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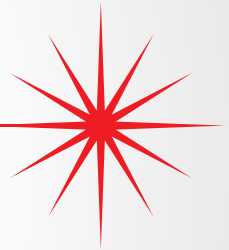

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Keynote

10 Rights of Asset Management

by Ramesh Gulati,
CRL, CAMA, CMRP, CMRT

Asset Management & Reliability Specialist, Jacobs

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Agenda

- What's Asset Management
- Defining Key terms
- Asset Life Cycle Phases
- Overview of key Best Practices - 10 Rights of AM
- Lessons Learned & Conclusion
- Q/A

Safety Moment

Safety Moment:

Are we learning and making workplace safer?

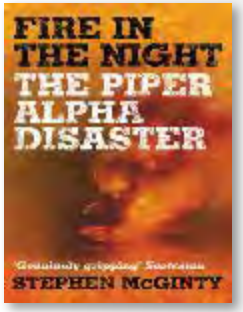
Every industrial accident provides an opportunity to work better, smarter and safer

Accident Report and Learning

It concluded that the initial condensate leak was the result of maintenance work being carried out simultaneously on a pump and related safety valve. The inquiry was critical of Piper Alpha's operator, Occidental, which was found guilty of having inadequate maintenance and safety procedures, but no criminal charges were ever brought against the company.

Key Learnings:

- Lack of proper procedures – LOTO
- Inadequate communication
- Flaws in the design guidelines and practices
- Misguided management priorities
    - tradeoffs between safety and productivity
- Human errors – lack of training
- etc.



The second part of the report made 106 recommendations for changes to North Sea safety procedures

37 recommendations covered procedures for operating equipment, 32 the information of platform personnel, 25 the design of platforms and 12 the information of emergency services

Ramesh Gulati

49 plus … years in industry

- Maintenance & Reliability and Operations Management
- Asset Management – Life Cycle Management
- Process Improvement – Design/Development
- Change Management – Creating culture of reliability, sustainability & safety
- Certified Professional – CMRP, CMRT, CRL, CRE, CAMA

Currently at Jacobs' Asset Management Group, Tullahoma, TN

AEDC/ATA-Jacobs – Arnold Engineering Development Complex, TN (1983-2016)

- Asset Management & Reliability Planning, Manager
- Reliability/Maintenance/Industrial Engineering Manager
- 30 plus years

Before AEDC (1964-1983)

- Carrier A/C (TN)
- True Temper Corp. (Ohio)
- Bethlehem Steel, Burke Steel (NY)
- Heavy Engineering Corp./Foundry Forge Plant

Heavily involved with Industry/Societies

- AMP and IMC/Reliability Web
- SMRP – Society for Maintenance & Reliability Professionals
- Reliability & Maintenance Center (RMC)/UT Knoxville
- IIE/ASQ/NASA – OMFIT/USAF – reliability council
- **Member US TAG – PC 251/ISO 55000 Asset Management**
- **Member US TAG – PC 56/Dependability**

Awards – Misc.

- **"2014 CMRP of the Year"**
- **Winner of 1st Prize – GOLD book Award** at RGVA@ MARTS (Maintenance Technology) 2011
- **Best Paper Award at Reliability 2.0** (2013)
- US Patent holder

Asset Management – M&R Professional/Reliability Sherpa – Change agent

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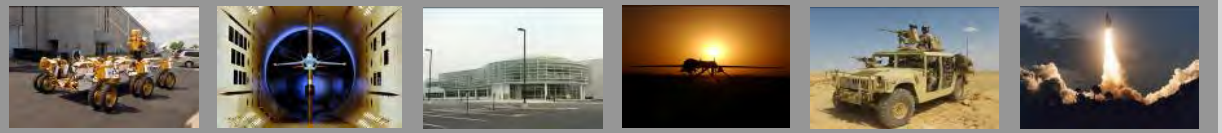
Jacobs at a Glance

- **One of the world's largest and most diverse providers of A&E, design/build, CM, and engineering/scientific services**
- **70 years old, now employing more than 65,000 + personnel**
- **Annual revenues of nearly $~~13B~~ 16 B (CH2M)**
- **Markets – Line of Business**
  - Aerospace & Technology
    - National Government – NASA/DoD/DOE/ Telecommunication/etc.
  - Petroleum & Chemicals
    - Upstream/Downstream/ Chemicals
  - Buildings & Infrastructure
    - Transportation/Rail – Airports/Water/etc.
  - Industry
    - Life Sciences / Mining/ etc.
- **Absolute commitment to safety**



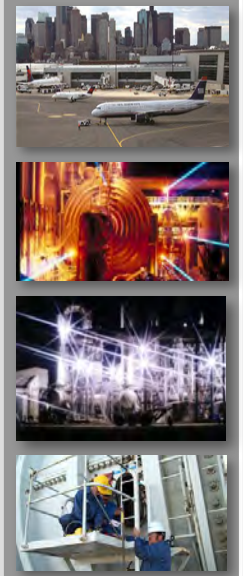
Jacobs is an Asset Management Company

"Cradle to Grave" Solution Provider

- Asset/Facility Planning
- Design
- Build/Project/Construction Management
- Install/Commission
- Operate and Maintain
- Decommission and Dispose

Asset Management Group

- Assessments – ISO 55000 + and Gap analysis
- Reliability and Operations Analysis
- Tailored training, etc.
- plus…



Best People….

Best People = Best Results

Best Informed (knowledgeable) People + Reliable Assets

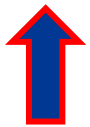
= Excellent Results

= Delighted Customer

= Repeat Business

Asset Performance – Reality

- **Assets – systems don't perform as expected**
  - don't meet designed/expected targets
  - cost too much – over budget (Capital Proj/major repairs – modifications) big **Value Leakage**
  - always late to agreed/scheduled dates
  - high O&M costs
- **In many organizations, "Fighting Fires (reactive maintenance)" is mode of operation**

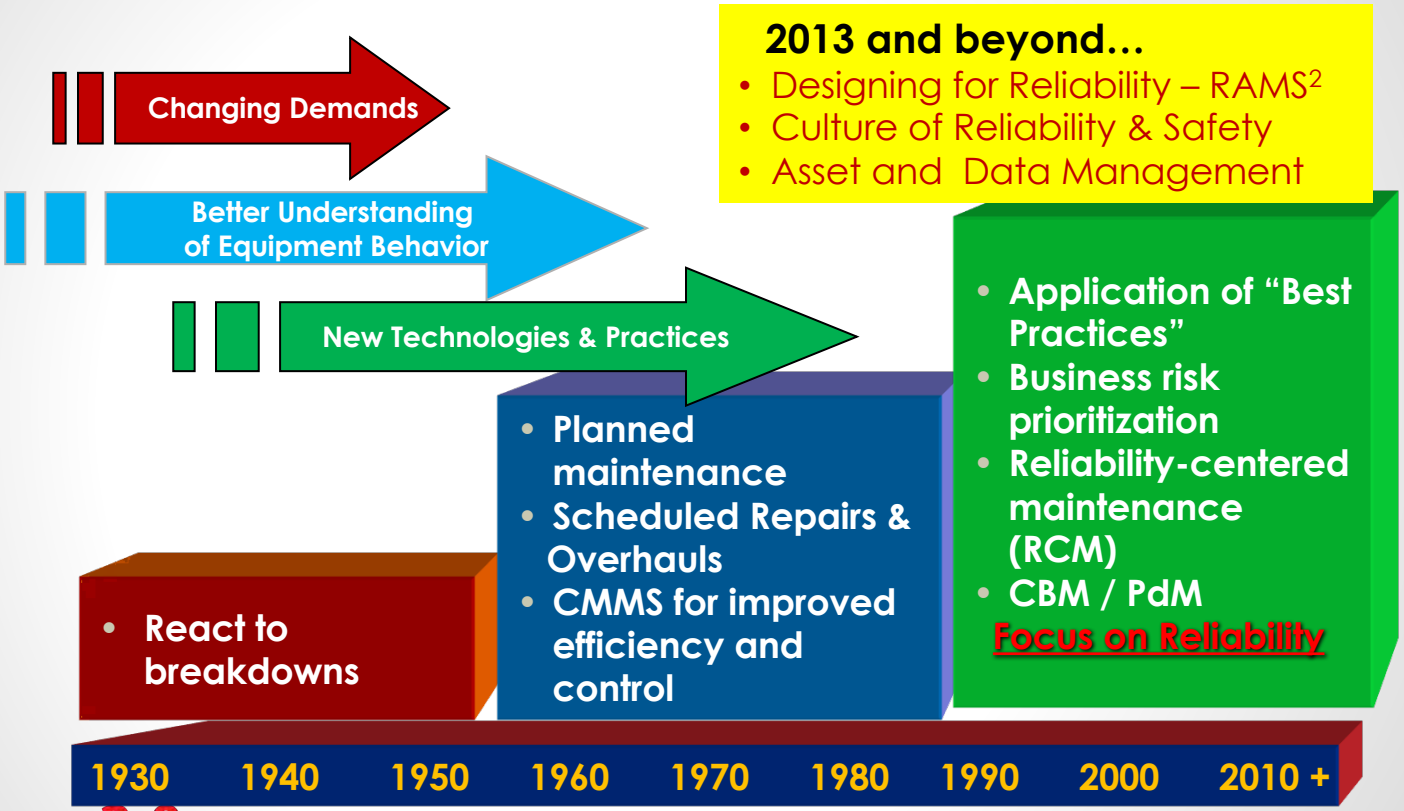
Total cost of ownership (TCO) 

