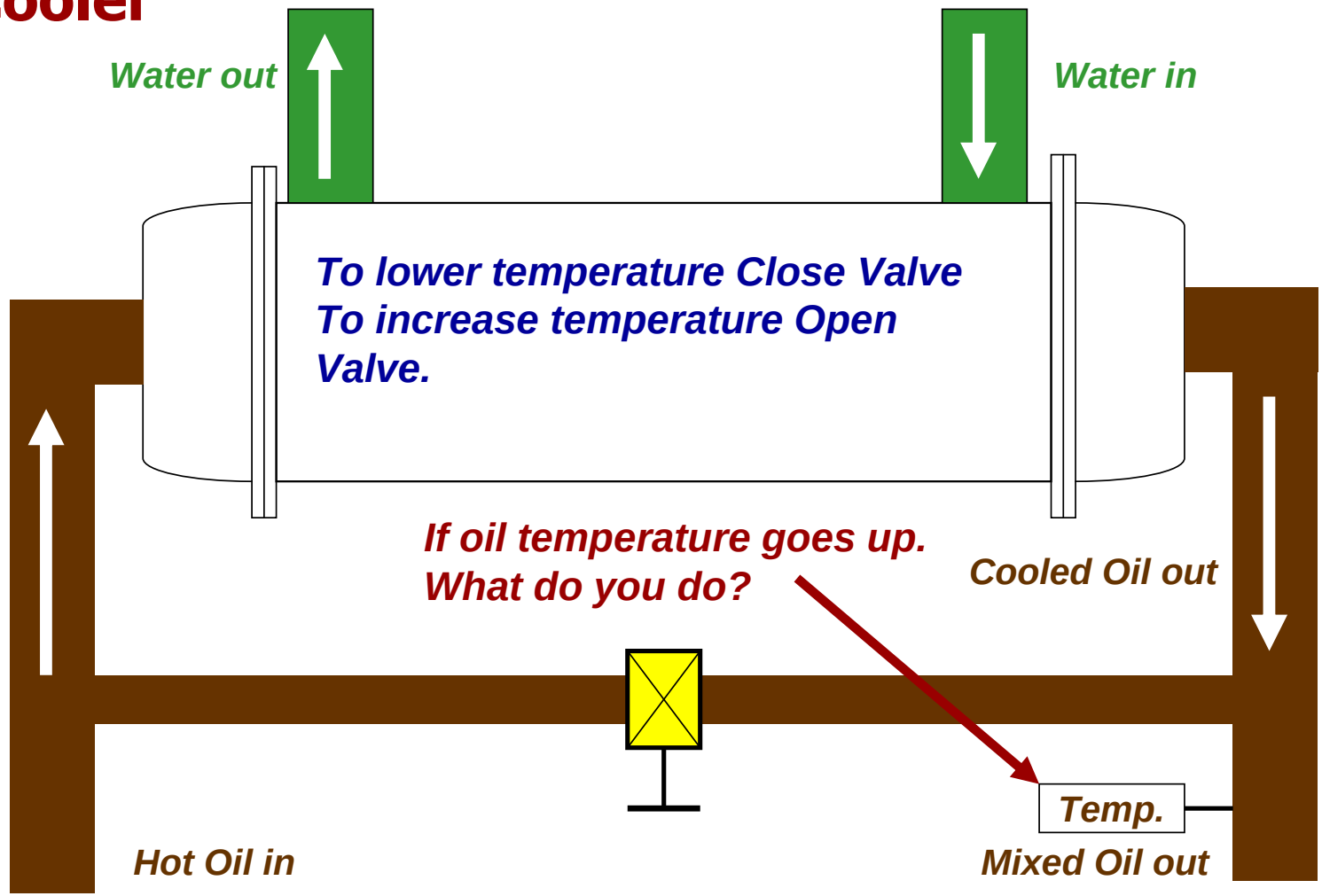
Equipment Reliability is Becoming More Important.



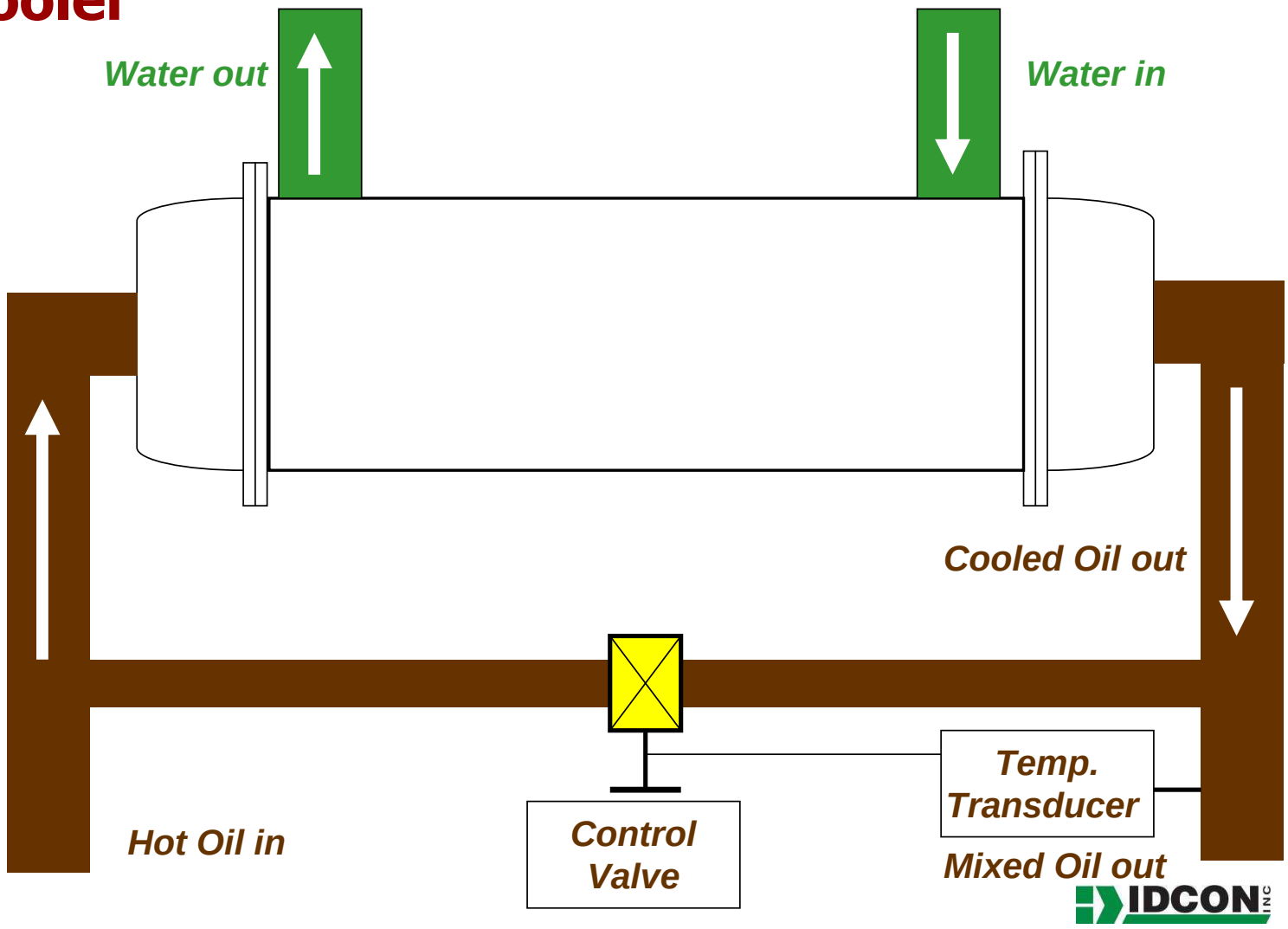
More Automation and Electronic Equipment



Cooler



Cooler



IDCON Beliefs

People and technology

To improve reliability through better maintenance is 90% people and 10% technology.

IDCON Belief

R = Q + A + E

R =Results Improved Reliability And Lower Costs.

Q = Quality decisions: Do the Right Things

A= Acceptance

E = EXECUTION

People and processes

People can not be more efficient than the processes they work in allows them to be.

It is a management duty to develop, document, communicate and reinforce these processes.

Leadership

People, Skills, Processes and Technology.

Best Performers

Best Performers.
What do they do different?

We all know what we need to do

Best Performers do it !

The gap between knowing what to do
and
doing it.

Best performers face brutal facts

They deal with inherited poor practices.

- *Union agreements that undermine survival.*
- *Working relationships that are counterproductive.*
- *Performance indicators that drives the wrong behavior.*
- *The wrong people.*

Management changes do not impede continued execution of Best Practices.

- **67% of plants have had more than 3 plant managers in the last 10 years.**
- **66% of plants have had more than 3 production managers in the last 10 years.**
- **62% of plants have had more than 3 maintenance managers in the last 10 years.**

Source: IDCON survey www.idcon.com Mobility of management

Plant leadership supports the front line organization

- ***Best practices are owned and executed by the front line organization. (Leaders, Planners, Coordinators, Crafts People, Operators).***
- ***Plant leadership demonstrate visible support, interest and evaluate performance on a regular basis.***
- ***Front Line Leaders dares to act as a boss when needed.***

Focus on Results Drivers, not cost only.

Better Reliability Drives down Costs.

Cost Reductions jeopardize Reliability.

Three ways to reduce maintenance costs

1.Cut costs

Short term savings.

•Long term loss in Reliability and higher costs.

Valid maintenance work is postponed, not Eliminated.

2. Maintenance Prevention

Alignment, balancing, lubrication, operating practices, filtration…

•Increased Reliability drives down maintenance costs.

3. Execute remaining maintenance more efficiently.

Identify early, prioritize, plan work, schedule work, execute work, record, analyze, improve.

•Increased Reliability drives down maintenance costs.

Reliability is practiced as a partnership between Operations, Maintenance and Engineering.

- ***The results of maintenance work is not service.***
- ***A Results Oriented Maintenance organization uses services to deliver Equipment Reliability.***
- ***Team building should start at the top of a manufacturing organization.***

Biggest threats to success

1. *The Management oxymoron:*

"Reliability is top priority, but we must cut our costs first".

2. *Mobility of management and lacking Current Best Practices Directive.*

3. *The wrong people driving implementation.*

Reliability Culture

Definitions, Reliability

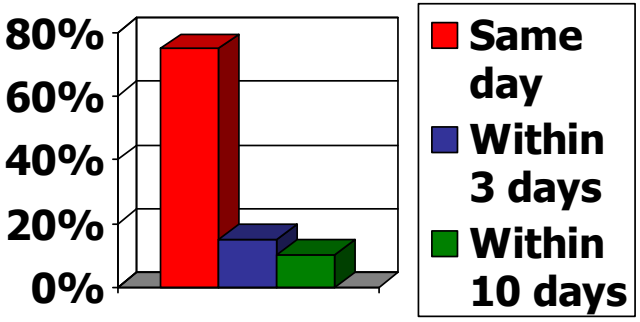
$$\frac{\text{Actual Performance}}{\text{Capacity}}$$

Quality x Time x Speed

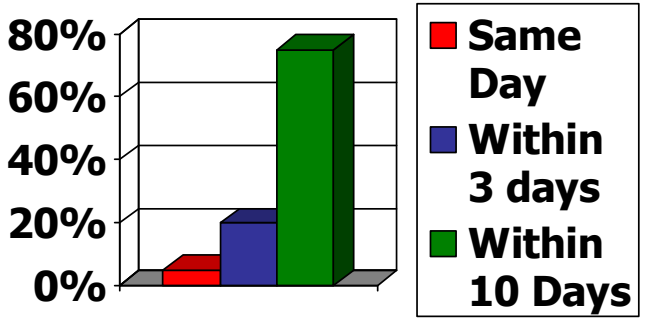
$$\frac{\text{MTBPL}}{\text{MPL}} \quad \text{Hrs/Ton}$$

What is good maintenance?

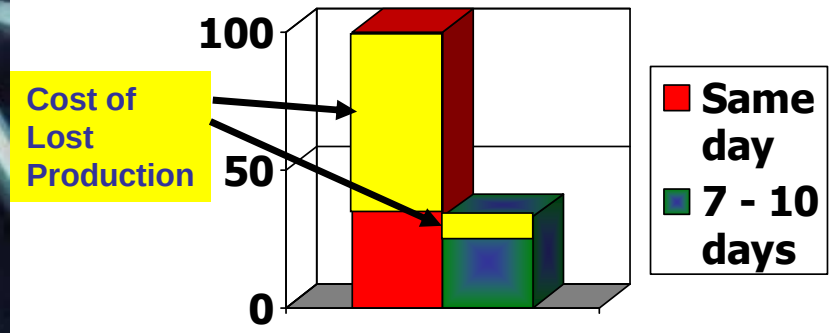
Operations view?



Maintenance view?



Cost Comparison



What do you do to improve?

- *Partnership*
- *Prevent*
- *Inspect*
- *Plan*
- *Schedule*
- *Execute*
- *Analyze/Improve*

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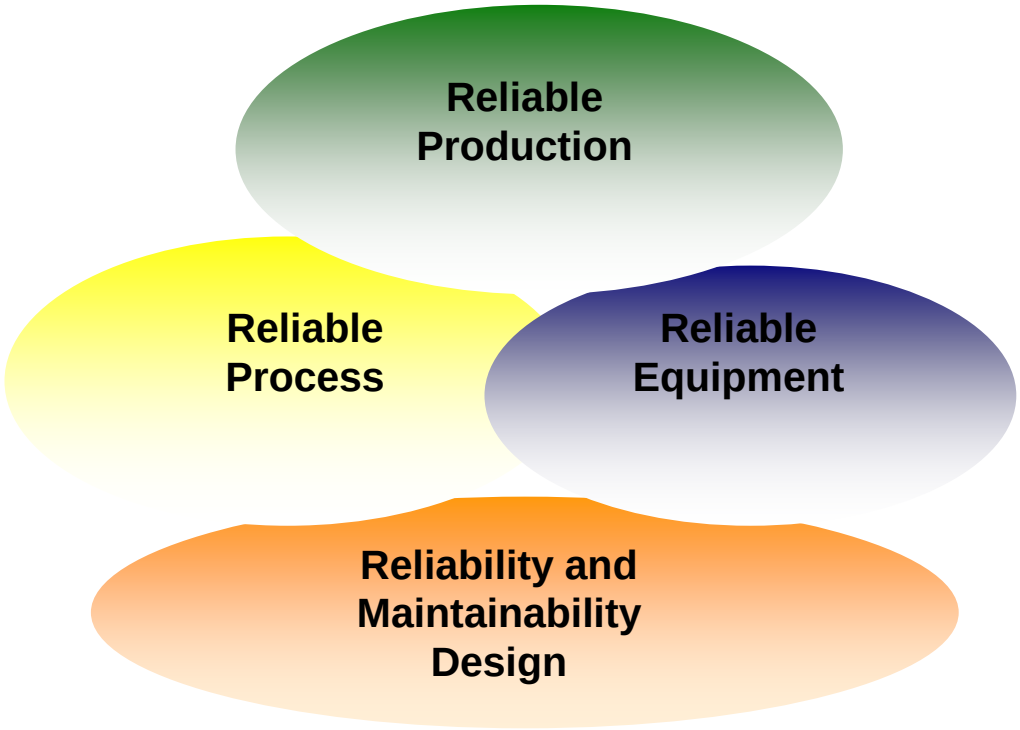
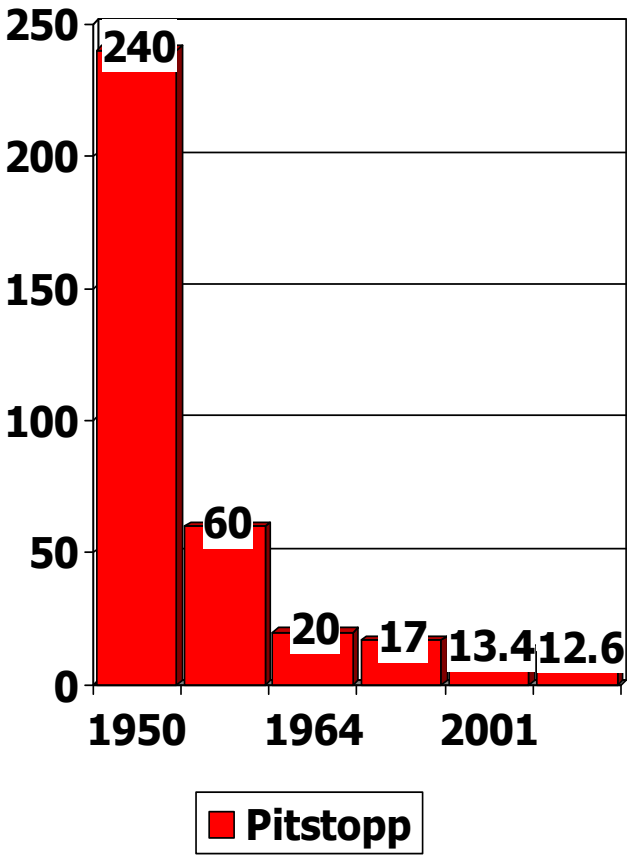
Best Reliability and Maintenance Practices, World Class Performance can Only be Achieved in a Partnership Work System



NASCAR racing pit stop time



- ***Lug nuts 24000 rpm.***
- ***Parts sorted where used***
- ***Steering wheel marked.***
- ***Wheel bolts rounded tops.***
- ***IR measurement of tire temp.***
- ***Measure tire wear.***
- ***Marking wheel position.***
- ***Lug nuts painted yellow.***
- ***Analysis of problems and successes***
- ***Train 20 hours a week for 20 sec. Work on Sunday***
- ***Always safe and right before fast***