(**TCO =** Asset acquisition cost + O&M costs for whole life)

If our assets – equipment are not reliable, not available when we need them, how can we make our customers (stakeholders) happy?

ASSETS are key in delivering value to our customers and PEOPLE make it happen !

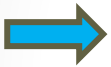
The Evolution of Maintenance…Reliability…AM



Transitioning to Reliability – to Asset Management

- **Focus is changing…**

  Maintenance

   Reliability

   **Asset Management**

Asset Performance – Expectations

- **Asset(s) deliver value when they**
  - Perform on demand (as scheduled)
    - at designed/demonstrated capability
    - producing quality products (or services)
    - at minimum total cost of ownership – TCO

- **Total Cost of Ownership (TCO):**
    - Acquisition cost
    - Installation cost
    - Operations & Maintenance (O&M) costs
    - Disposal costs

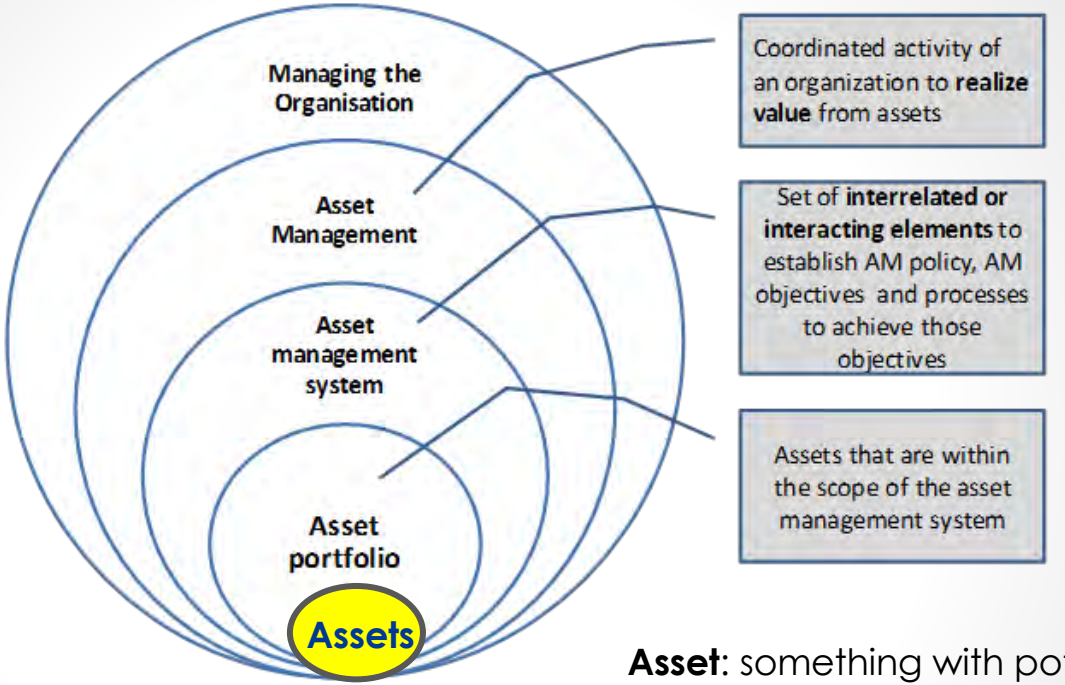
Something to ponder…

- How do we manage our assets?
- Do we have a system which manages asset based on its life cycle?
- Is that system (or process) effective –robust?
- What we need to do to get more value from our assets?

What's an Asset?

- **Something that has a value to the organization**
  - People (People are our greatest assets…)
  - $ (Financial instruments)
  - Material –inventory
  - Goodwill / brand
  - **Plant equipment –assets that generate value/income**

Asset and related Key Terms



Asset: something with potential or actual value to an organization

- Creates a value
- Has a responsibility to take care

Source: ISO 55000

Maintenance and Maintainability

- **Maintenance**
  - Fix it when breaks *(repair)*
  - To keep asset in operating condition

  Maintenance (new way)

  ✓ **Maintenance = Capacity Assurance**

  To ensure asset performs it's functions when needed

- **Maintainability**
  - Ease of maintenance
  - Design Attribute
  - Measured by MTTR

Reliability + Maintainability ~ (f) Availability

Reliability:

- Does it works when needed and does it do what it is supposed to do (function)?
- A probability function…. and for constant failure domain $R = e^{-\lambda t}$

Maintainability:

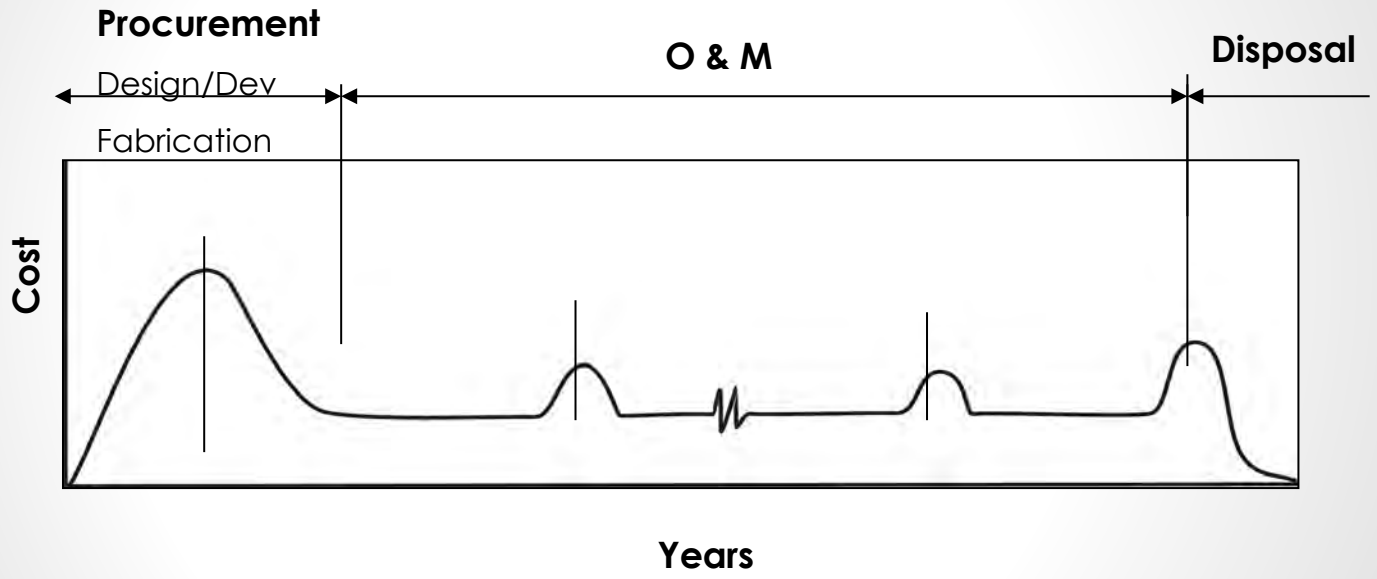
- Ease of maintenance

Availability:

- In simple terms, it may be stated as the probability that an asset will be in operating condition when needed
- Availability = Function of (Reliability & Maintainability)

$$\text{Availability} = \frac{\text{Uptime}}{\text{Uptime} + \text{Downtime}} \quad \textbf{OR} \quad \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}}$$

Asset/System Life - Cost Timeline



How do we maximize value from our assets?

How do we minimize the total cost of ownership?

How do we apply Asset Management Principles ?

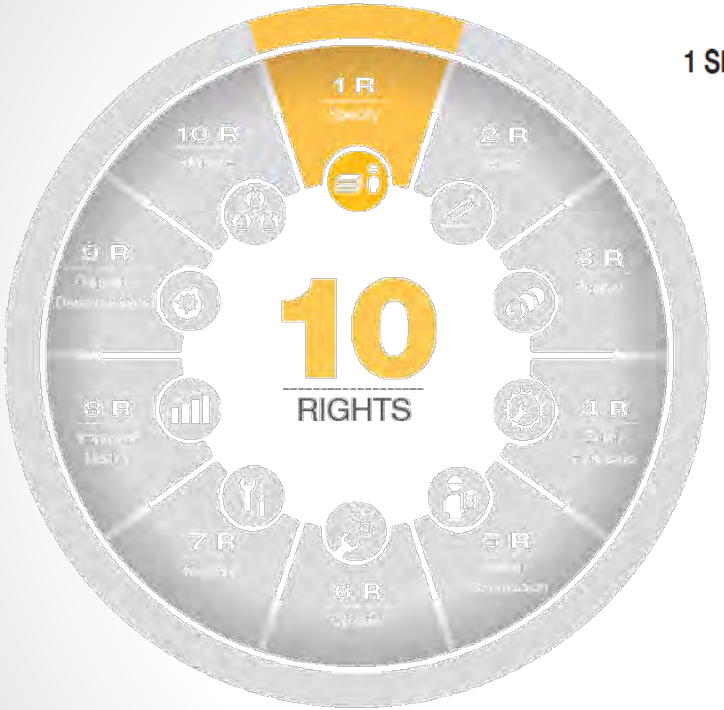
Possible Solution…

- Implement a "Value" based Asset Management strategy – **10 Rights of Asset Management** - Best Practices

Asset Life Cycle – 10 Rights of Asset Management

1. Specify It Right
2. Design It Right
3. Source It Right
4. Build/Fabricate It Right
5. Install/Commission it Right
6. Operate It Right
7. Maintain It Right
8. Improve/Modify It Right
9. Dispose/Decommission It Right
10. Manage It Right

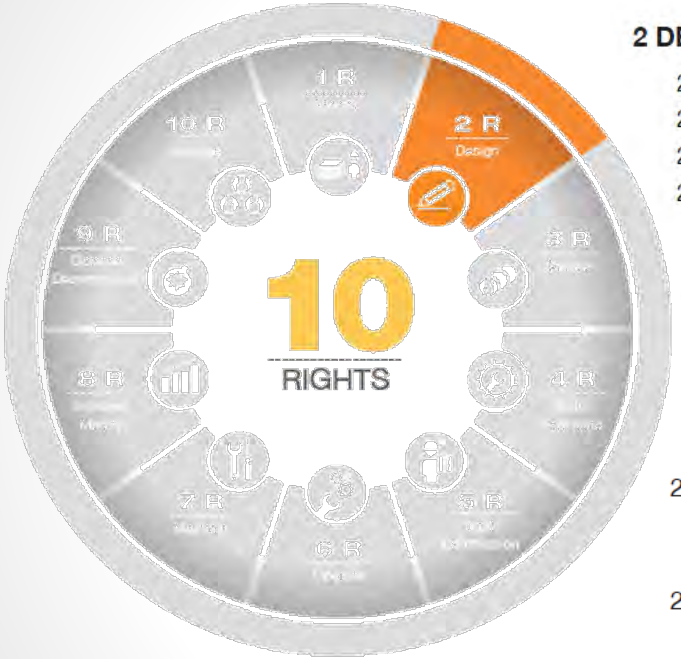
Specify It Right – 1R



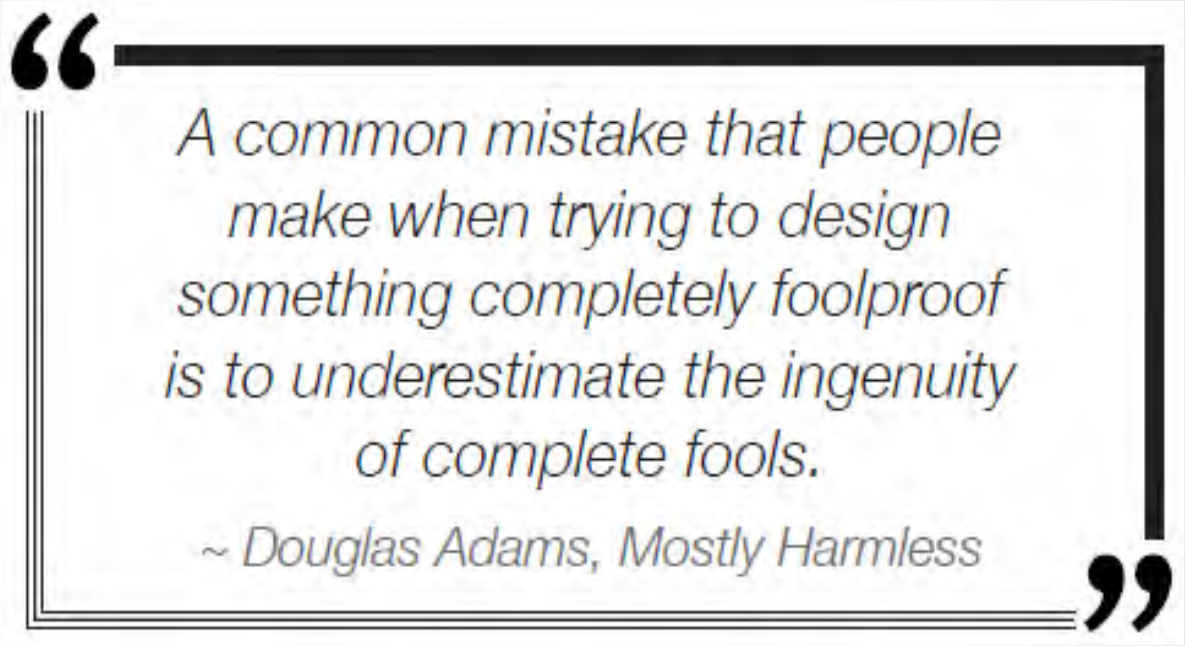
Specifications

- **Specifications are one of the most important part of purchasing – an asset/system/service/ commodity**
- **Preparation/writing for specification is probably the most difficult function**
- **Specification refers to :**
  - "Description of the characteristics of asset/product/ commodity/service required or desired."
  - Specifically, it is defined as the explicit requirements furnished with a solicitation upon which a purchase order or contract is to be based.