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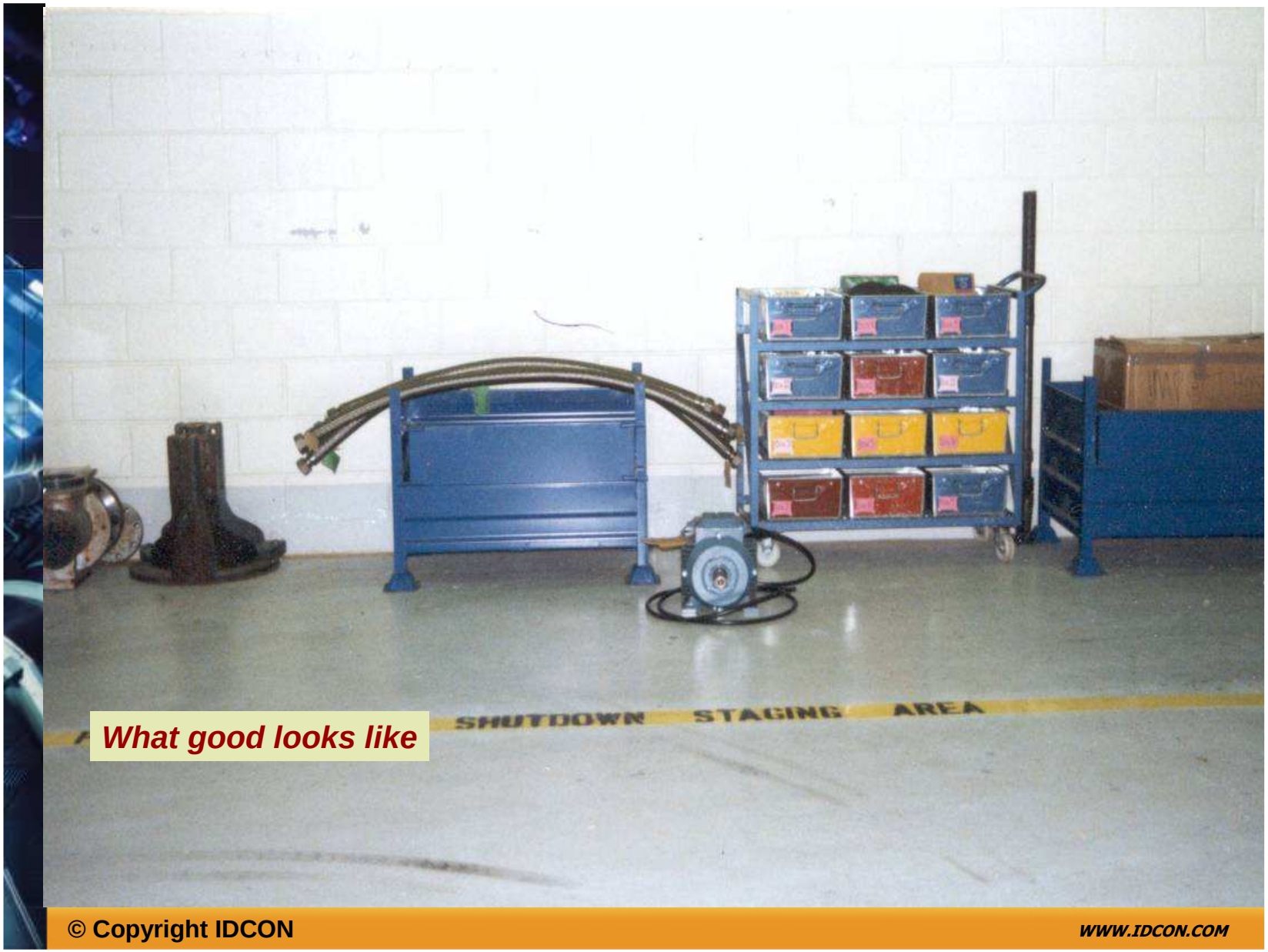
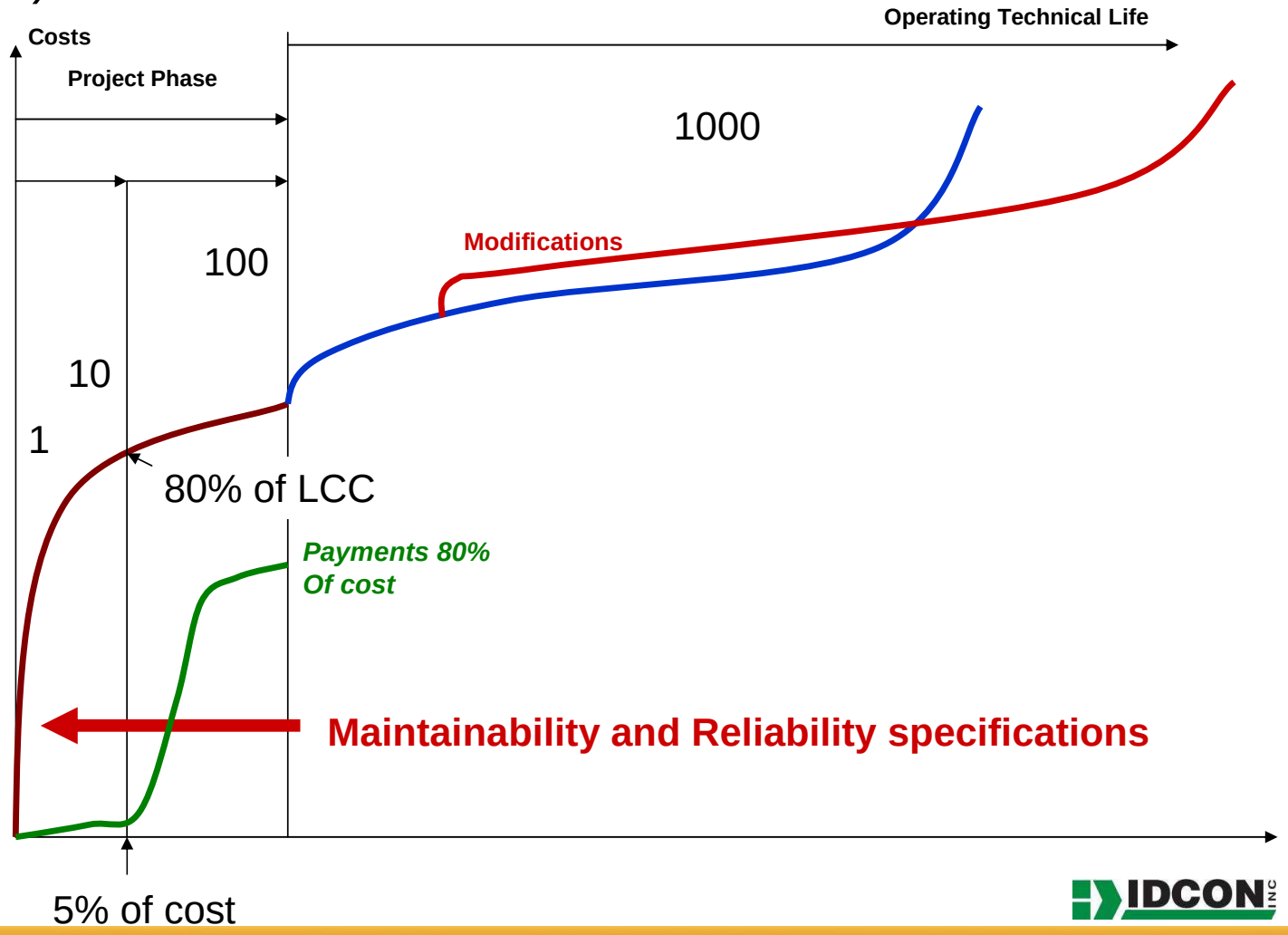
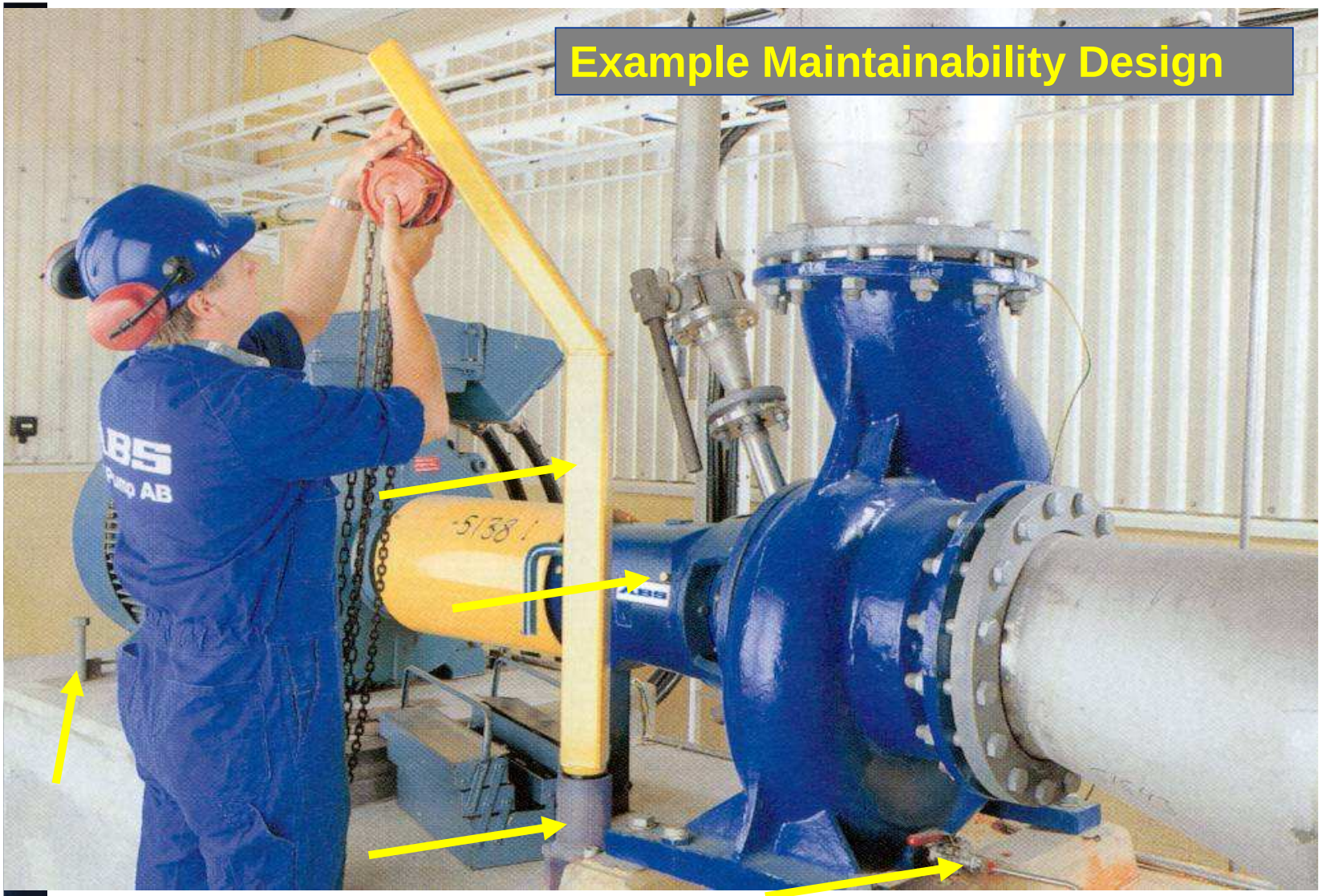


What good looks like

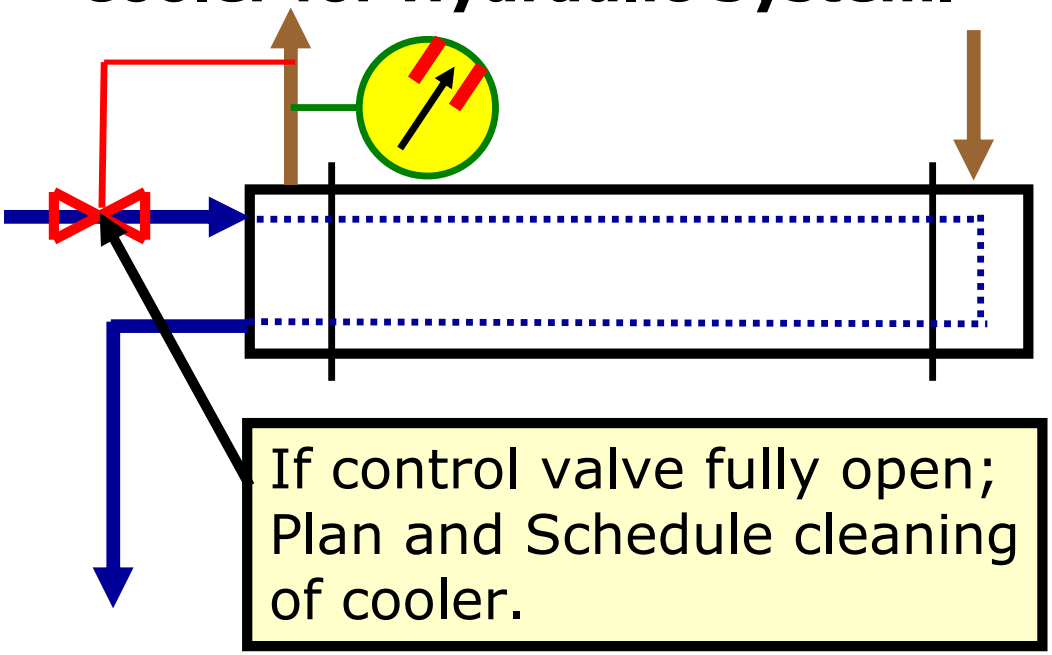
Life Cycle Cost



Example Maintainability Design



Cooler for Hydraulic System.



CMS 128R

Coupling -"Tire" (L

CMS101R

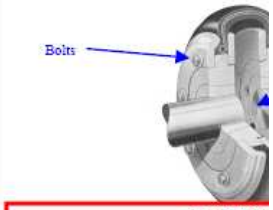
Condition Monitoring Stanc

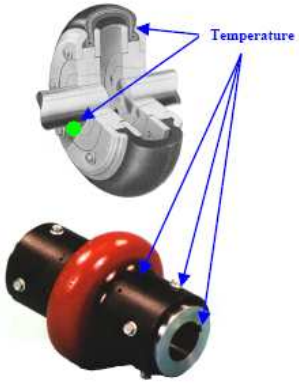
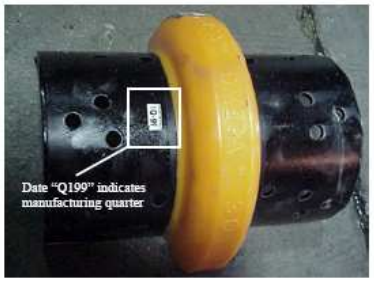
The shaft is connected to one coup
tire made of rubber or other elastic
the coupling half and the plate (Dc
The metal flanges are attached to t
the coupling halves.

The tire coupling is made for lowe
tire outward due to centrifugal for
causing the bearings connected to
high speeds, which causes an imba
connected to it.

Picture Courtesy: Omega

KEY	
Noise	Listen for abnormal n

KEY	WHAT
Visual	Use a stroboscope and make sure the coup for loose rubber pieces on the tire. Crack: be noted. Check for any loose and/or corroded bolts and/or looseness. The Dodge is shown in inspection is also true for the Omega coup  SAFETY FI Strobe light causes Rotating objec touch coupling
Guards	The guard has to have an inspection open inspection of the coupling. Some guards ports with wire mesh metal or inspection guard modifications that will enable coup black to increase visibility.  When modifying guards, refer to OSHA s allowed size of the wire mesh depends on the mesh. For example, a 1-inch (25.4 mm inches (38.1 mm) away from the coupling standards than OSHA, make a wire mesh then apply a hinged lid over the wire mesh

KEY	WHAT	WHY
Temperature	Through the wire mesh or other safe inspection access, check temperature with an infrared temperature device where the forces are acting on the coupling (see figure). Misalignment, imbalance and other sources of damaging forces will increase the temperature. 	Take the temperature at the coupling - shaft – key interface ● because forces are transferred from the shaft to the coupling half at this point. High temperature may be due to misalignment or operation at higher speed than recommended. High temperature between rubber and coupling half may be due to misalignment, imbalanced, high speed, or higher torque than allowed.
Installation	The "Omega" coupling is a perishable goods. The elastic element and glue deteriorates over a 5- to 6-year period. It is therefore very important NOT to store the couplings too long, or to have them in use much longer than 6 years. 	Coupling rubber elements that tears, or come loose in the joint may be experiencing aging rubber, or glue.