Design It Right – 2R



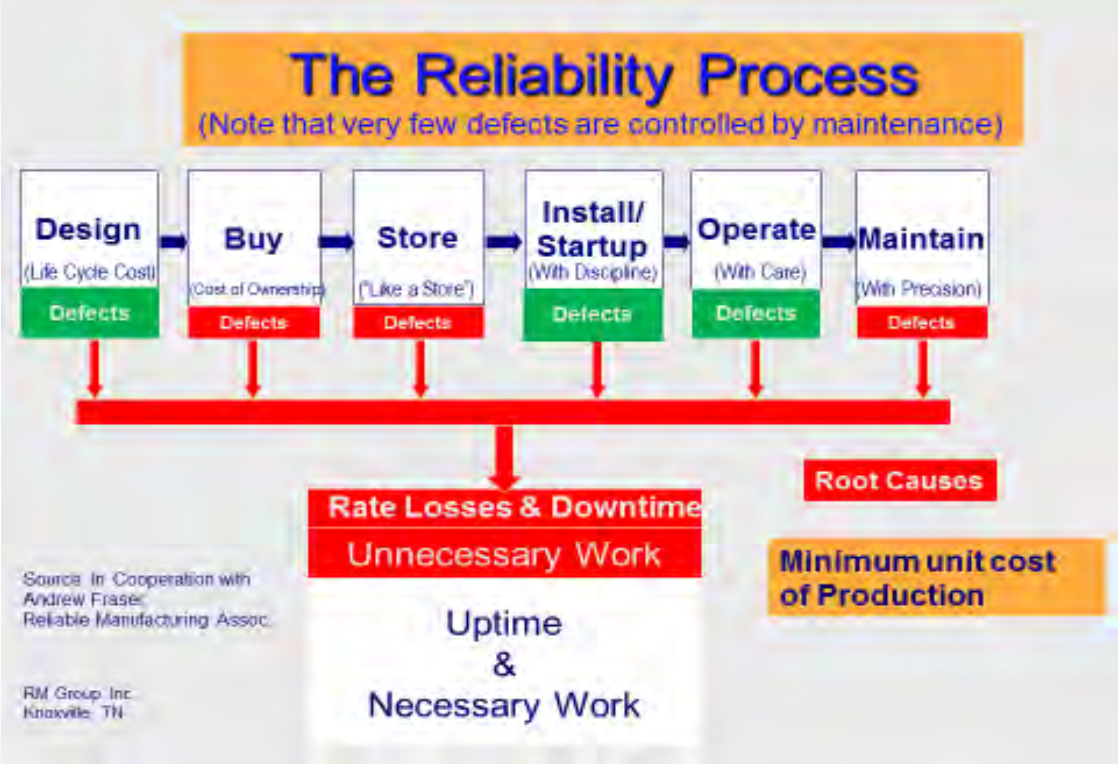
2 DESIGN IT RIGHT



Design a Major Issue for Asset Failures

- **“Poor Design” is one of the major contributors of failures in assets according to Ron Moore, a well-known Reliability Guru and author**
- **My own experience and working in various industry for 50 years indicates the same conclusion**
  - In last few years…had to spend considerable time with the designers and capital project managers as I was assigned to capital project group to improve reliability and maintainability of new design. It was a very challenging task as they are driven to meet cost and schedule.

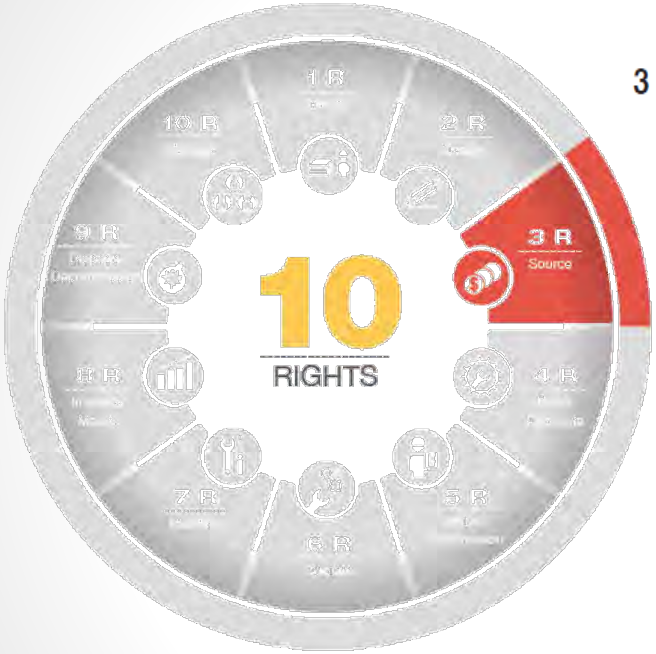
Design – a Major Defect/Failures Creator



" Design it not just what it looks like and feels like. Design it how it works"

– Steve Jobs

Source (Purchase) It Right – 3R

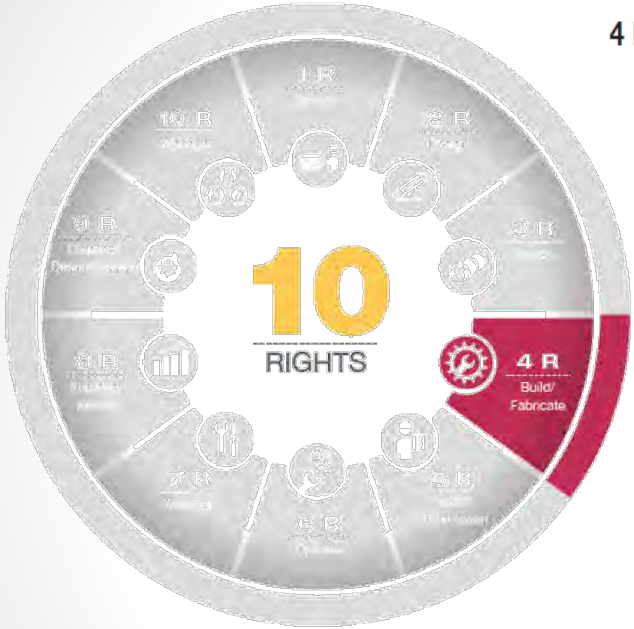


3 SOURCE IT RIGHT

Importance of Right Sourcing (Procuring)

- **Are we buying "Best Value" or "Lowest Cost" products or services?**
- **What's "Best Value"?**
  - Example bearings, "O" rings/Oil seals
  - Examples – services
    - "Are we good in everything we do?"

Build / Fabricate It Right – 4R



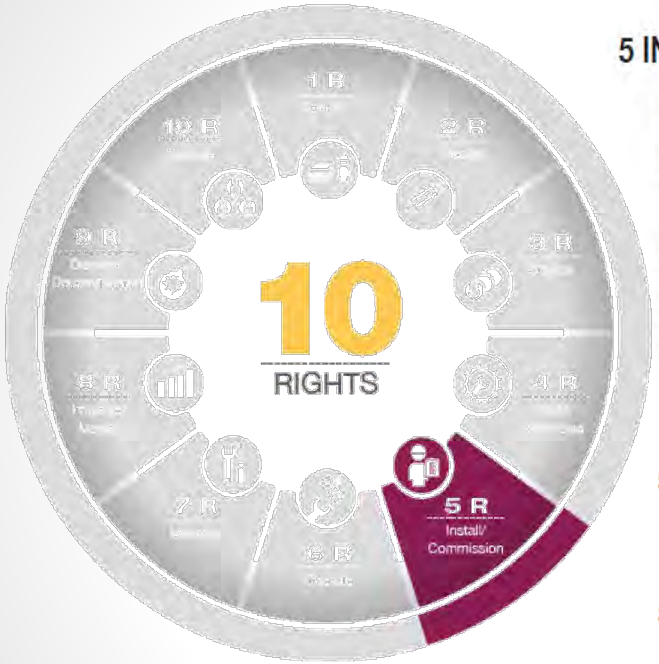
4 BUILD IT RIGHT

Building / Fabrication issues

Causes of early failures

- Inadequate design
- Use of inferior parts/components
- Poor shop practices
    - Poor – bad weld or solder joints
    - Seals leaking
    - Incorrect positioning of parts (incorrect assembly)
    - Surface contaminations
- Lack of standard practices
- Poor – lack of quality control
- Poor workmanship
- Transportation damages
- Etc.

Install/Commission It Right – 5R

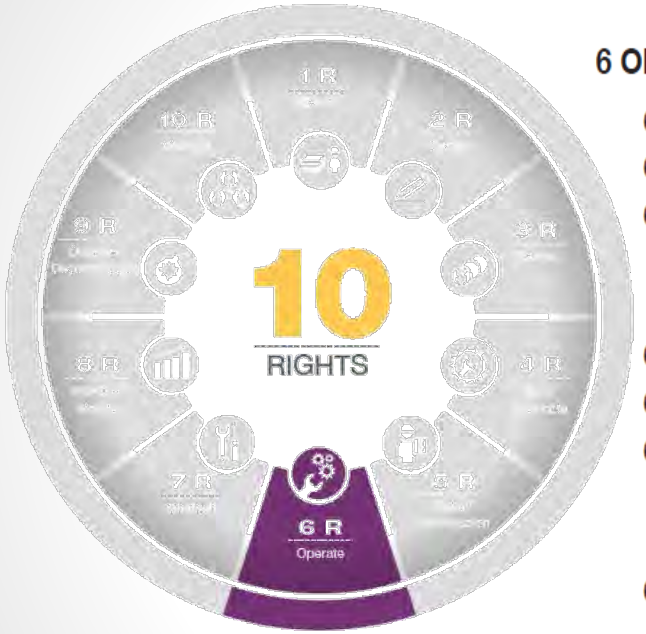


5 INSTALL /COMMISSION IT RIGHT

Install It Right – Best Practices

- **Space requirements**
- **Floor and foundations**
- **Leveling and alignment**
- **Installation documentation**
- **Commissioning**
  - internal/external
- **Fixing issues**
  - who
- **Acceptance plan**
- **etc.**

Operate It Right – 6R

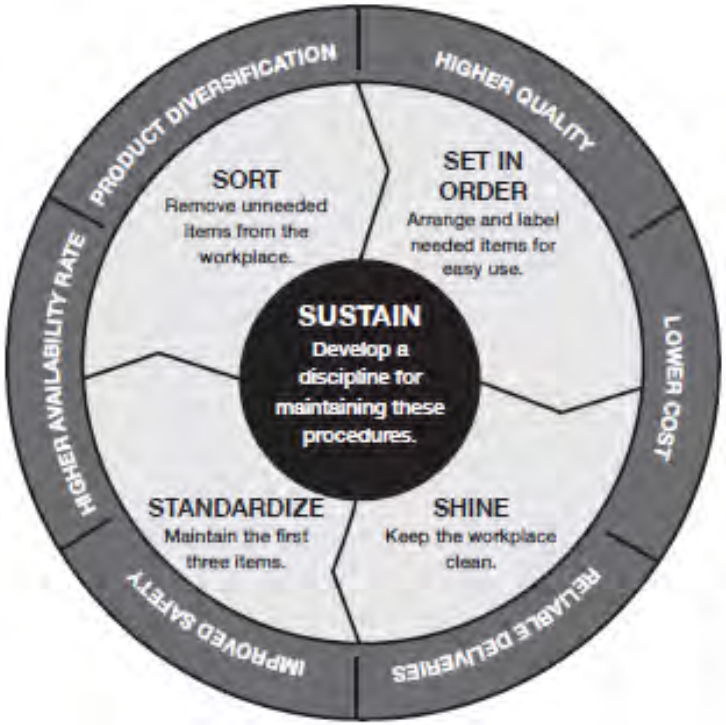


6 OPERATE IT RIGHT

Operating Environment

- **Several studies indicated > 40% of failures directly result from operational errors or unsuitable operating conditions.**
  - Failures due to faulty inherent design can also be minimized or eliminated if operators understand the asset and how its operation affects overall performance.
  - Operators must feel responsible for proper operation of assets under their control because they sense if something is wrong or abnormal about that asset's operation.

Workplace Design – 5 S



S1 Sort (Seiri)
S2 Set in Order (Seiton)
S3 Shine (Seiso)
S4 Standardize (Seiketsu)
S5 Sustain (Shitsuke)

Maintain It Right – 7 R

7 MAINTAIN IT RIGHT

7 R – Maintain It Right

- **Maintenance**
  - Types of maintenance
- **Workflow process**
  - Planning
  - Scheduling
- **MRO storeroom**

Goal: To minimize failures and if it fails, bring it back to operations as quickly as possible

Maintenance Approaches/Types

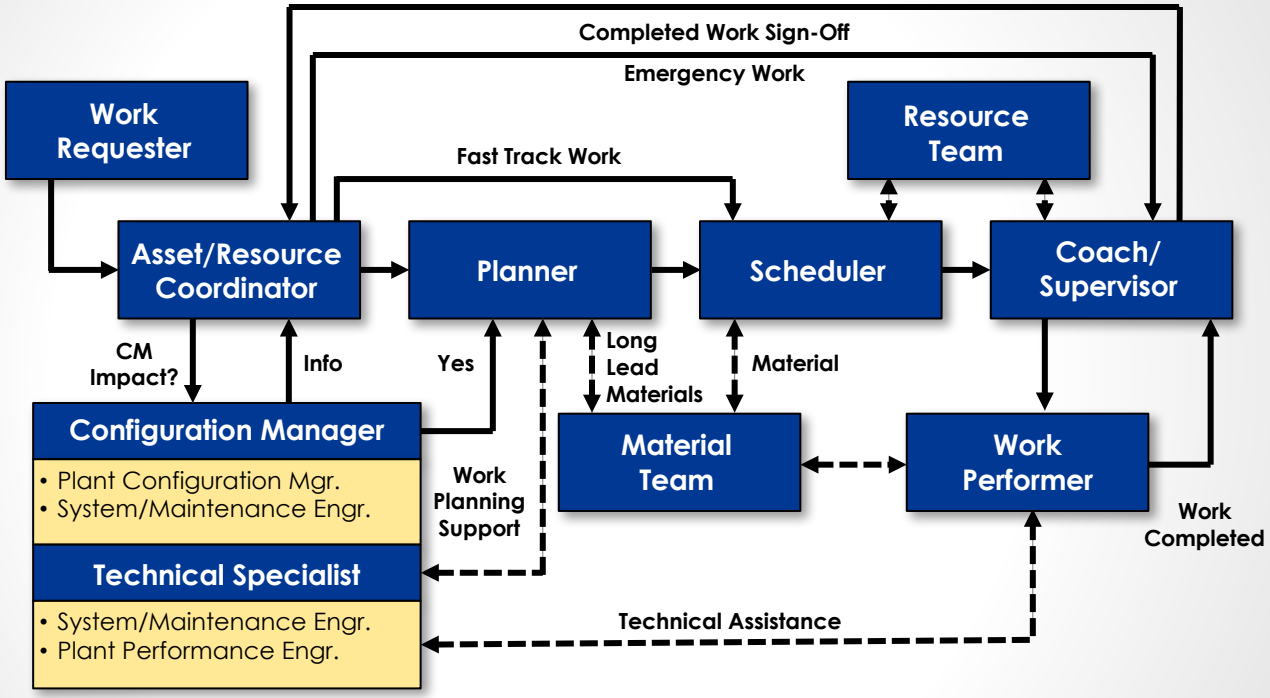
- Condition Based Maintenance (CBM)/Predictive Maintenance (PdM)
- Preventive Maintenance (PM)
- Proactive Maintenance
- Corrective Maintenance (CM)/Run-to-Failure (RTF)

Planning and Scheduling

- Work planning = **What** and **How**

- Work Scheduling = **Who** and **When**

Work Flow Process with Roles



What is Reliability Centered Maintenance (RCM)?