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919-847-8764

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Do Not Copy

Definitions

Definitions

Good

Corrective Maintenance
All maintenance done to Correct a failure or a Break down

Maintenance

85% ***15%*** ***"0"%***

Corrective Maintenance

- ***Planned and Scheduled***
- ***Only Planned***
- ***Only Scheduled***
- ***Break In Work***

Preventive Maintenance

Programmed Maintenance.
- ***Prevent Failures***
- ***Find Failures***

Continuous Improvement

Root Cause Problem Elimination RCPE.
Design Out Maintenance DOM.
Design For: Maintainability DFM And Reliability DFR

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Definitions

Great

Corrective Maintenance
All maintenance done to Correct a failure or a Break down

Maintenance

70%

10%

20%

Corrective Maintenance

Preventive Maintenance

Continuous Improvement

Planned and Scheduled

Only Planned

Only Scheduled

Break In Work

Programmed Maintenance.
•Prevent Failures
•Find Failures

Root Cause Problem Elimination RCPE.
Design Out Maintenance DOM.
Design For: Maintainability DFM And Reliability DFR

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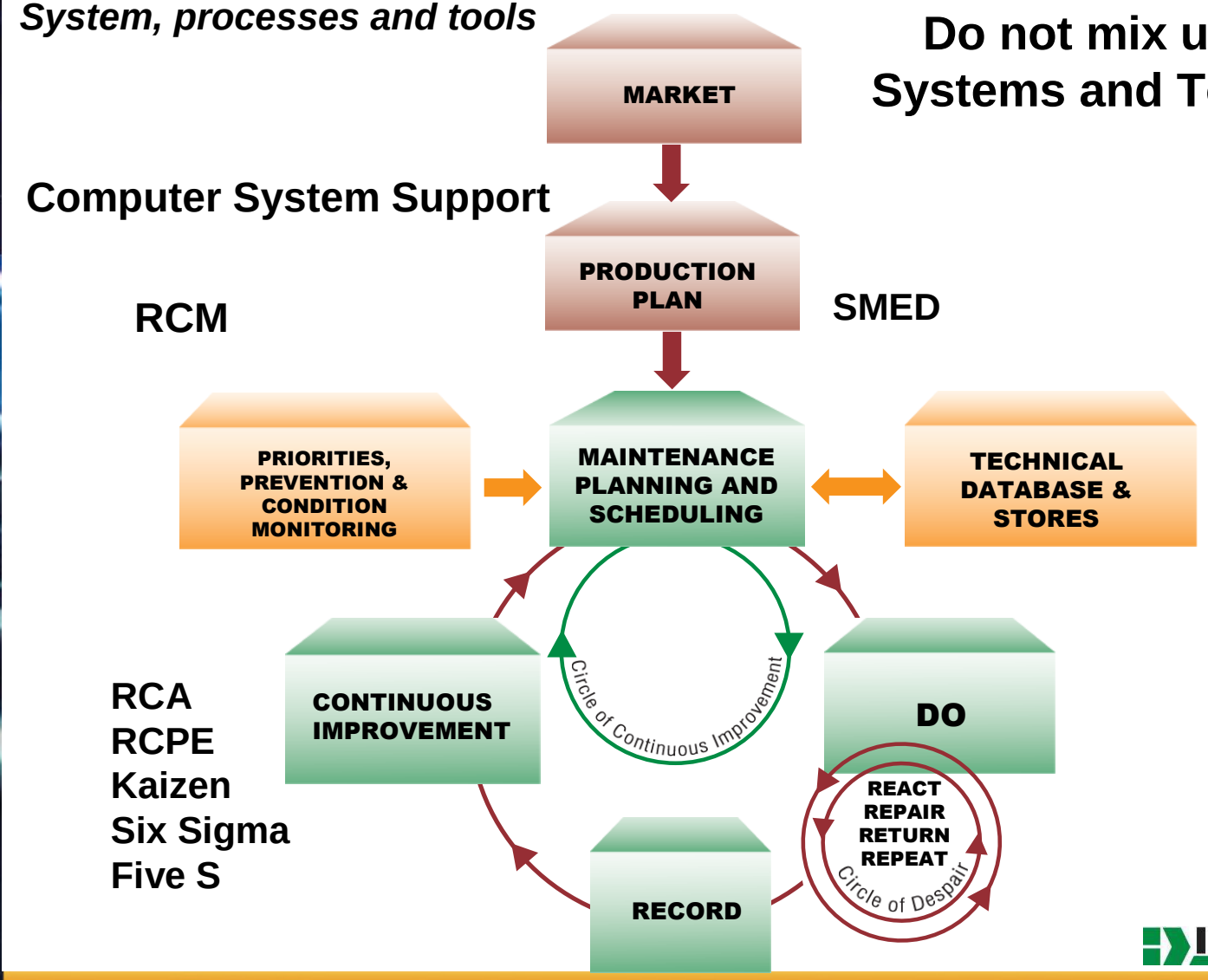
System, processes and tools

Do not mix up Systems and Tools



A typical Day?

Reactive

07:00 Arrive

07:30 First job assignment. “Limited flow to Tank T- 460”.

07:30 – 8:15 Two mechanics troubleshoot.

08:15 – 8:50 Get tools/rigging.

09:00 – 09:15 Morning Break

09:15 – 11:00 Going to store(s) looking for parts.

11:00 – 11:30 Lunch break

11:30 – 14:30 Fix problem.

14:30 – 15:30 ?

15:30 End of day.

Best Practice.

Several days before.

Problem identified during inspection or with right priority.

Correction Planned and then Scheduled.

Day before.

11.00. Freeze Schedule.

15:00 – 15:10. Review Schedule with crew.

15:10 15:30. Individual planning.

Next Day.

07:00 – 09:00 Fix problem.

09:00 – 15:00 Open for other work

Estimation of efficiency improvement potential

Reactive Unplanned and Unscheduled	Wasted Time	Total Wasted Time
70 %	60 %	42 %
10 %	40 %	4 %
Improvement		38 %
50 % Success		19 %

Cost of reactive maintenance

- **Very likely to cause safety hazards.**
- **Very likely to occur when equipment is needed for production. Very likely to cause losses in Quality, Time or Speed.**
- **Very likely to cause more expensive repairs and poor efficiencies.**
- **76.2 % likely to require repair on overtime.**
- **Barring you to do what you should do.**

In summary; Reactive maintenance causes lower Quality Production Throughput (Lower reliability) and higher costs.

The illusion of being good.

- We have done an audit and documented a detailed improvement plan.
- We have benchmarked ourselves to other plants and we are among the best. “Best is the enemy of improvement”.
- We just started a new program.
- We have reorganized our maintenance organization.

Actions but not much execution.

How good are you?

Do you know how good you are?

Do you know where your biggest improvement potential is?

Do you have a plan?

An audit without an action plan and an action plan without execution is a waste.

The shortest distance between two points is a straight line.

- If you do not know where you are, and you do not know where you are going – you end up nowhere.

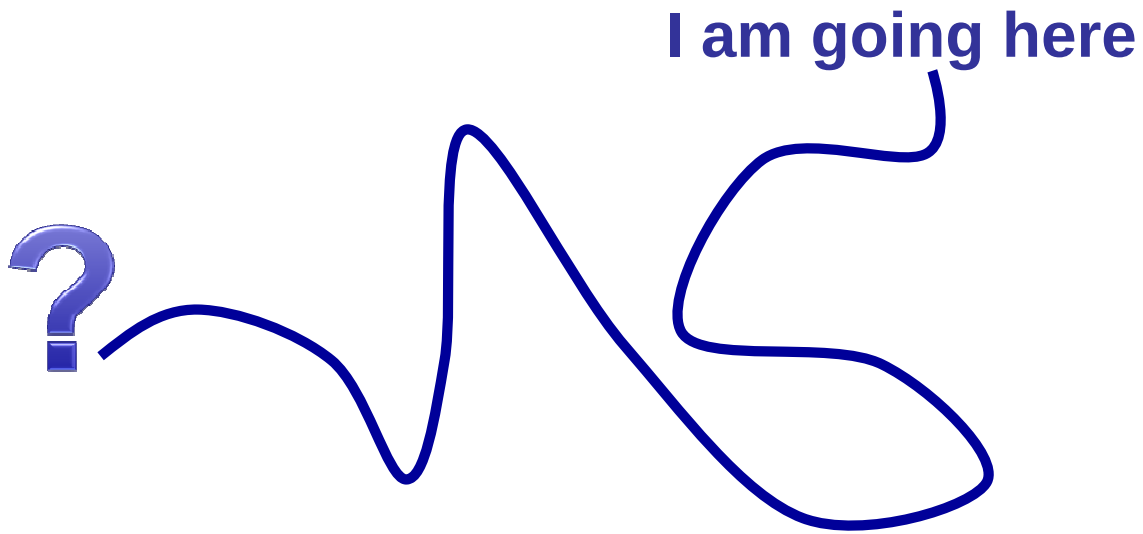
The shortest distance between two points is a straight line.

- If you know where you are, but do not know where you are going - you end up somewhere else.

I am here

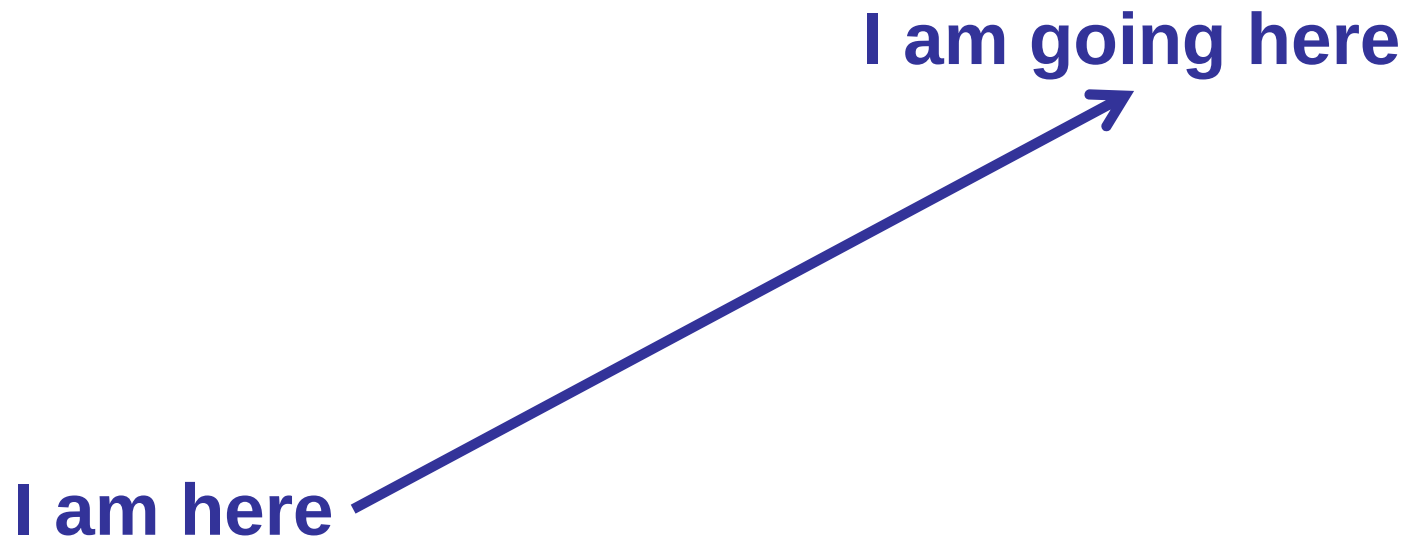
The shortest distance between two points is a straight line.

- If you do not know where you are, but know where you are going – you will take a very long road to reach your destination.



The shortest distance between two points is a straight line.

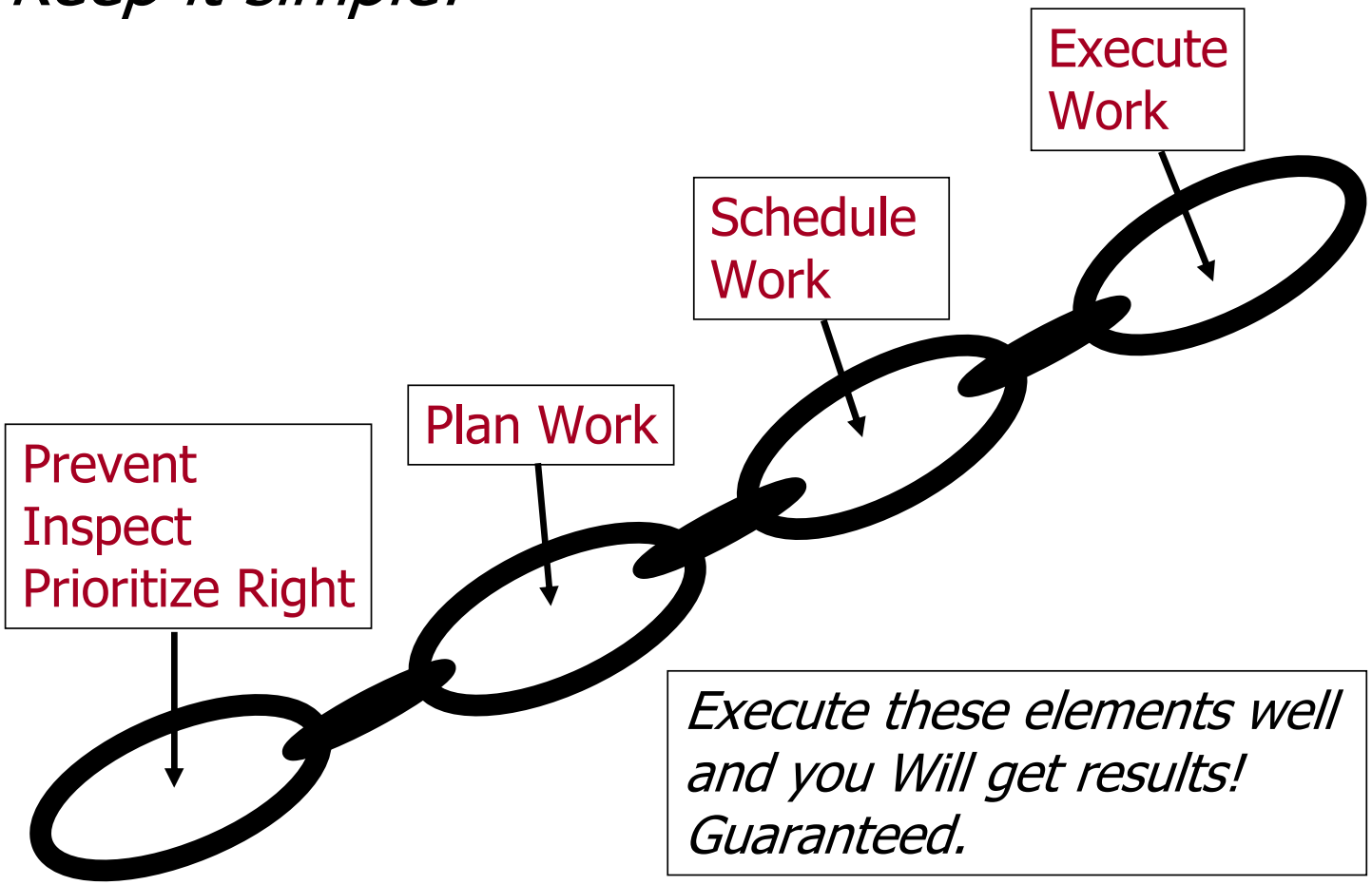
- If you know where you are and you know where you are going – you will reach your destination in the shortest time.



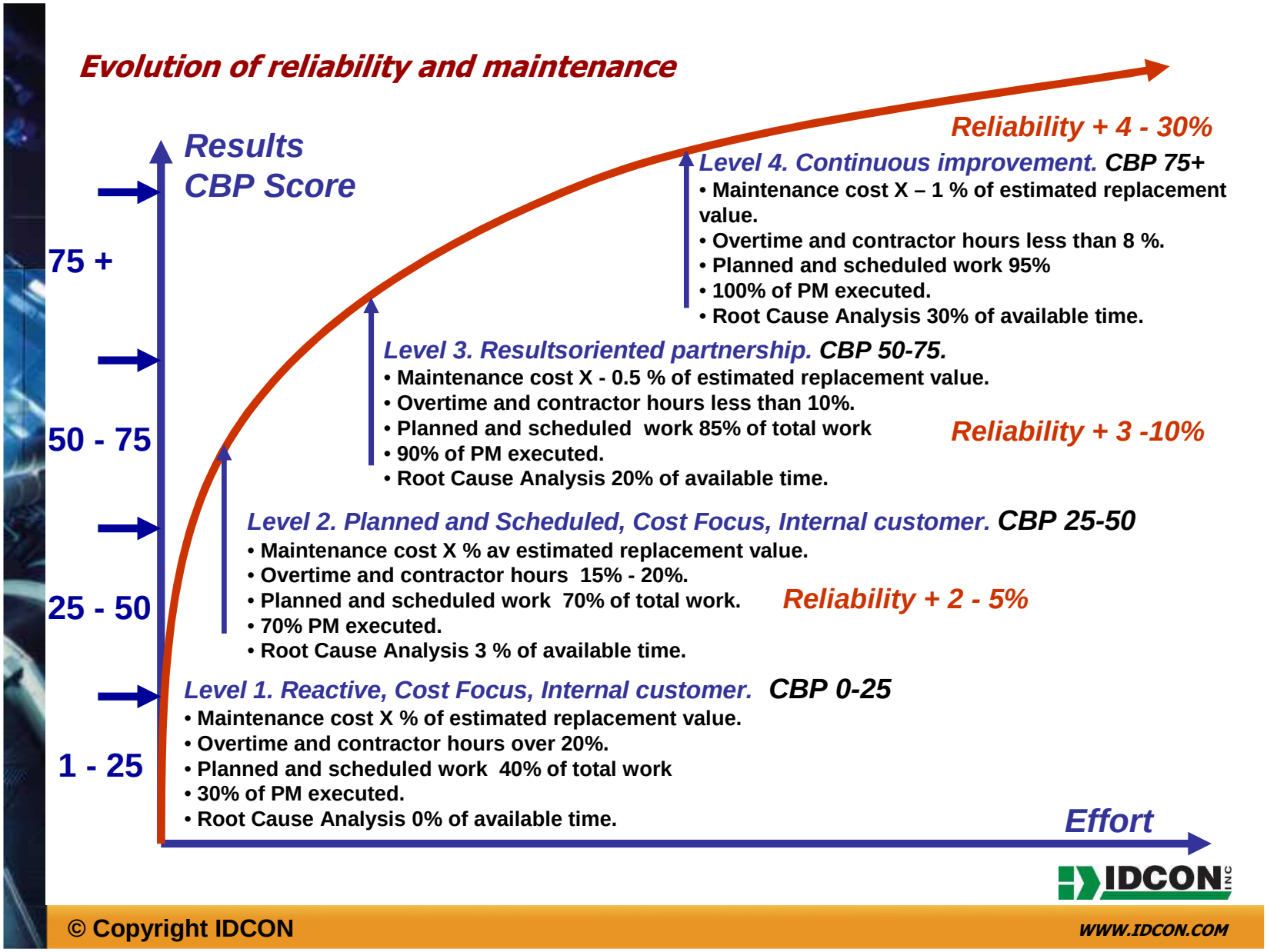
The shortest distance between two points is a straight line.