Logic based decision analysis process used to optimize an effective preventive maintenance program on systems/equipment.

Focus: Preserve system function

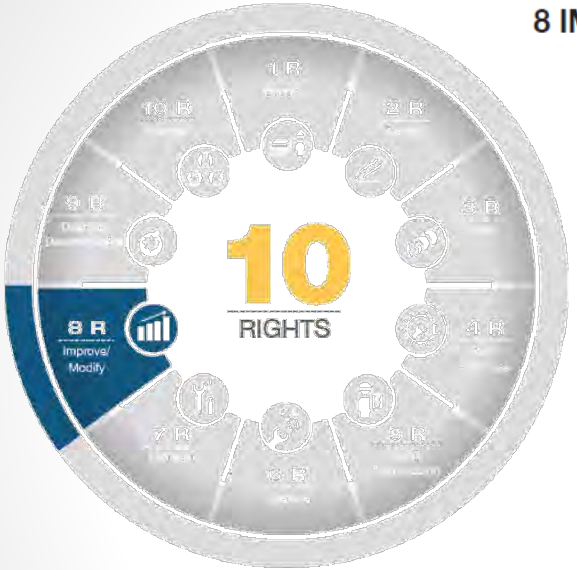
Goal: Optimize total Maintenance Costs, decrease downtime and increase system availability

Total Maintenance $ = CM + PM

PM Effectiveness

- **How do we measure PM effectiveness?**
- **How good are your PM procedures/work instructions?**
  - Are they catching things?
  - Is Lost time/downtime going down?
  - How often you review them?

Improve It Right – 8 R



8 IMPROVE IT RIGHT

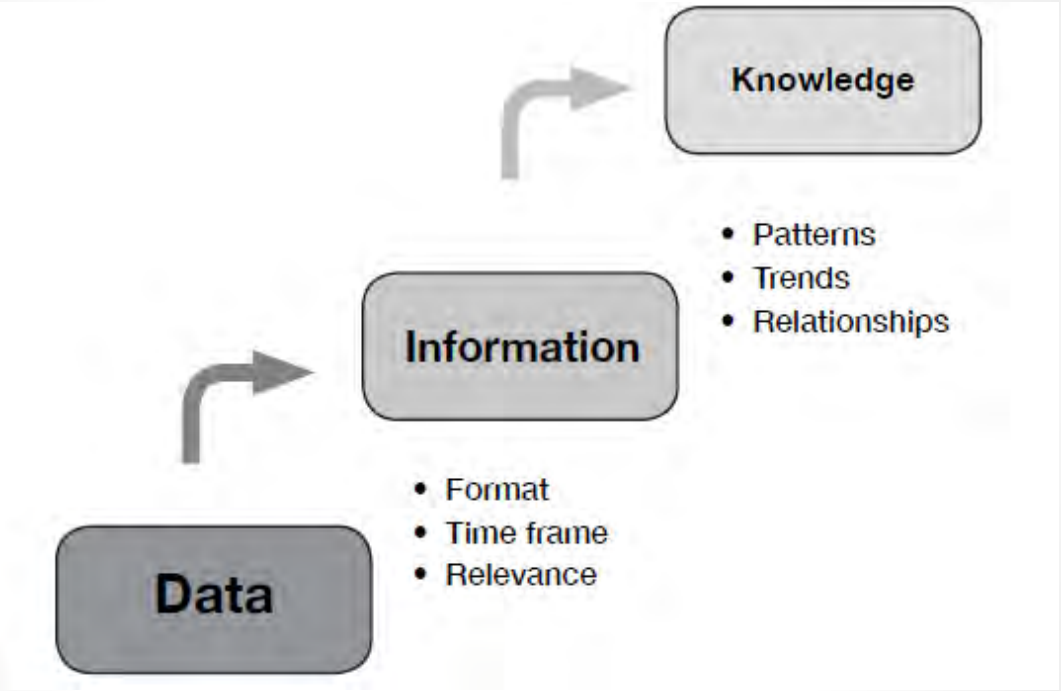
"Every problem is an opportunity."

– Kilchiro Toyoda, Founder of Toyota

In GOD we trust,
all other must bring DATA

– W. Edwards Deming

Data…Information…Knowledge



Problem Solving Tools

Control Charts

5 Whys

Cause Mapping

Value Stream Mapping

Root Cause

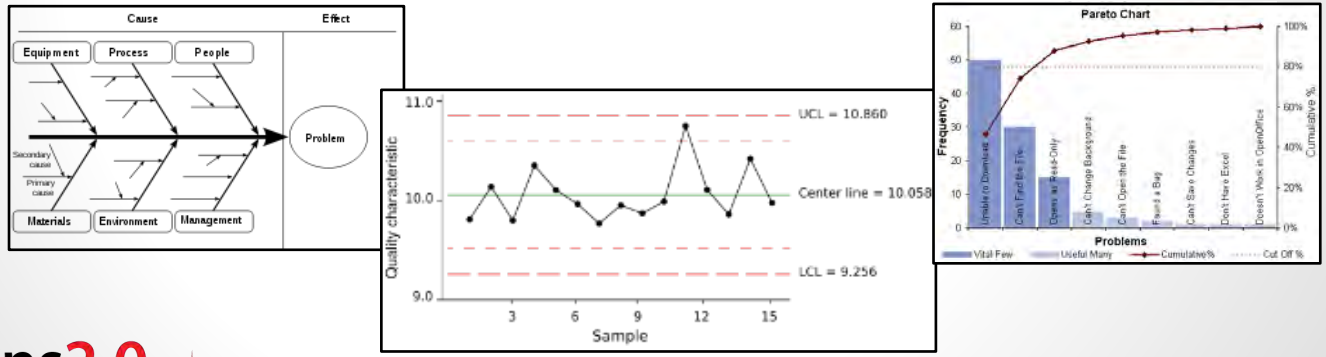
Fault Tree

Barrier Analysis

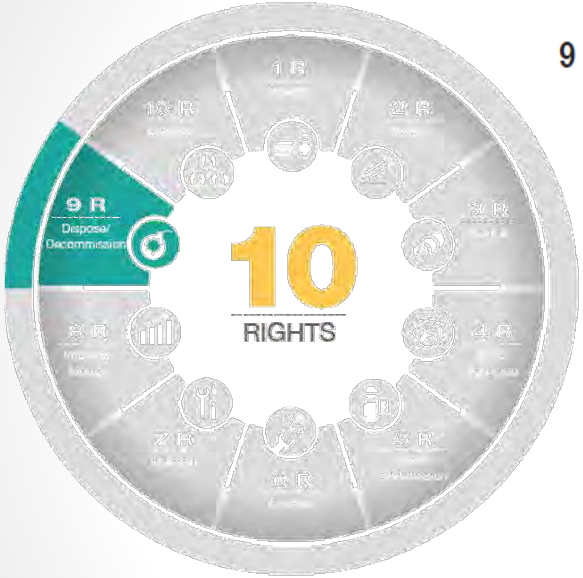
- Failure Modes
- Design of Experiments
- Statistical Analysis
- Six Sigma
- Mistake Proofing
- DMAIC