An audit is done to identify – and make the organization aware of - the gap between how good you are and how good you can become and then draw the straight line action plan to close the gap.

Keep it simple!

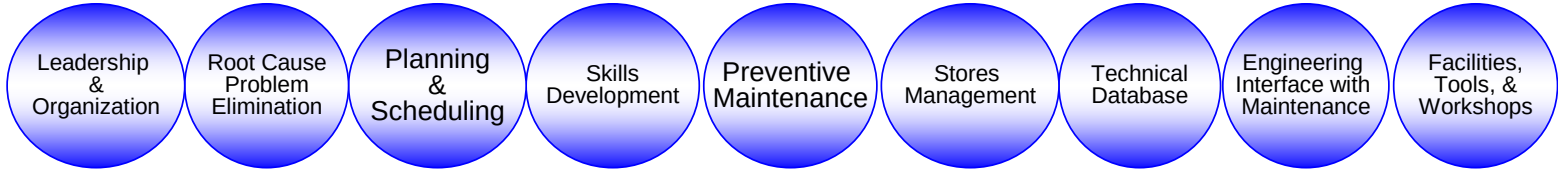


Thank you for listening



Current Best Practices (CBP) Reliability and Maintenance

KEY PROCESS



SUB PROCESSES

Work Request	Maintenance Method Selection
Prioritization	Cleanliness
Backlog	Lubrication
Planning	Alignment
Scheduling	Balancing
Execution	Operating Procedures
Recording	Filtration
CMMS Tool	Condition Monitoring

ELEMENTS

Examples of "Planning elements"

32. Standard job plans are used for all repetitive and critical jobs

33. Jobs are always planned before they are scheduled

34. Operations support the planning process

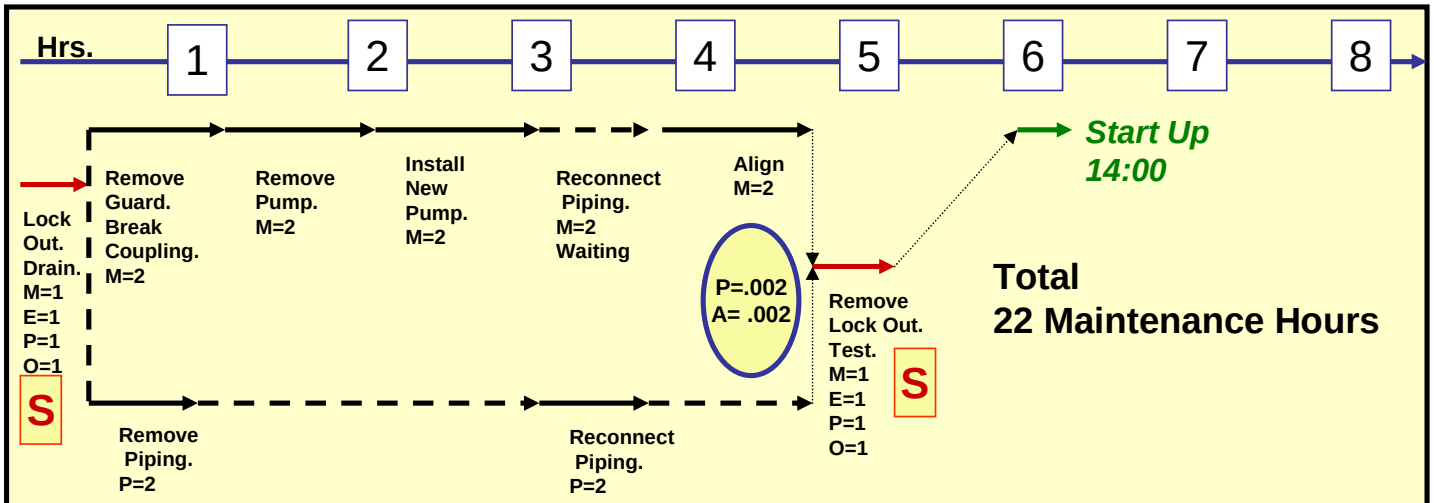
Examples of "Lubrication elements"

26. Lubricants are stored properly in clean, organized storage areas.

27. Filtration is used to maintain lubricant cleanliness.

28. Ferro graphic analysis is used to identify oil contaminants.

Planning Template: Example Pump Change.



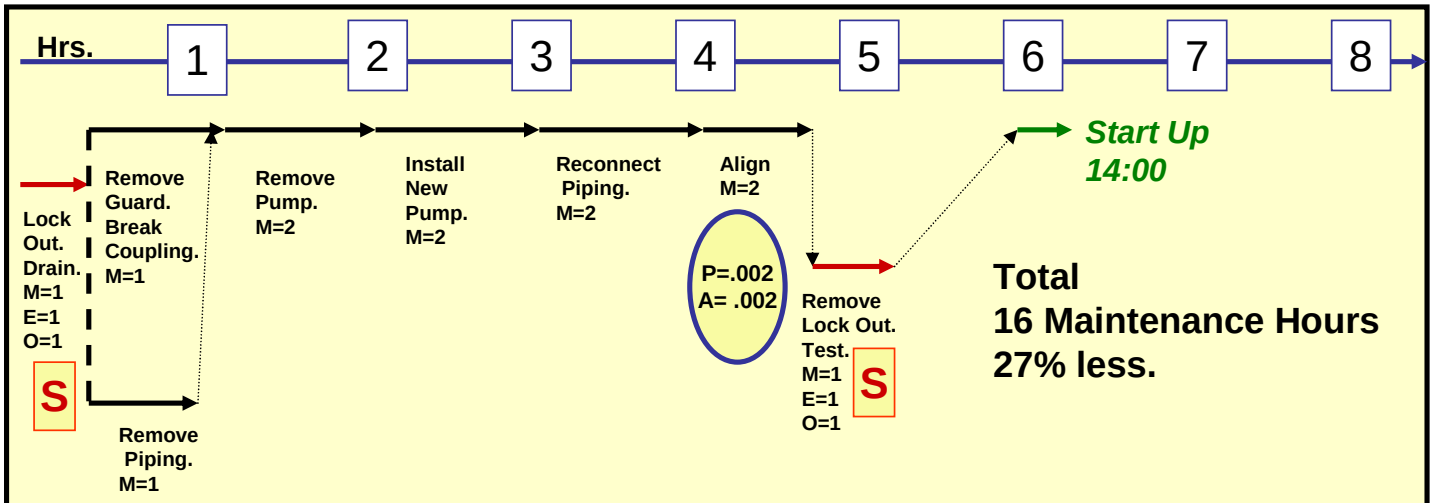
M	1	2	2	2	2	2	1	
E/I	1						1	
O	1						1	
P	1	2				2	1	
Total	4	4	2	2	2	4	4	

Pre Shut Down Activities
Hang Rigging.
Install ½of coupling on new shaft.
Deliver new pump to work area.
Bag & Tag Spare Parts.

Spare Parts: Kit # P42
Pump
Coupling
Gaskets
Shim Pack
BOM hard Copy

Special Tools: Kit #19B
Chokers
Come-A-Long
Shackles
Eye Bolt
Pump Cart

Planning Template: Example Pump Change.



M	1	2	2	2	2	2	1	
E/I	1						1	
O	1						1	
Total	3	2	2	2	2	2	3	

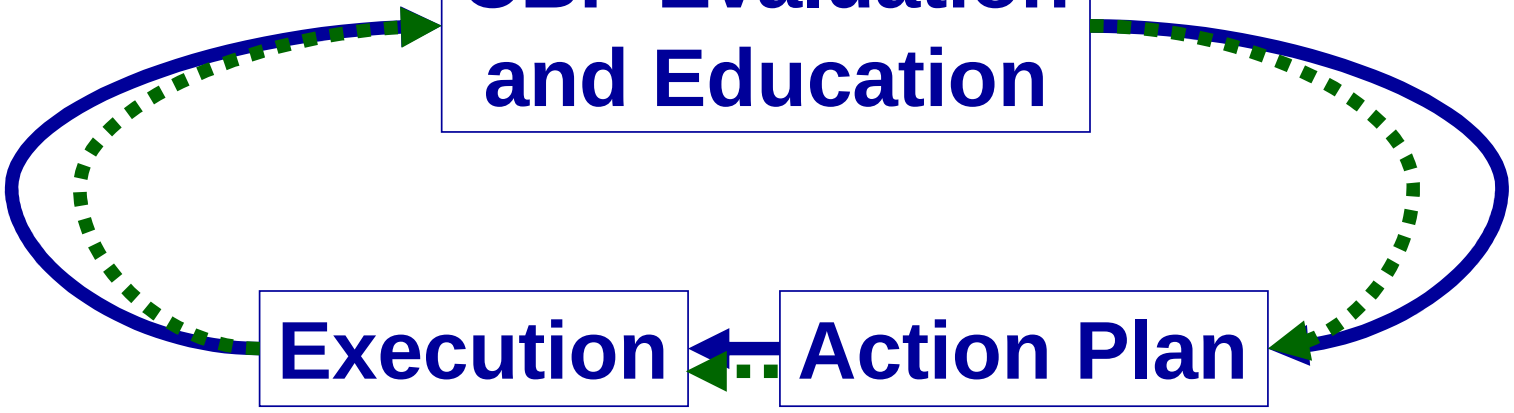
Pre Shut Down Activities
Hang Rigging.
Install ½of coupling on new shaft.
Deliver new pump to work area.
Bag & Tag Spare Parts.

Spare Parts: Kit # P42
Pump
Coupling
Gaskets
Shim Pack
BOM hard Copy

Special Tools: Kit #19B
Chokers
Come-A-Long
Shackles
Eye Bolt
Pump Cart

VISION
By the end of year 2014 achieve a CBP score of 75+

Mission
In a partnership with Operations Safely deliver continuously improved Equipment Reliability through the implementation of CBP.



Key Performance Indicators

Key Performance Indicators

Drivers

- **Break-In Work in Shut Down, Weekly and Daily Schedules.**
- **% Planned work.**
- **% Scheduled work.**
- **Preventive Maintenance completion rate. (If PM Content is right).**
- **% Work generated from inspection routes. (Including basic inspections and Predictive Maintenance).**
- **Precision Planning.**
- **Precision Scheduling.**
- **% Continuous Improvement work.**
- **Average Vibration Trend**

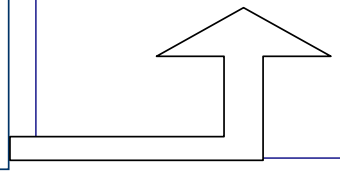
Results

- **Competitiveness.**
- **Productivity.**
- **Cost.**

- **Reliability**

Combined trends of hours:

- **Backlog**
- **Overtime**
- **Contractor**



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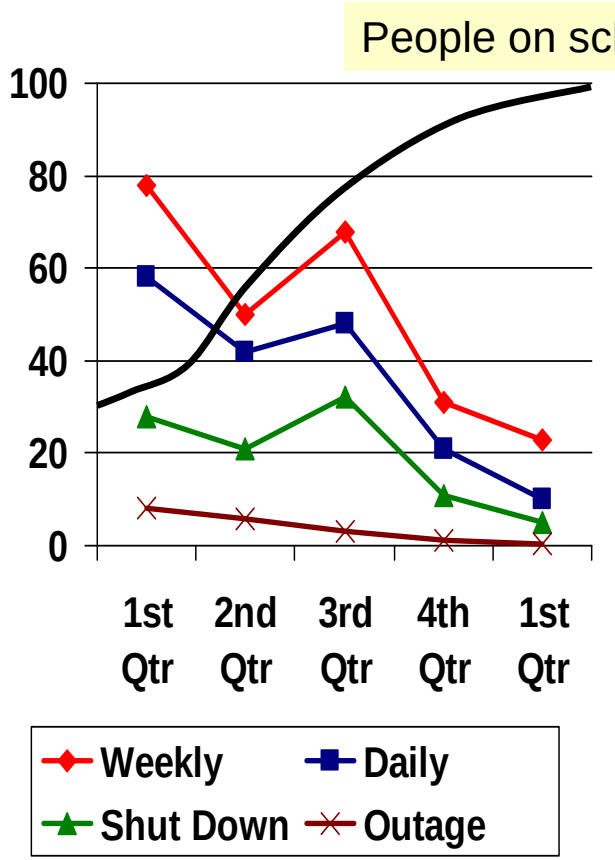
Key Performance Indicators

To become good you must improve what drives good.

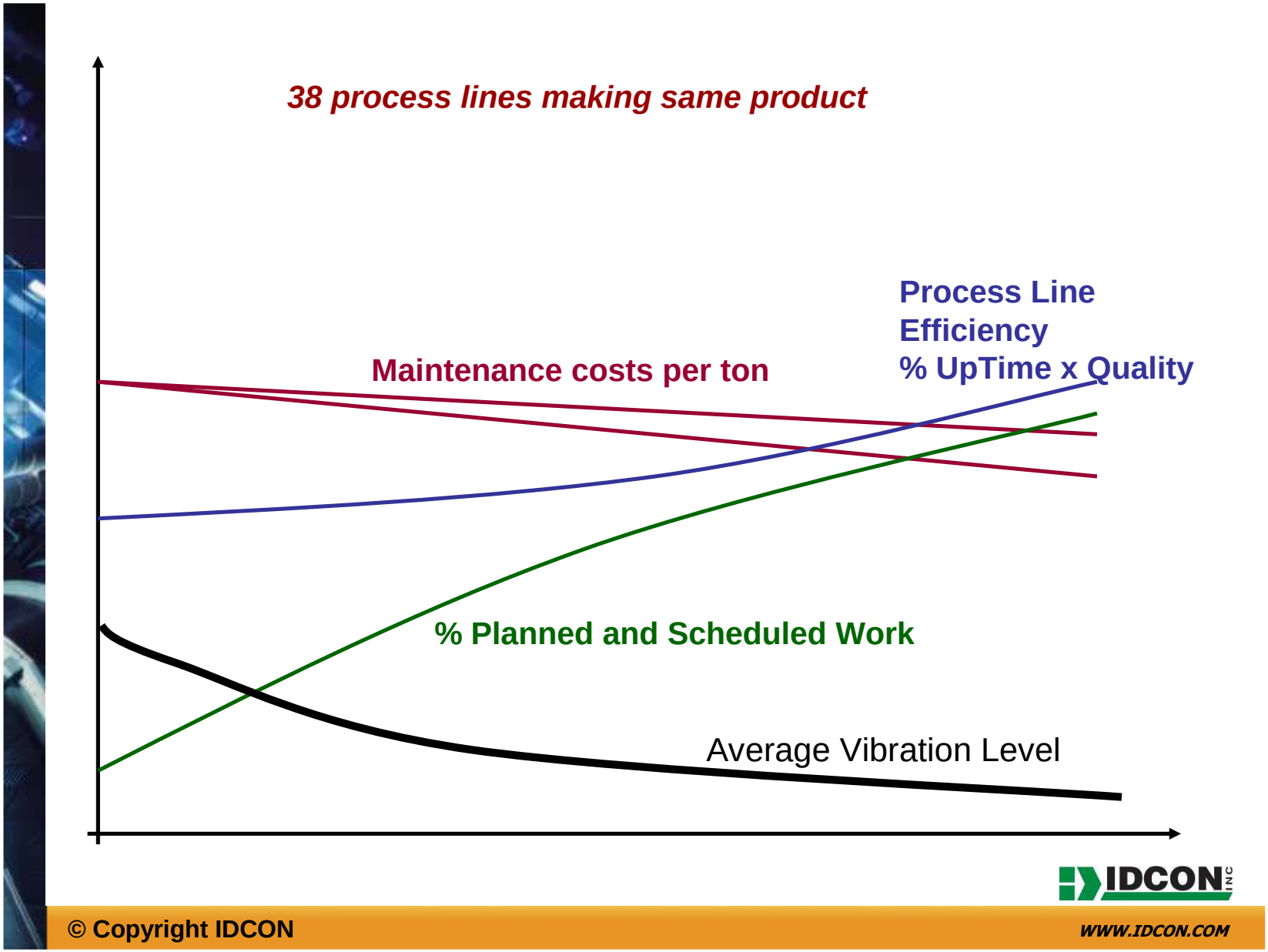
To lower costs you must improve what drives cost.

Compare Safety and Energy Improvements.

Break In Work

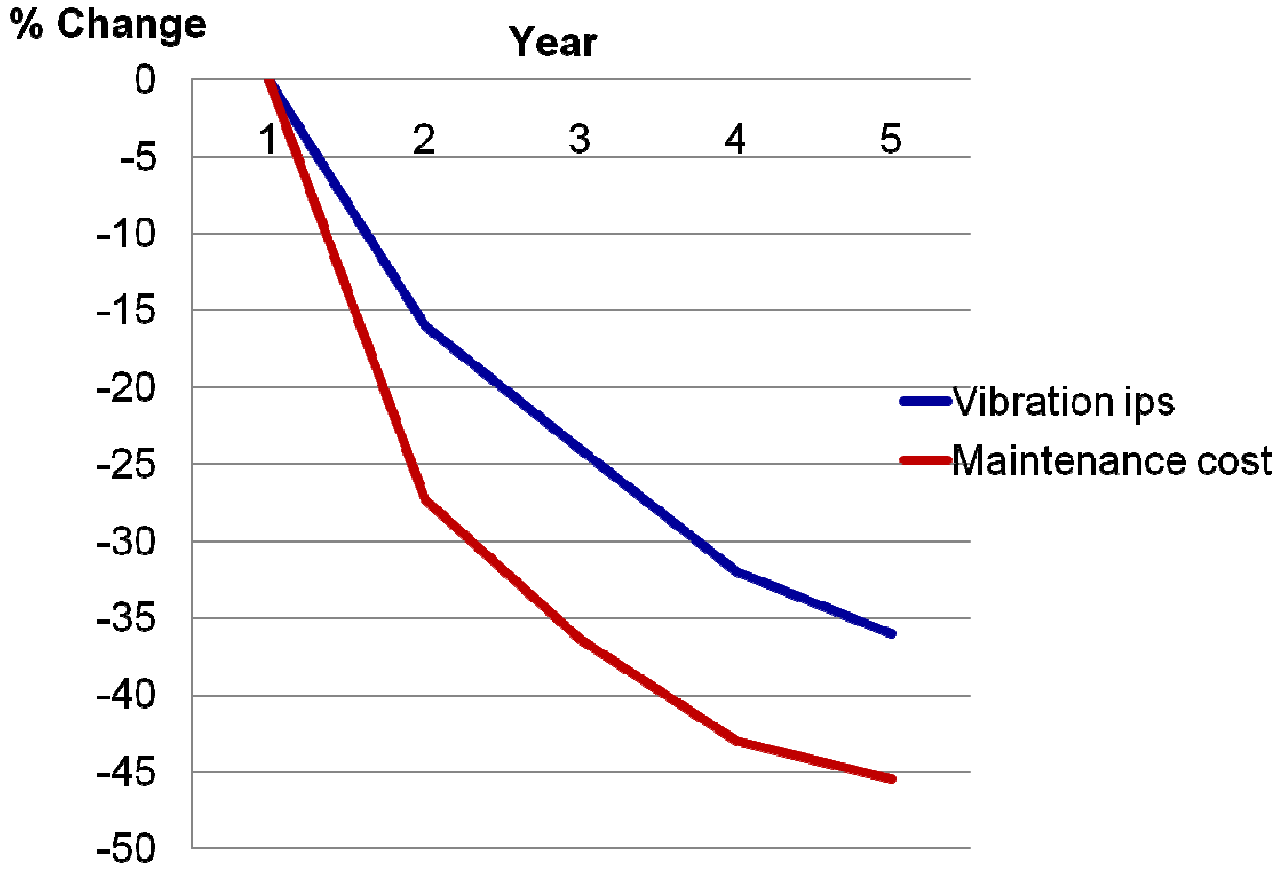


- **Weekly Break In Work = all work added to weekly schedule after 11:00 am Thursday before schedule date.**
- **Daily Break In Work = all work added to next day schedule after 11:00 am day before schedule date.**
- **Shut Down Break In Work = All work added to schedule after seven days before schedule date.**
- **Outage Break In Work = All work added to schedule after thirty days before schedule date.**



Vibration level and maintenance costs.

Reference Update International , Denver, CO. Ralph Buscarello



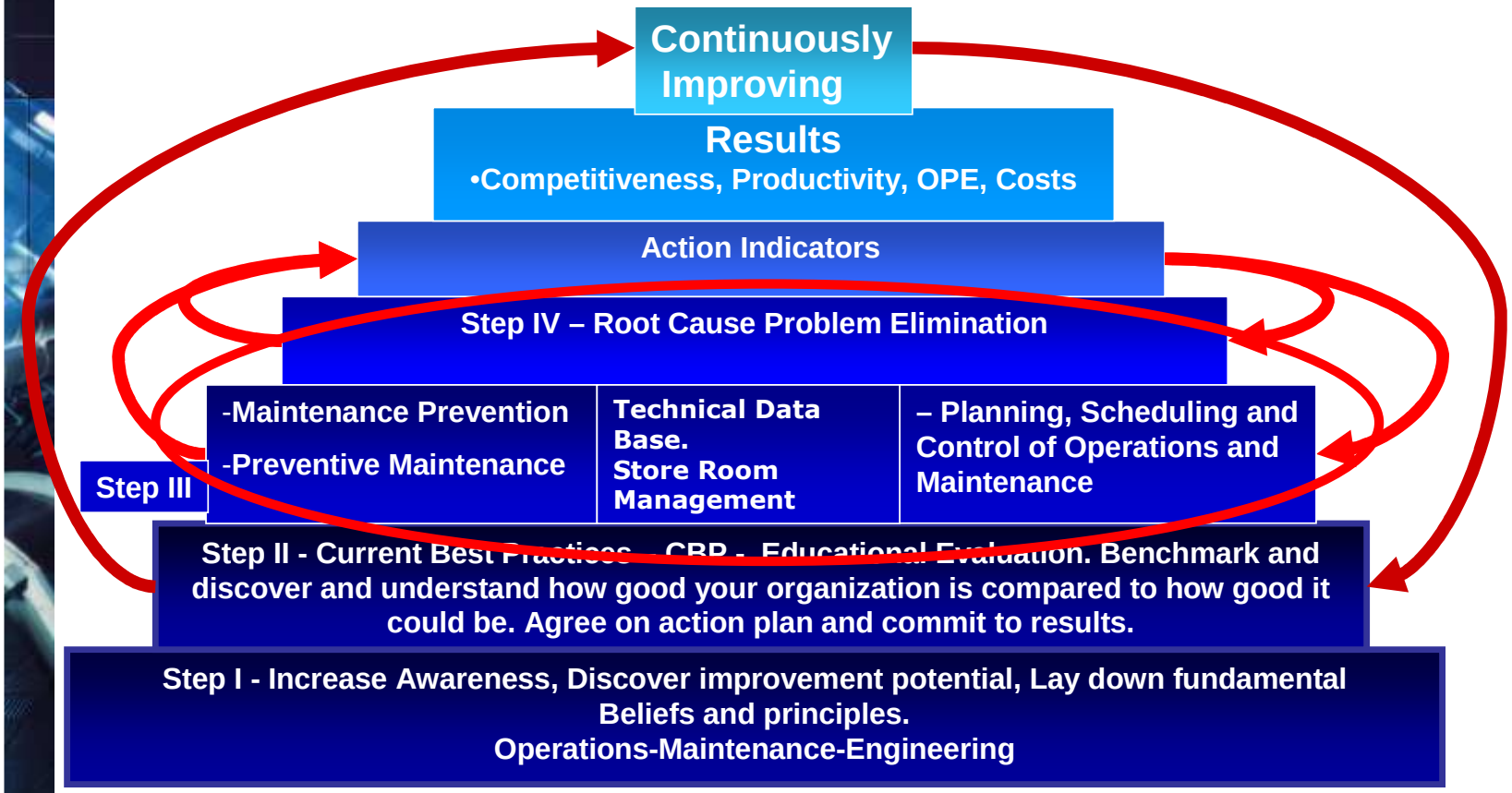
Maintenance cost vs. Vibration level

Reference Update International , Denver, CO. Ralph Buscarello

Equipment	*Highest IPS*	*Maintenance Cost US $*	*Lowest IPS*	*Maintenance Cost US $*
Pump 1800 rpm	0.15	10 298	0.012	2 668
Pump 3600 rpm	0.26	46 383	0.021	2 603
Fan	0.338	16 793	0.052	226
Total	***Highest***	***73 474***	***Lowest***	***5397***

Total difference US $68,077

Implementation Model



What Good Looks Like

Standard Job Plan

ınge PM2 Dryer Steam Nozzle, Steam Inlet Pipe and Insulating Pipe

© Target: 2 hrs

ndatory PPE: Safety Footwear, Eye ection, Gloves, & Hearing Protection

Recommended PPE:

Purpose

Use this document to Change a Steam Nozzle in PM2 Dryers

The estimated total time to remove and install the roll is 2 hours using 2 fitters and a Scaffolder if an upper steam nozzle to be changed where a work platform will be required.

✓ Meetings:

- ☑ Standard Pre Shut and Shut Meetings

Hazards

- Dehydration: Hot Work. Drink plenty of water and replacement fluids continuously.
- Dehydration: Hot Work inside Dryer Cylinder. Drink Plenty of water and work for short periods, always have a Confined Space watch person present when inside the Cylinders.
- Heavy Work. Some task require two people using correct lift techniques to eliminate the risk of back injuries
- Ensure work area is clear of hoses, tools etc before and during the change to prevent trips and falls

✓ Pre-Checks (Things to check before starting this process)

- ☑ Check Operations schedule
- ☑ Confirm availability of materials and tools
- ☑ Confirm maintenance crew available

Isolations

- Electrical Drive: Group Isolation 82-8 (PM2 Dryers Section)
- Service Numbers: 821077 DRIVE, 1ST DRYER; 820885 DRIVE, 2ND DRYER; 820888 DRIVE, 3RD DRYER; 821356 DRIVE, 4TH DRYER; 820900 DRIVE, 5TH DRYER; 821008 DRIVE, SWEAT DRYER

Environmental

High Temperature Work

Working environment inside Dryer Cylinder can be

PM2 Lower Dryer Cylinder Nozzle

Tools & Equipment Requ

Quantity & Description	Comment	Quantity
☑ 32mm Ring Spanner	Slipper Adjusting bolts	☑ 3/8" BSF
☑		☑

Time Line

Step	Procedure Overview	Time
1	Remove Nozzle	1 Hour
2	Reinstall Nozzle	1 hour

Labour Required

Quantity & Description	Hours
☑ 2 off Fitters	2
☑ 1 off Scaffolder – if required	1
☑	

References:

Document Name & Description
☑ 82-ML-1969 PM2 Steam Fit Body, Gen Arrangement
☑ 82-ML-1970 PM2 Steam Fit Body, Gen Arrangement
☑ 82-ML-1971 PM2 Steam Fit Body, Sectional Arrangement
☑ 82-ML-1972 PM2 Steam Fit Body, Sectional Arrangement
☑ 82-ML-2460 PM2 arrangement of Steamfit Siphon
☑ 82-ML-2461 PM2 Nozzle rotary union and spider assembly

- ☑ IIN0025873n – 3/8" X 1" SS Allen capscrew – Item #17
- ☑ IIN 0002604 – Split Pin, 3.2MM X50MM
- ☑ 1 Tin of Anti seize compound
- ☑ Rags

Prepared: Mal Evetts	Authorised: C. Carter	Date: 13-03-2008
Page: 1 of 3	250-PM2-Dryer-1002-WI	Version: 01
Uncontrolled copy printed on 18/02/10 @ 12:40 – out of date in 3 days! Check the version before use		

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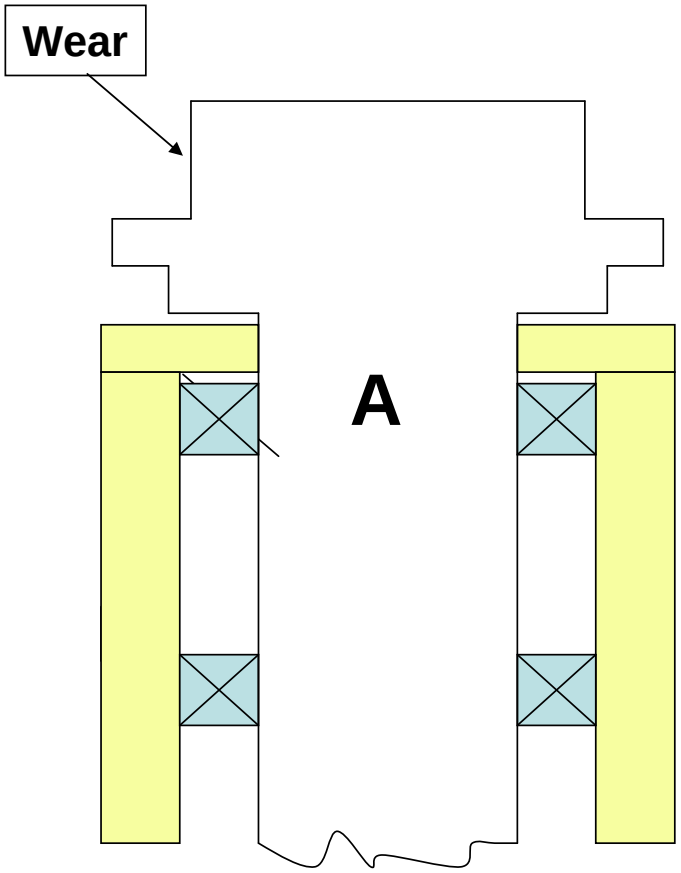
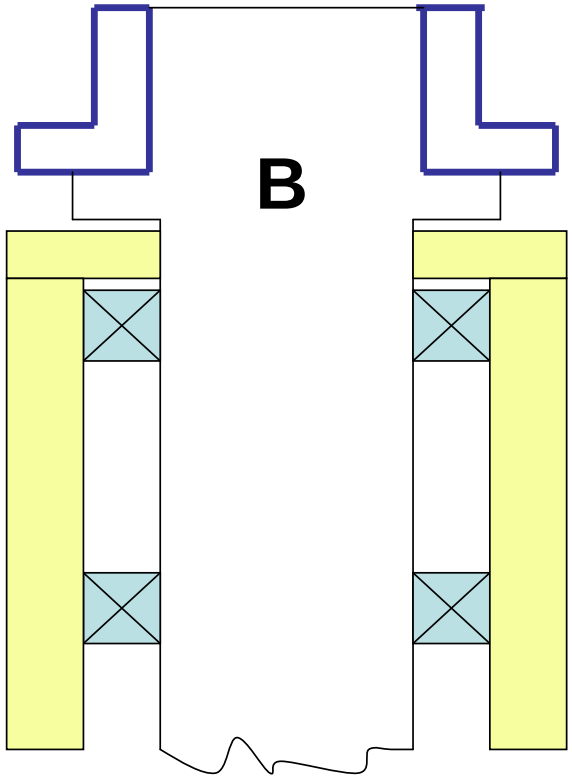
What good looks like

LCC Example



Replace worn wheel unit $900.
6 hours down time



Replace worn wheel $270
2 hours down time

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Priority	Example of Failure or Incident	Maximal time in backlog
Is the job necessary to do?	**Yes No On Hold**	
1 a. 1 b. 1 c. 1 d. 1 e. 1 f.	Immediate safety risk Immediate risk of environmental damage Immediate risk of quality losses. Critical equipment down Immediate risk of break down of critical equipment Immediate risk of high costs of break down.	Immediately. Will break other less important ongoing work.
2 a. 2 b. 2 c.	Critical equipment is running at reduced speed Critical equipment is running in manual mode Manageable safety risk	1 day - 1 week 1 - 2 days. 1 day - 2 weeks.
3 d. 3 e. 3 f. 3 g. 3 h. 3 j.	Critical equipment running on spare equipment Failures that need correction Spare equipment out of function Leaks PM activity Mandatory inspections ***Example IDCON Partnership Planning and Scheduling Training.***	2 days - 2 weeks. 1 day - 6 months 2 days - 2 weeks. 1 day - 6 months 2 - 6 weeks. Set by time.
4 a. 4 b.	Improvement work - expense. Improvement work - capital	> 1 month > 3 months

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Coupling -"Tire" (L

CMS101R

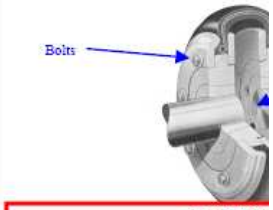
Condition Monitoring Stanc

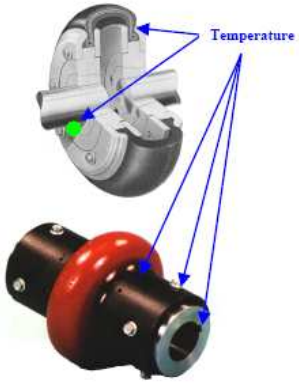
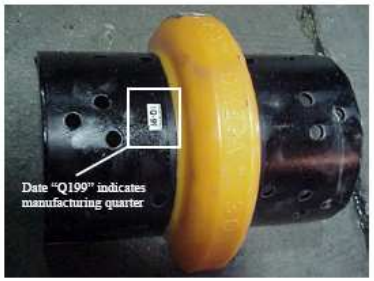
The shaft is connected to one coup
tire made of rubber or other elastic
the coupling half and the plate (Dc
The metal flanges are attached to t
the coupling halves.

The tire coupling is made for lowe
tire outward due to centrifugal for
causing the bearings connected to
high speeds, which causes an imba
connected to it.