- Scatter Diagram
- Stratification
- Theory of Constraints
- Deming PDCA
- Pareto Analysis
- Histogram
- Flow Chart

So many Tools/Techniques, which one to choose…which one right for my application



Dispose/Decommission It Right – 9 R



9 DECOMMISSION / DISPOSE IT RIGHT

Importance of Dispose It Right

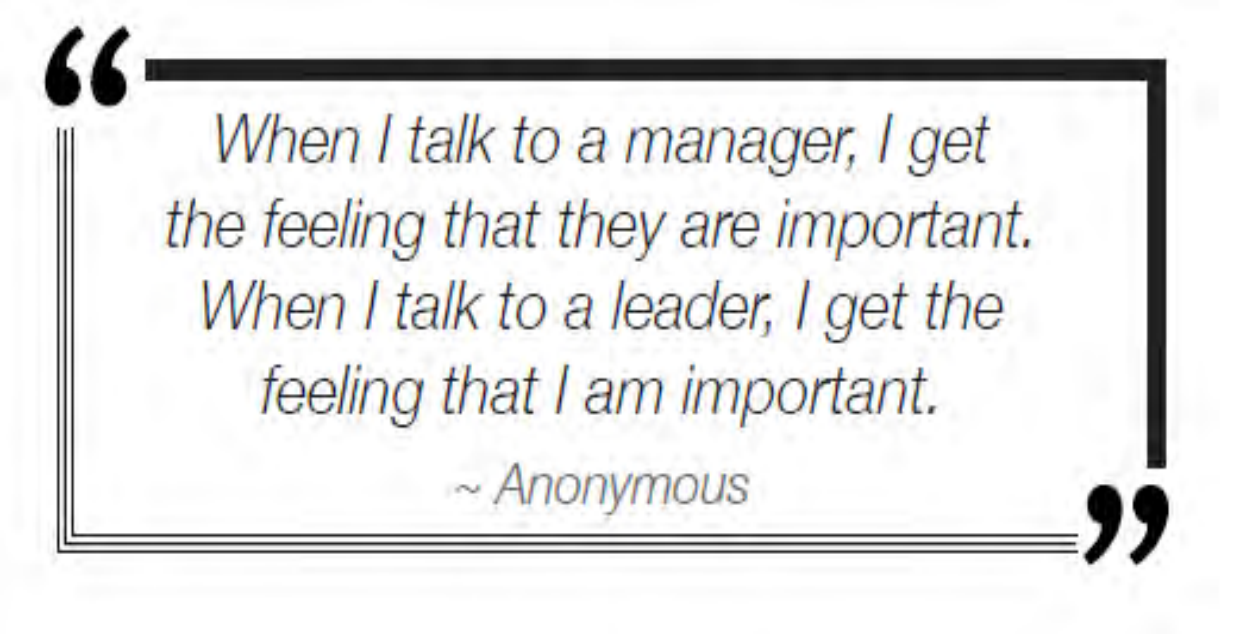
- **1st principle: Dispose what we don't need**
  - No clutter – improves safety and efficiency
  - If we may need it, store it properly – in right manner
- **2nd principle: Dispose it right – properly considering**
  - Environment (sustainability)
  - Safety
  - Security (data)

Manage It Right – 10 R

10 MANAGE IT RIGHT

Manage It Right

- The Right People
- The Right (Robust) process
- The Right Technology



Asset Management Related Standards

- **ISO's – Management & Leadership Standards**
  - ISO 9000 Quality Management
  - ISO 14000 Environment Management
  - ISO 26000 Social Responsibility
  - ISO 27000 Information Security
  - ISO 31000 Risk Management
  - ISO 45000 OH&S Mgmt. system (to be released 12/17)
  - ISO 50001 Energy Management
  - **ISO 55000 Asset Management**
  - ISO 14224 Taxonomy – standardized codes etc.
- **OHSAS (18001) Safety and Health**

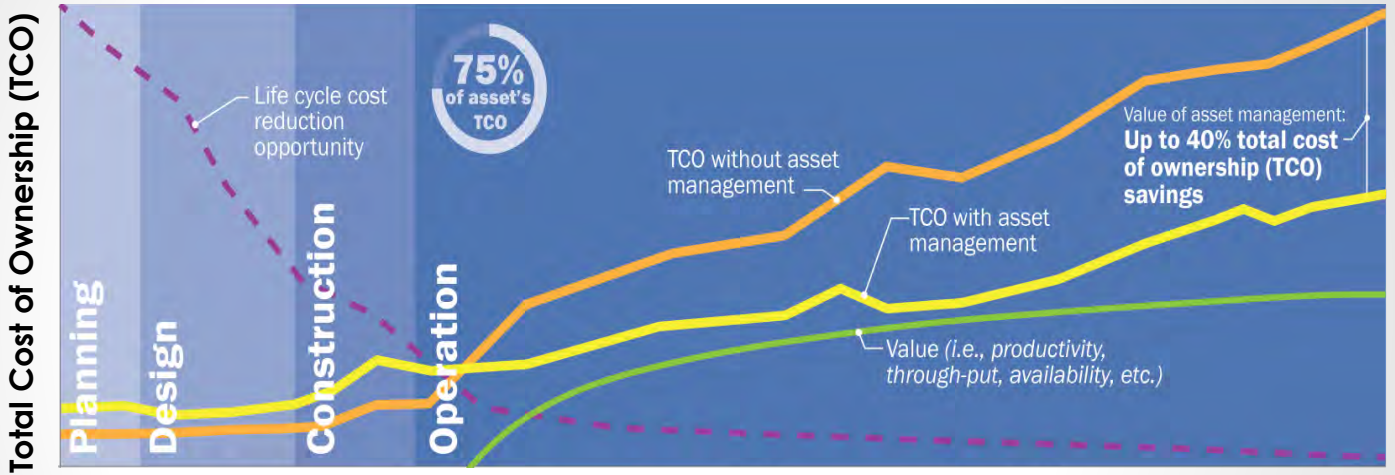
Challenges/Lessons Learned

- **When things break, we (Maintenance) always in pressure to fix quickly**
  - No time to analyze and find root cause and then take corrective action
  - Availability of good (quality) data
- **Lack of a robust maintenance – AM process**
- **Don't get involved (or too late) in asset development phase**
- **Don't have enough resources to do a good job in installation /commissioning phase**
- **Lack of skilled workforce**
- **Etc.**

Doing 10 RIGHT Things…

1	**Specify It Right** – provide the right requirements and specifications;
2	**Design It Right** – design it with RAMS² to minimize failures and O&M costs;
3	**Source It Right** – purchase best value components and equipment (assets);
4	**Build It Right** – fabricate and assemble the asset with quality workmanship;
5	**Install/Commission It Right** – install with precision quality;
6	**Operate It Right** – operate with care and safety within its design limits;
7	**Maintain It Right** – perform the right maintenance;
8	**Improve It Right** – apply the right tools and practices to improve;
9	**Dispose of/Decommission It Right** – dispose of it in an environmentally safe manner;
10	**Manage It Right** – ensure the right skill and talent available at every role to do all 10 Rights right.

Impact of Asset Management (AM) on TCO



Conclusion

- **Organizations exist to :**
  - Deliver value to its customers
  - Fulfill its mission
- **Asset(s) play key role in delivering value**
  - Producing products or providing services
    - delivering on time
    - at reasonable/affordable cost
- **Unreliable assets can't deliver value**
  - Practices such as JIT, Lean etc., are unsustainable w/o AM
- **Application of Standards such as ISO 55001 make processes:**
  - Robust, Reliable, Productive, and Safe
  - Streamline, and Uniformity across organization/enterprise

Standards are Best Practices ...implement them to have business success

- **Establish Asset Management (AM) Process by Implementing 10 Rights of AM**

10 Rights of Asset Management *

1. Specify It Right
2. Design It Right
3. Source It Right
4. Build/Fabricate It Right
5. Install/Commission it Right
6. Operate It Right
7. Maintain It Right
8. Improve/Modify It Right
9. Dispose/Decommission It Right
10. Manage It Right

Authors: Ramesh Gulati and Terrence O'Hanlon

Questions?