Picture Courtesy: Omega

KEY	
Noise	Listen for abnormal n

KEY	WHAT
Visual	Use a stroboscope and make sure the coup for loose rubber pieces on the tire. Crack: be noted. Check for any loose and/or corroded bolts and/or looseness. The Dodge is shown in inspection is also true for the Omega coup  SAFETY FI Strobe light causes Rotating objec touch coupling
Guards	The guard has to have an inspection open inspection of the coupling. Some guards ports with wire mesh metal or inspection guard modifications that will enable coup black to increase visibility.  When modifying guards, refer to OSHA s allowed size of the wire mesh depends on the mesh. For example, a 1-inch (25.4 mm inches (38.1 mm) away from the coupling standards than OSHA, make a wire mesh then apply a hinged lid over the wire mesh

KEY	WHAT	WHY
Temperature	Through the wire mesh or other safe inspection access, check temperature with an infrared temperature device where the forces are acting on the coupling (see figure). Misalignment, imbalance and other sources of damaging forces will increase the temperature. 	Take the temperature at the coupling - shaft – key interface ● because forces are transferred from the shaft to the coupling half at this point. High temperature may be due to misalignment or operation at higher speed than recommended. High temperature between rubber and coupling half may be due to misalignment, imbalanced, high speed, or higher torque than allowed.
Installation	The "Omega" coupling is a perishable goods. The elastic element and glue deteriorates over a 5- to 6-year period. It is therefore very important NOT to store the couplings too long, or to have them in use much longer than 6 years. 	Coupling rubber elements that tears, or come loose in the joint may be experiencing aging rubber, or glue.

www.idcon.com
919-847-8764

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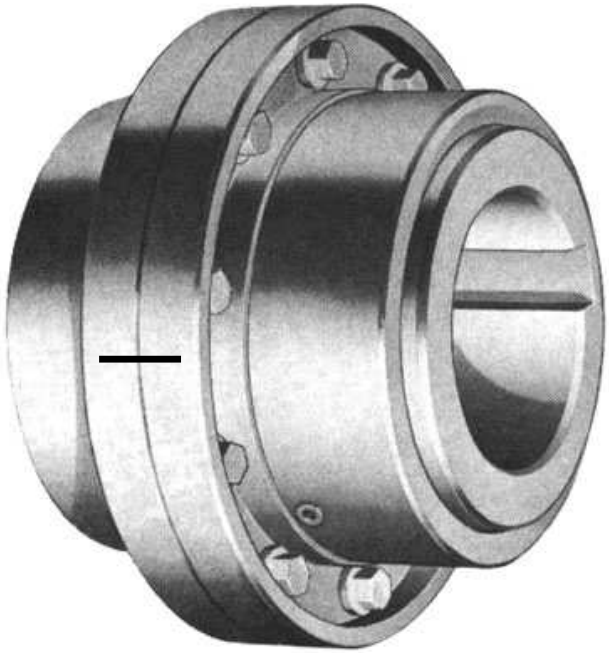
Do Not Copy

Basic inspection technique example

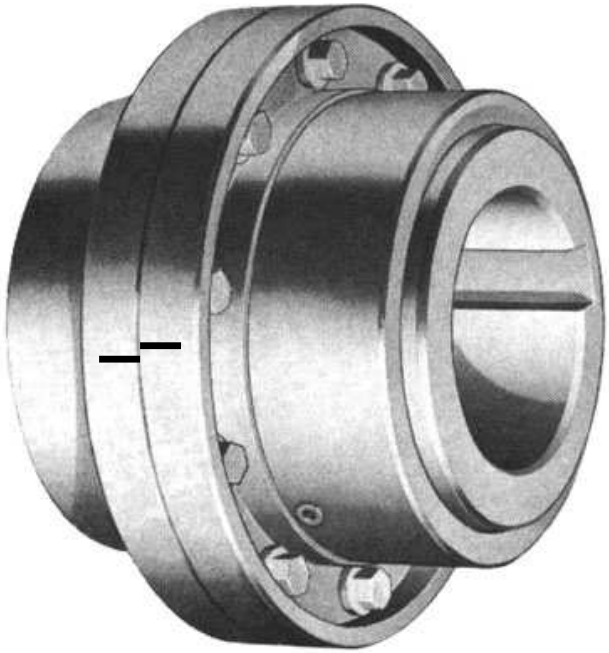
.

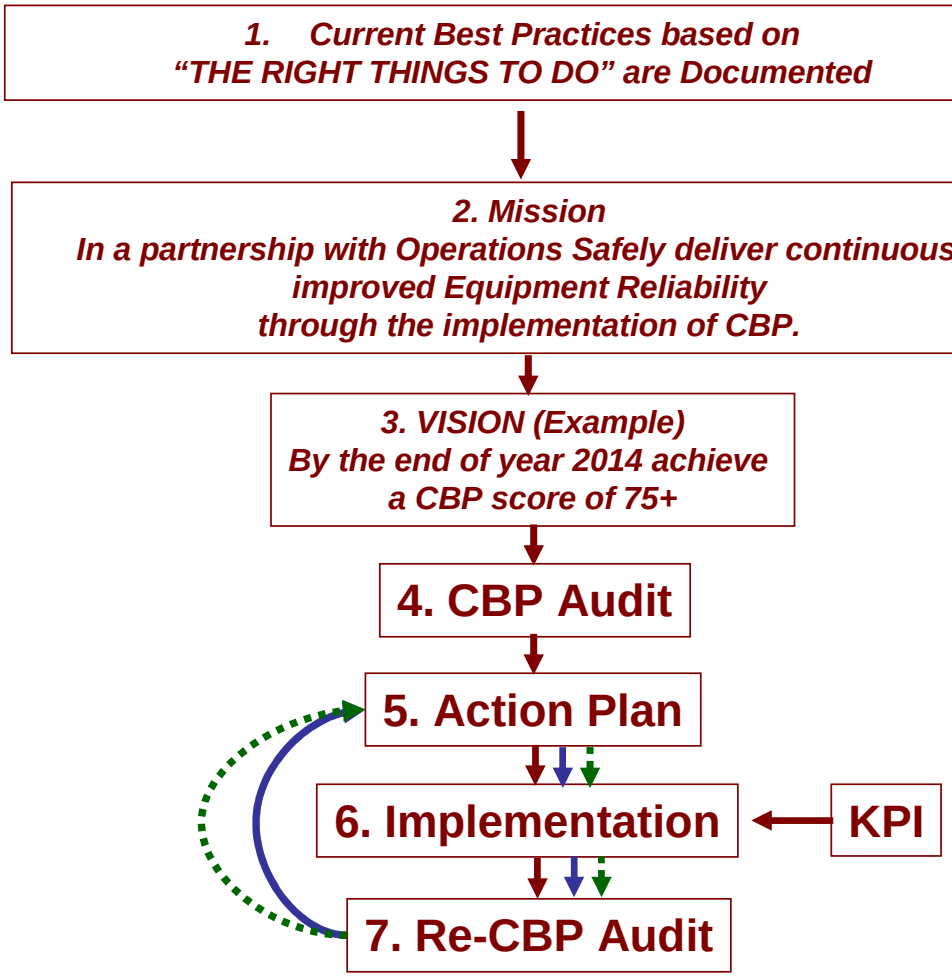
- Coupling Example



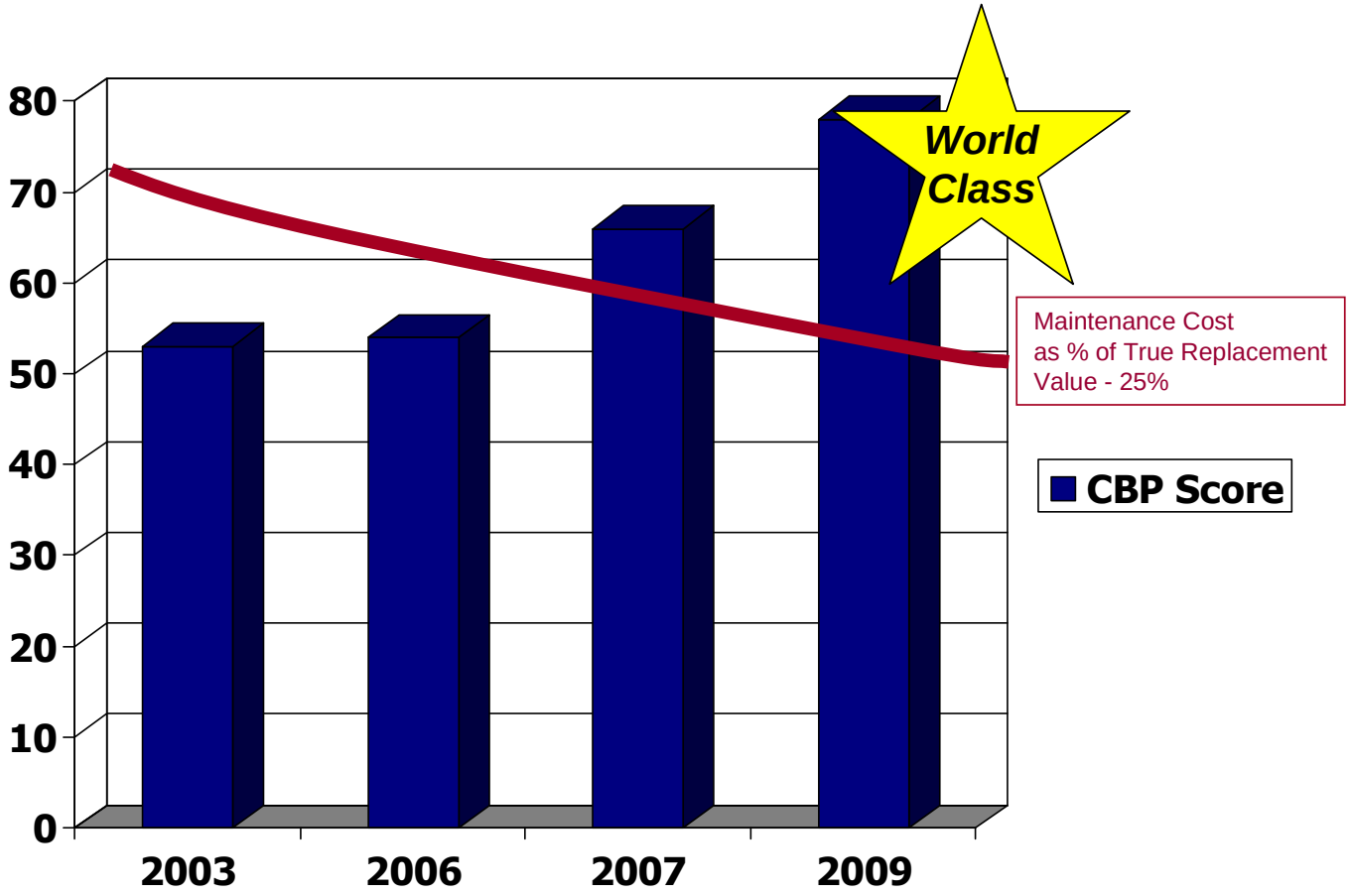
Basic inspection technique example

- Coupling Example.





Total CBP Scores



Common Road Blocks to Overcome

Common Mistakes

- Too much focus on the tools instead of the people.
- Lacking mission and vision.
- Not enough information, education and training.
- Forming happy islands.
- Frequently starting new programs.
- Failing to see the difference between tools and a complete reliability and maintenance management system.
- Ignoring existing good initiatives and practices.
- Failing to continuously focus on the basics.

Focus on drivers

Common mistakes

Focus on cost instead of what drives cost.

Implementation and execution of Best Reliability and Maintenance Practices drives Better Reliability.

Better Reliability drives down costs.

Compare with safety and energy savings.

People

Common mistakes

Too much focus on the tools instead of the people.

People is not your most valuable asset.

The Right People are your most valuable asset.

The system is an important tool, but leadership and people will, or will not, make it work to its full potential.

Mission and Vision

Common mistakes

Lacking mission and vision.

Mission: Why we are doing this.

"In a partnership with operations we will safely deliver continuously improved manufacturing reliability……"

Lacking Mission and Vision

Common mistakes

Lacking mission and vision.

Vision: Paint a picture of what future will look like.

- A Best Practices score of 75+ before end of 2014
- Manufacturing Reliability 96 % +.
- No maintenance people on shift.
- Overtime below 5 %.
- Operators will do 50 % + of all PM inspections.
- 20 % + of all maintenance hours is continuous improvement.
- …….

Information.

Common mistakes

Not enough information, education and training.

Repeat, repeat, repeat.

Stay on track, demonstrate your intentions.

Always refer to Mission and Vision Statements.

This is NOT a Program, it is a process with a starting point, but no end.

Happy Islands

Common mistakes

Forming happy islands.

Spread the Mission, Vision and improvement initiatives beyond the implementers.

Make sure your improvement initiative is not only a maintenance improvement effort.

Build on existing good practices.

Common mistakes

Failing to build on existing good practices.

Adapt the system functions to support these practices.

E.g. Many big computer systems do not support route based activities* well.

*** Lubrication, Basic Inspections, Predictive Maintenance.**

Stay on track.

Common mistakes

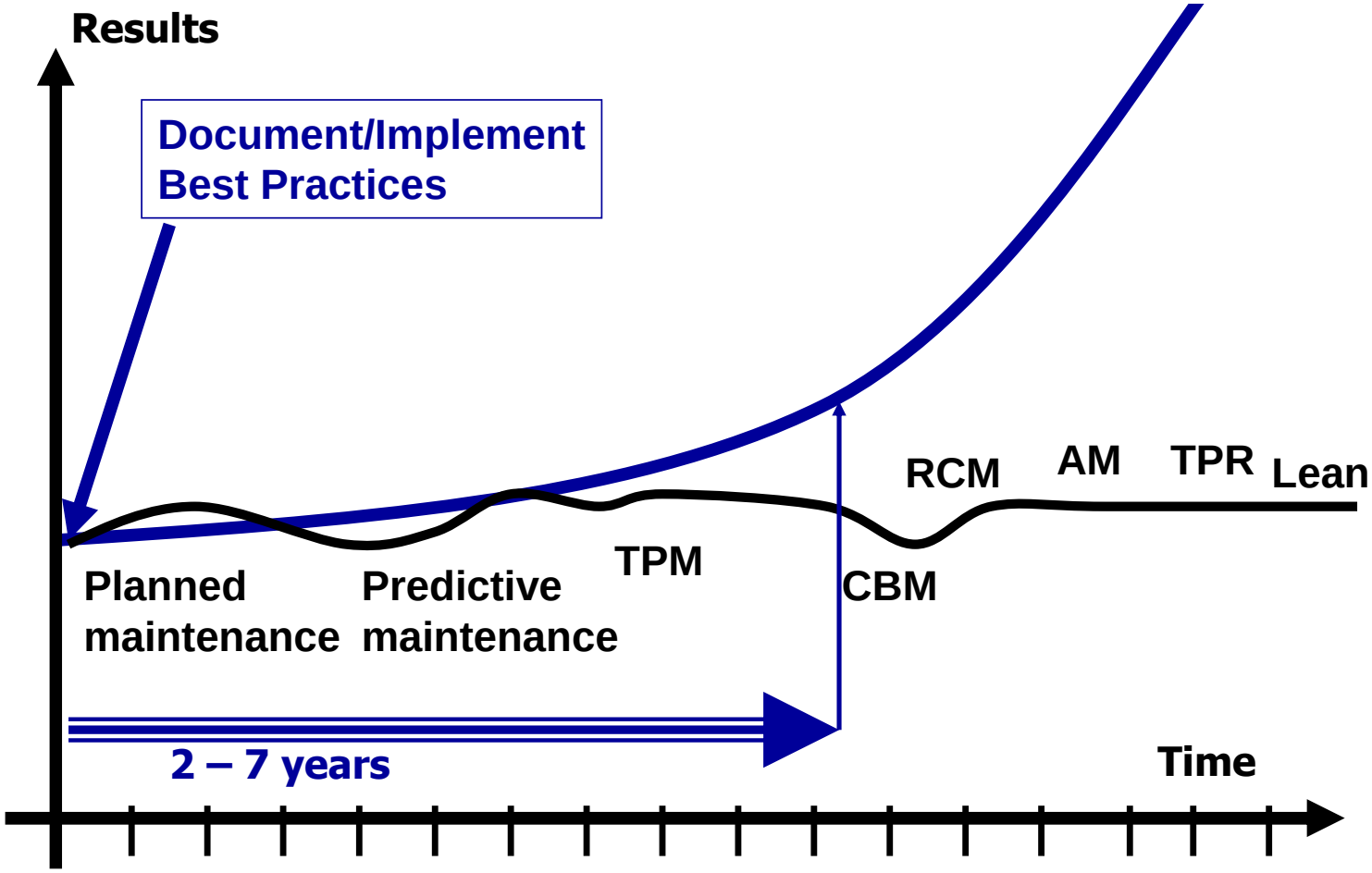
Frequently starting new programs.

Ensure that management changes do not impede continued implementation of best reliability and maintenance practices.

- 67% of plants have had more than 3 plant managers in the last 10 years.
- 66% of plants have had more than 3 production managers in the last 10 years.
- 62% of plants have had more than 3 maintenance managers in the last 10 years.

Source: Surveys www.idcon.com

Stay on track, execute best practices better and better.



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Call maintenance what it is.

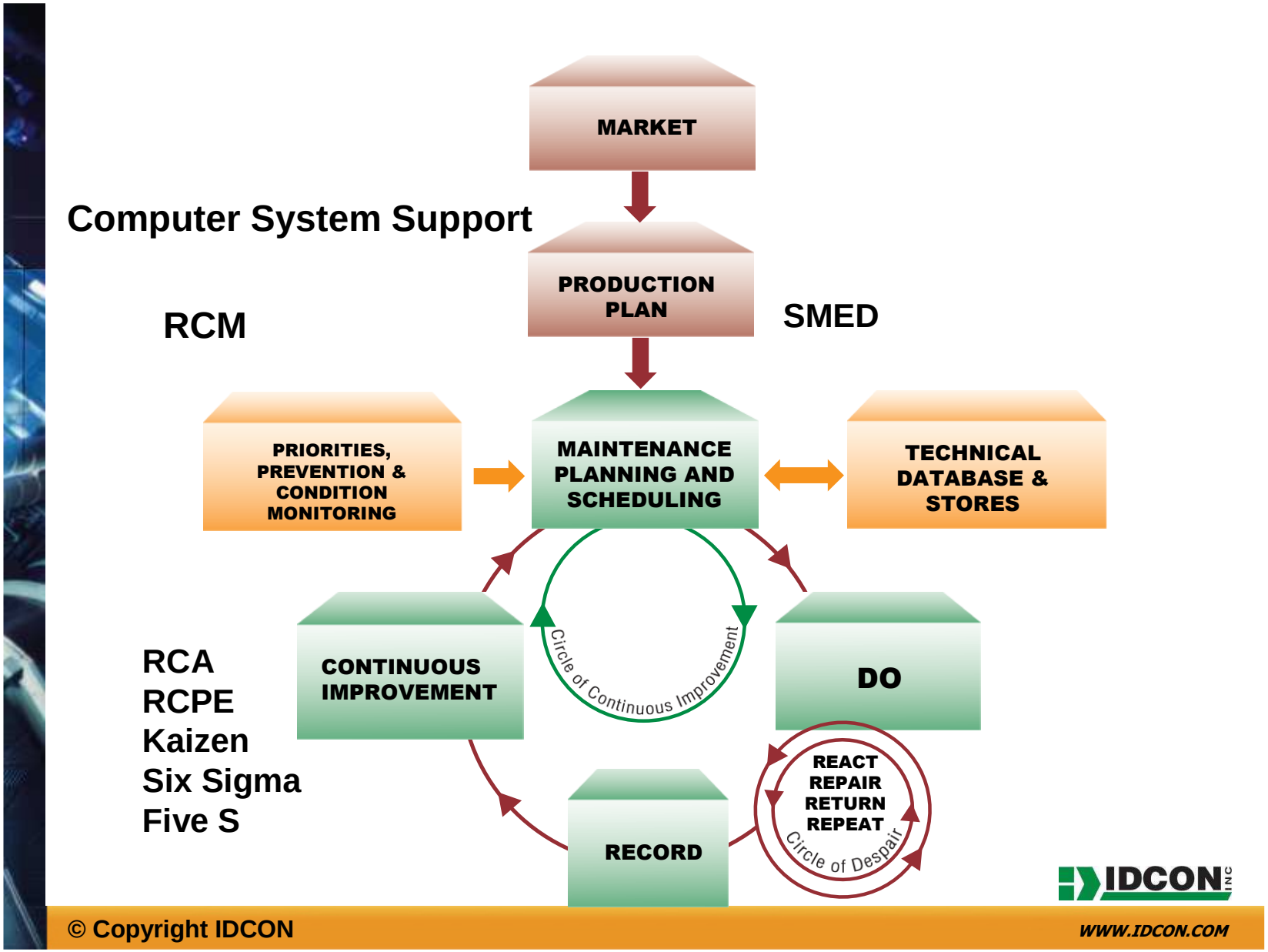
Common mistakes

Failing to focus on the basics.

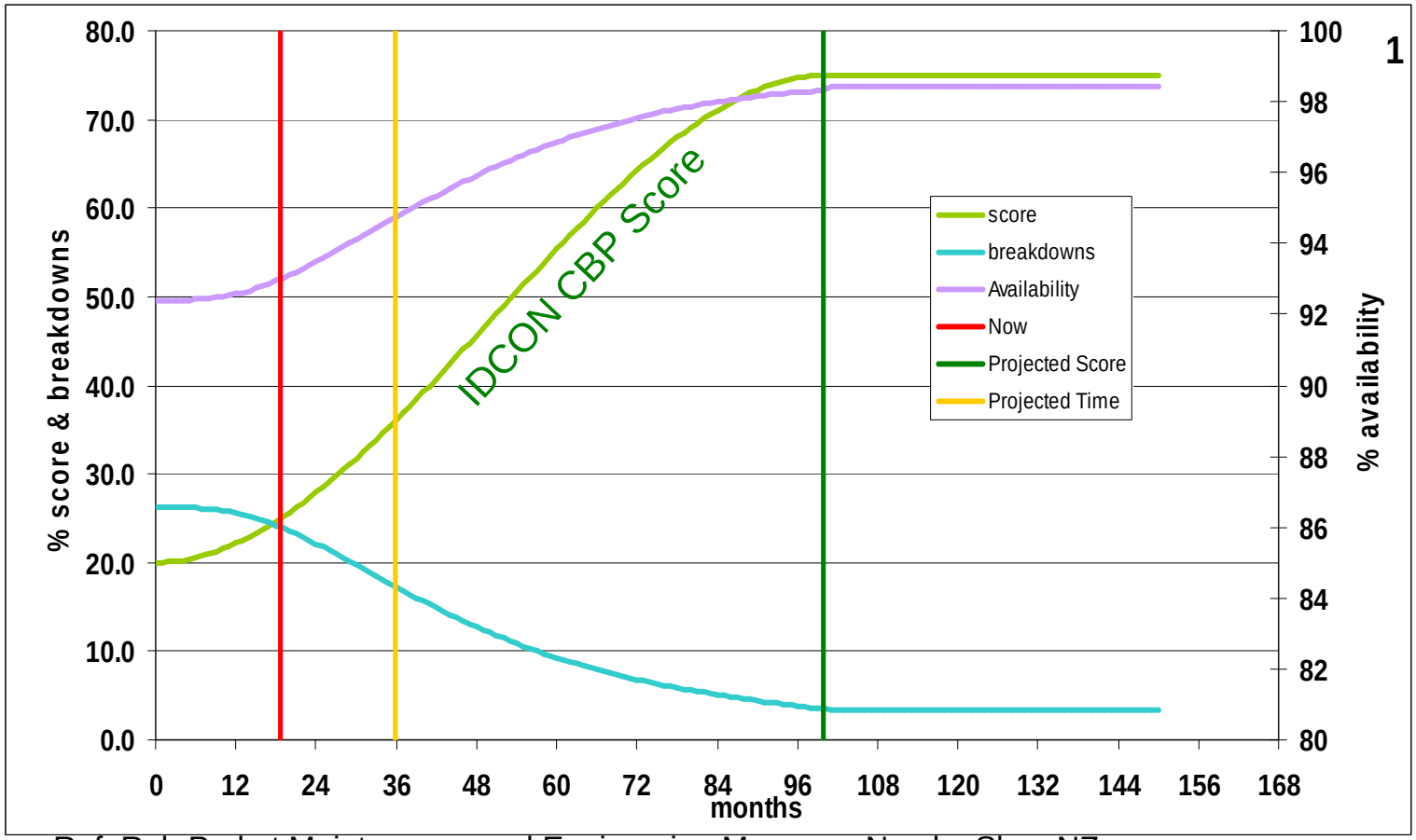
Why can we not call Maintenance Management just Maintenance Management ?

Common mistakes

Failing to see the difference between tools and a complete reliability and maintenance management system.

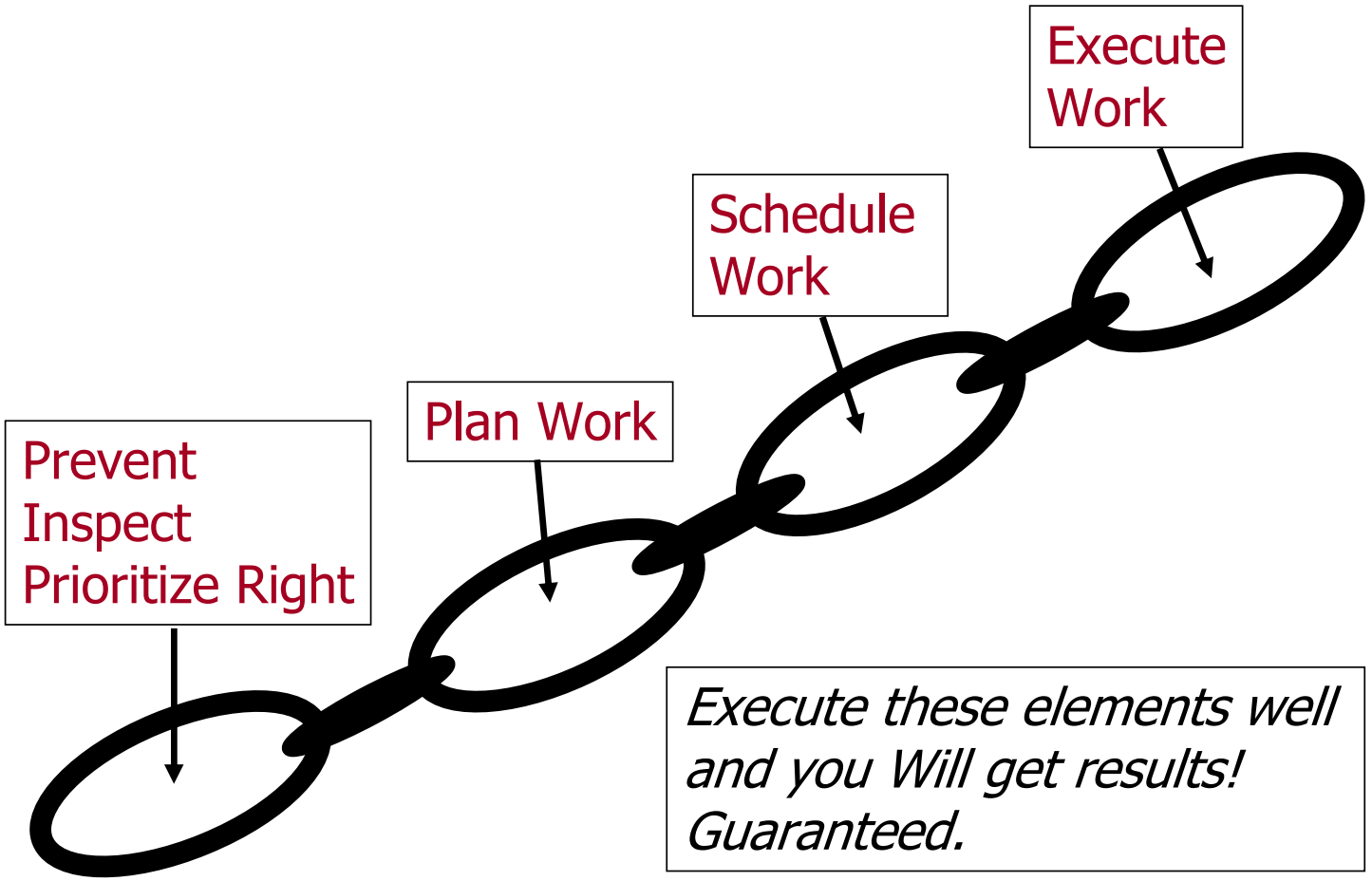


ROI Engine Model – Key Trends



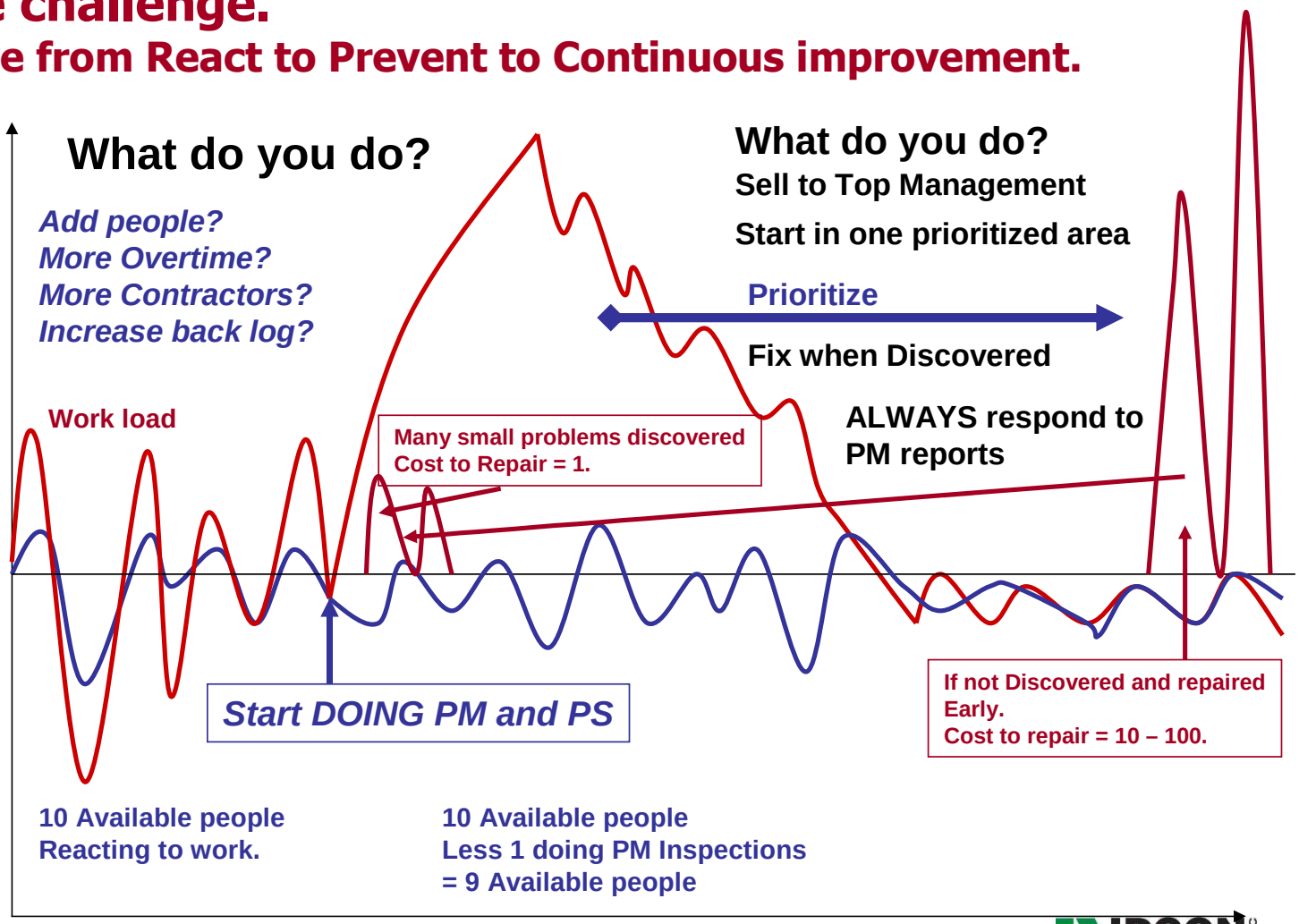
Ref. Rob Probst Maintenance and Engineering Manager. Norske Skog NZ

Chain of Essential Elements



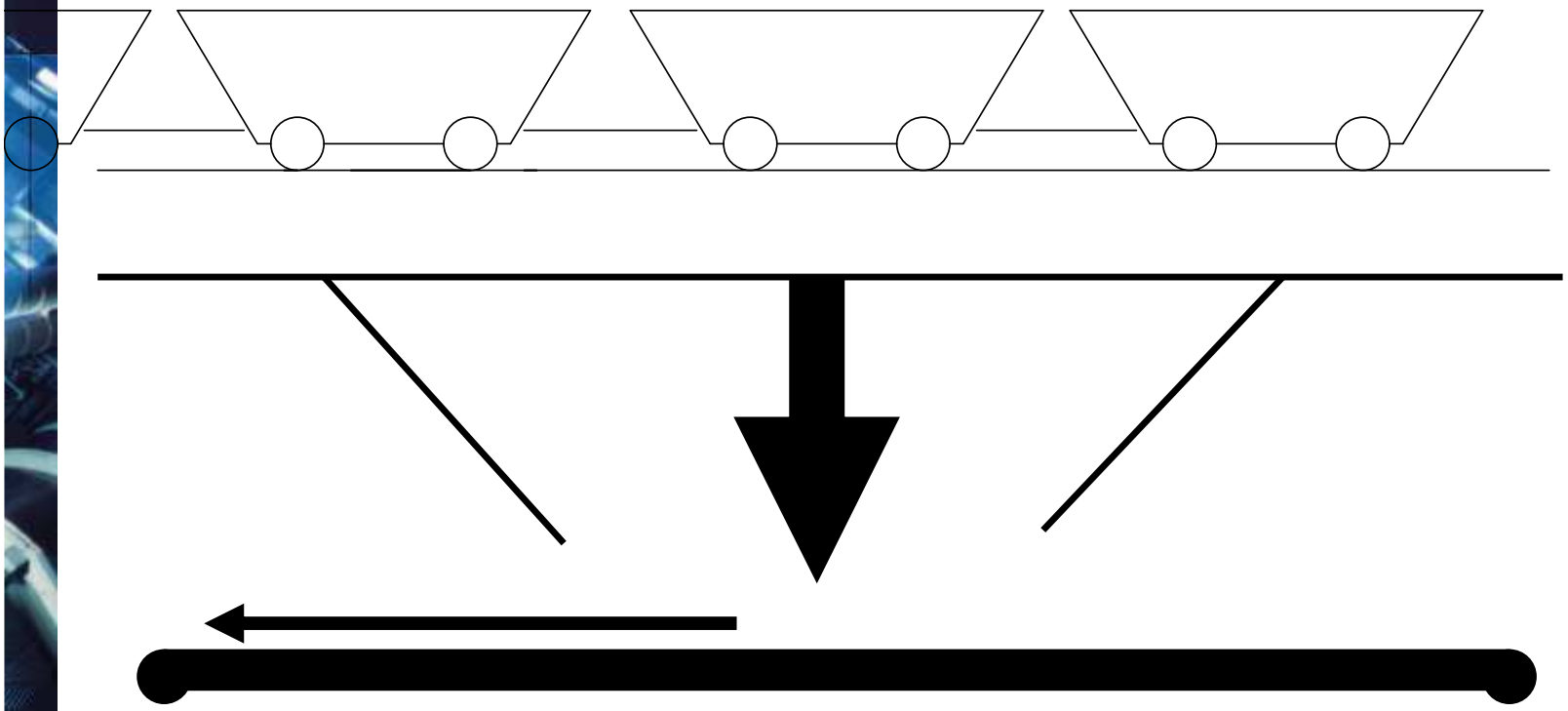
The challenge.

Move from React to Prevent to Continuous improvement.



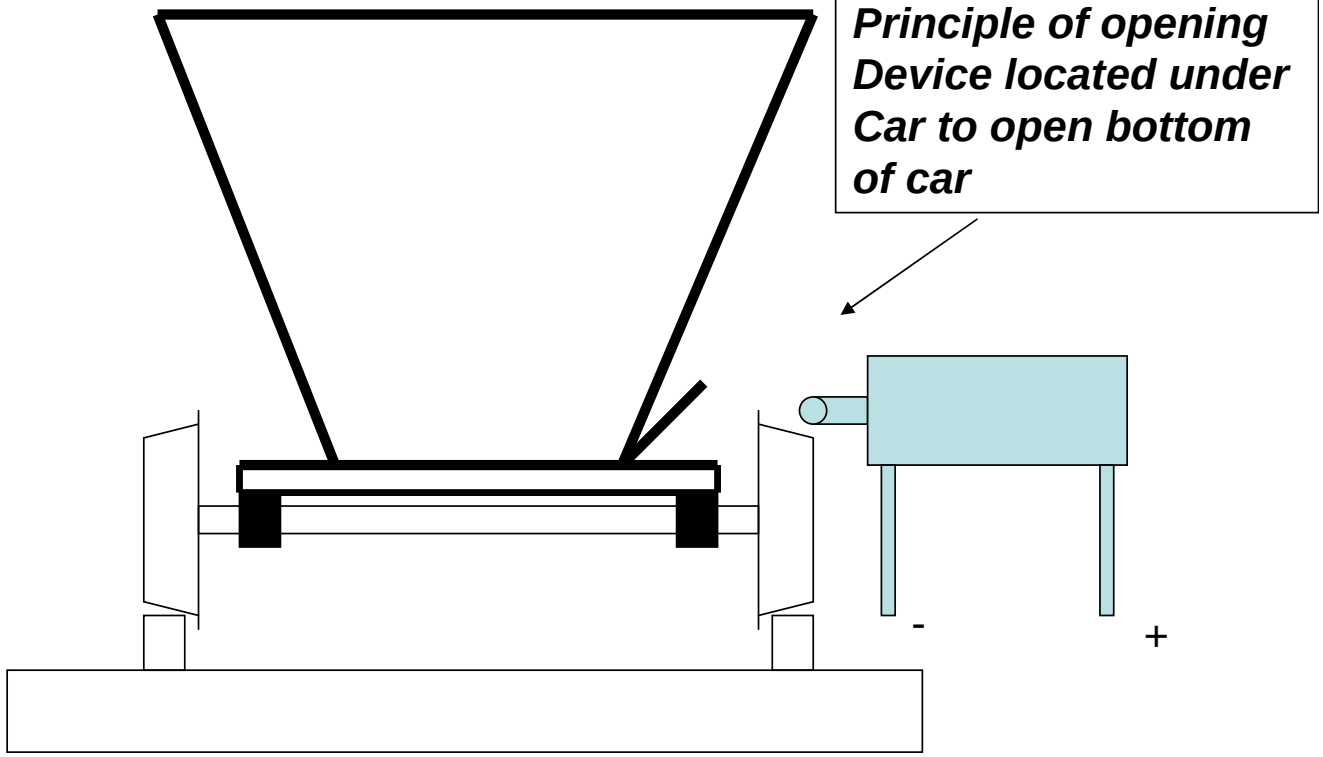
Case Study
Financial Impact of better Planning and Scheduling

Iron Ore Downloading Station



Unplanned and Unscheduled Example

Problem: At 11:30 am operator calls and reports that unloading of railway car stopped.



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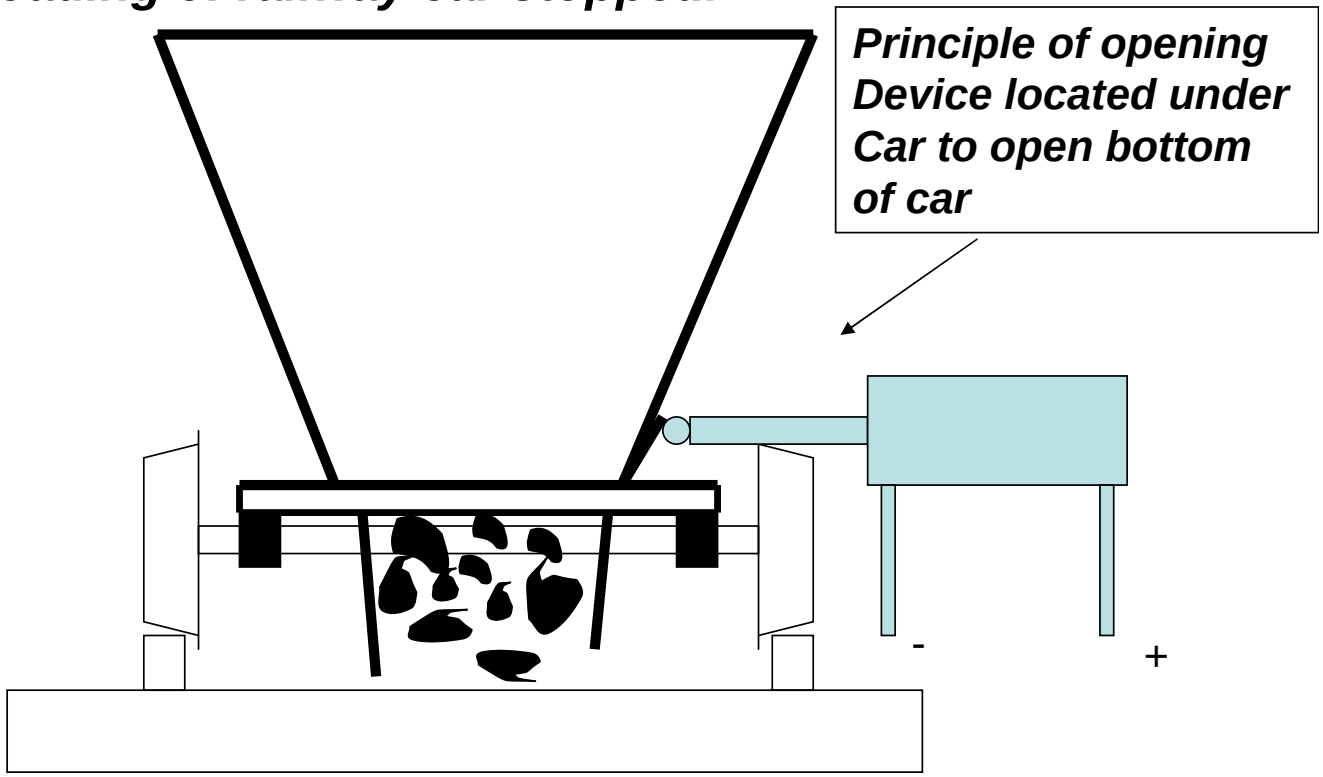
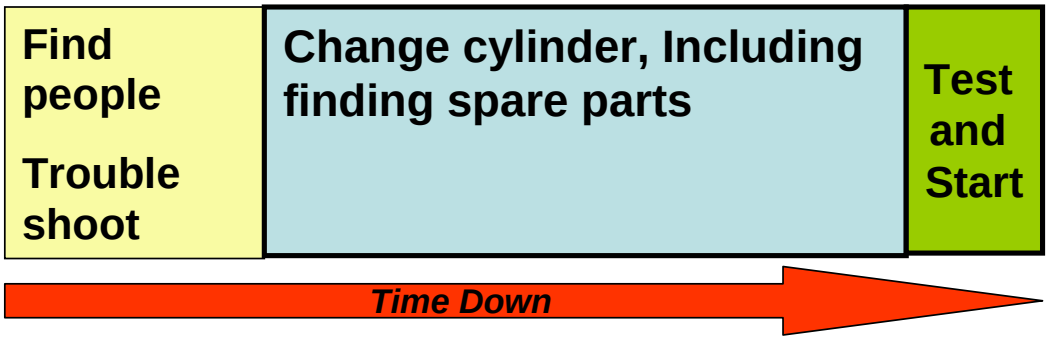
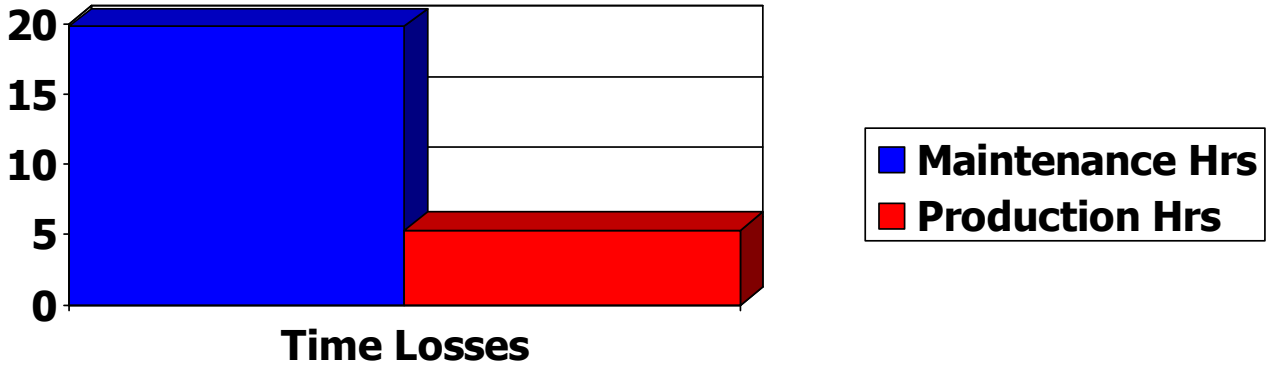


Unplanned and Unscheduled Example

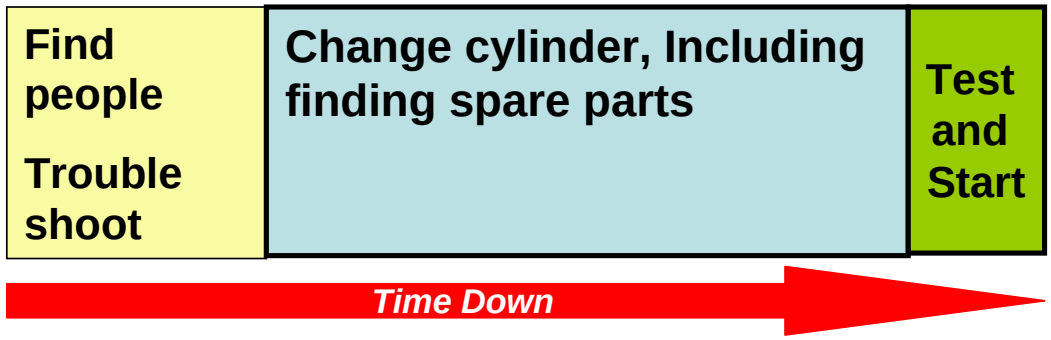
Time	*Activity*	Minutes
11:30	Unloading stops, Operator calls maintenance	2 x 10
11:50	Two mechanics and one electrician arrives	3 x 20
11:50	Trouble shooting starts	
12:40	Finds that pressure OK. Cylinder moves only half way. Cylinder hot.	3 x 50
12:50	Decides to change cylinder because of internal leak. Calls store to find out if they have a spare cylinder. Name plate missing. Equipment record is missing data on type of cylinder. Store sends three possible choices of cylinders Start disconnecting cylinder after locking out hydraulic system.	5 x 40
13:30	One more mechanic is called to get the right tools including rigging tools.	
14:45	Cylinder removed	4 x 75
16:10	New cylinder in place	4 x 85
16:50	Unlock, remove air from system, start up and test completed	4 x 30
Time Down	5 Hrs and 20 Minutes	
	Maintenance Hours 19 Hrs and 50 Minutes	

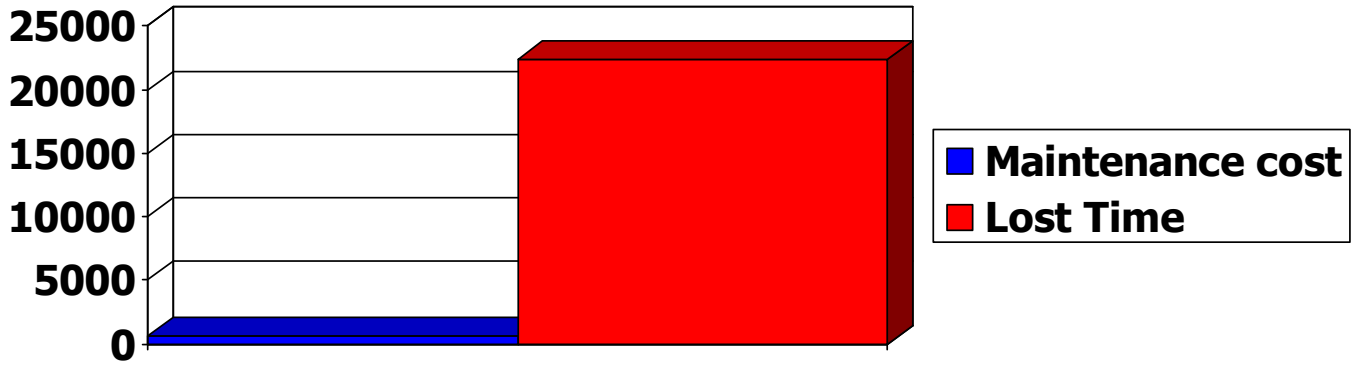
Unplanned and Unscheduled Example





Unplanned and Unscheduled Example



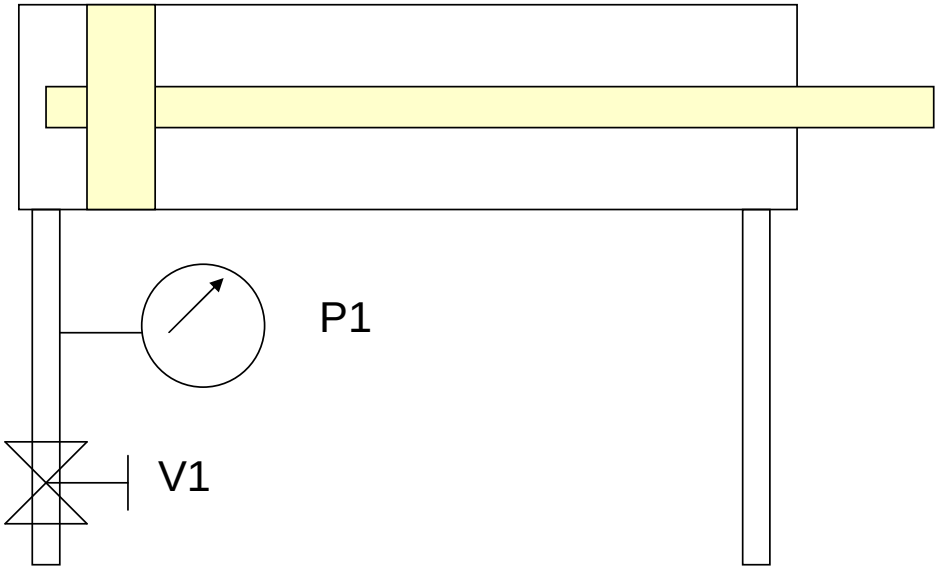


We can reduce Down Time to Zero and reduce maintenance cost by 50%.

Maintenance Prevention:
Root Cause Problem Elimination.
Filtration, Hydraulic Fluid Temperature.

Preventive Maintenance:
1.Inspect Cylinder Weekly
for internal leakage.

Inspect Cylinder



1. Operate the piston to minus position

2. Close valve V1. If pressure P1 increases the cylinder is leaking.

1. ***Inspect Cylinder Weekly for internal leakage.***
2. ***Plan replacement of cylinder.***
3. ***Document and save plan.***
4. ***Schedule replacement when unloading station is available.***

New Scenario

- ***Operator inspects cylinder as part of his/her work – Cost = "0"***
- ***Planning replacement of cylinder four hours $40 = $160. Job plan will be documented and saved.***
- ***Organized store delivery of parts one hour = $20.***
- ***Two people will replace cylinder safely in two hours = $240.***

•Total Maintenance Cost $420.

New Scenario

- ***Before: Maintenance costs = $800.***
- ***After : Maintenance costs = $420.***
- ***Maintenance Cost Savings: $380 = 48%***
- ***Reliability savings = $22,386 = 100%***