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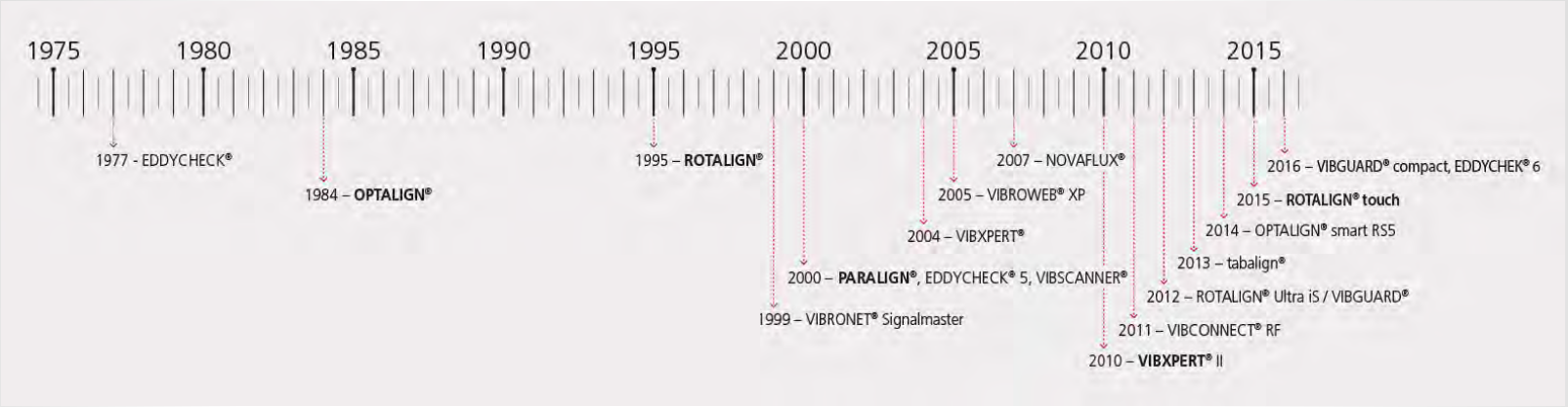
Creators of laser shaft alignment



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Accurate Shaft Alignment

- Allows machines to operate optimally within their design limits
- Extends machine availability with increased MTBF
- Leads to reduced vibration thereby protecting facility assets and improving product quality

Cost savings include :

- Reduced bearing and mechanical seal repairs
- Reduced labour costs related to these repairs
- Reduced power consumption

The ROTALIGN touch

- Cloud enabled alignment approach makes the alignment process an integral part of asset management
- RFID tagging allows unique identification of each machine and opening of the correct file
- Onboard camera allows for integrated documentation of visual defects and machine status

ROTALIGN touch Computer

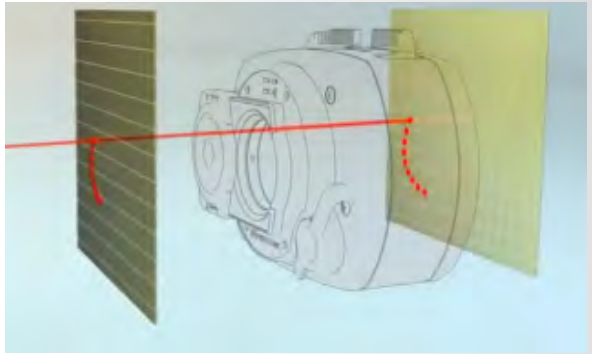
Built to withstand the most severe environments

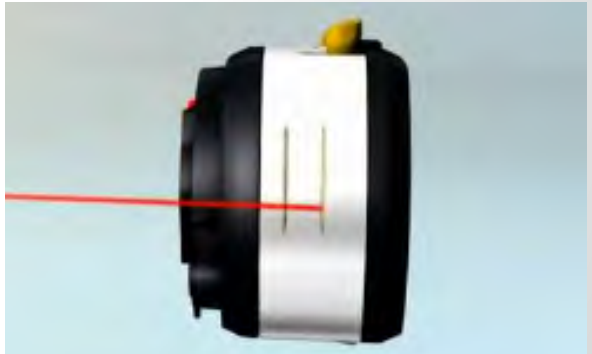
- Capacitive, glove-enabled touch screen
- Strengthened gorilla glass screen
- IP65 rated
- Rechargable Li Ion battery
- Sliding cover for connectors
- USB Host connector (PC/USB Stick)

ROTALIGN touch sensALIGN heads

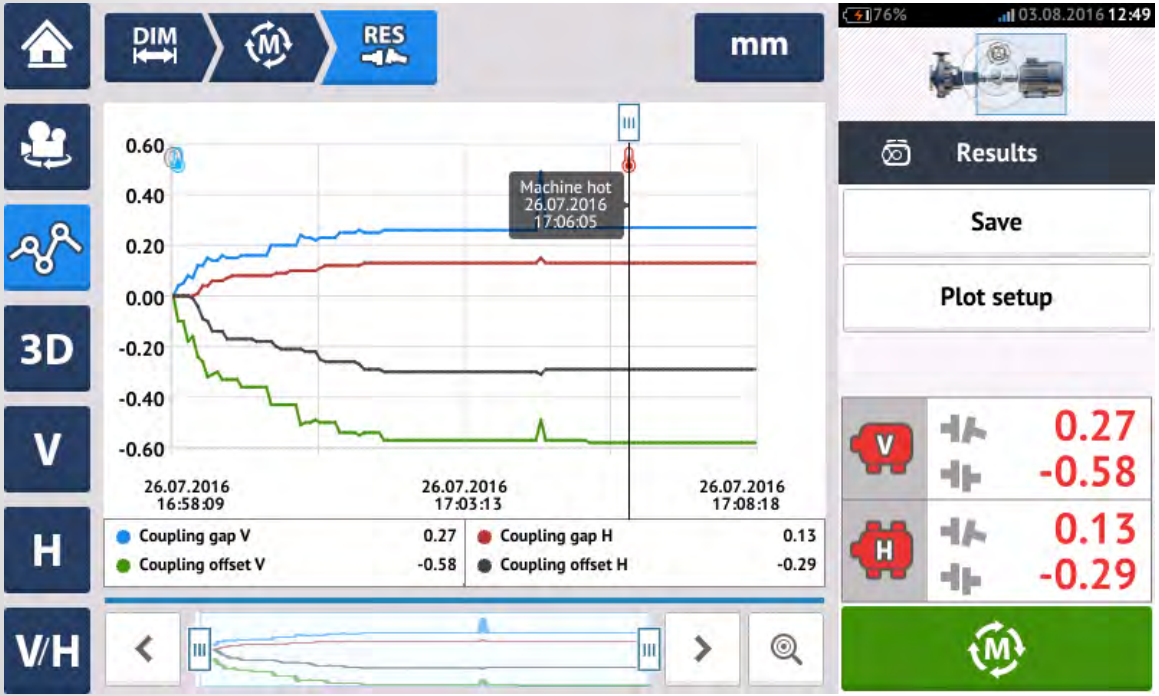
The sensALIGN heads - with built-in intelligence

- XXL detector size and high-definition Position Sensitive Detectors (PSD) – gross misalignment can be handled at any distance irrespective of coupling length
- Built-in precision MEMS inclinometers provide accurate rotational angle and accounts for excessive adjacent vibration



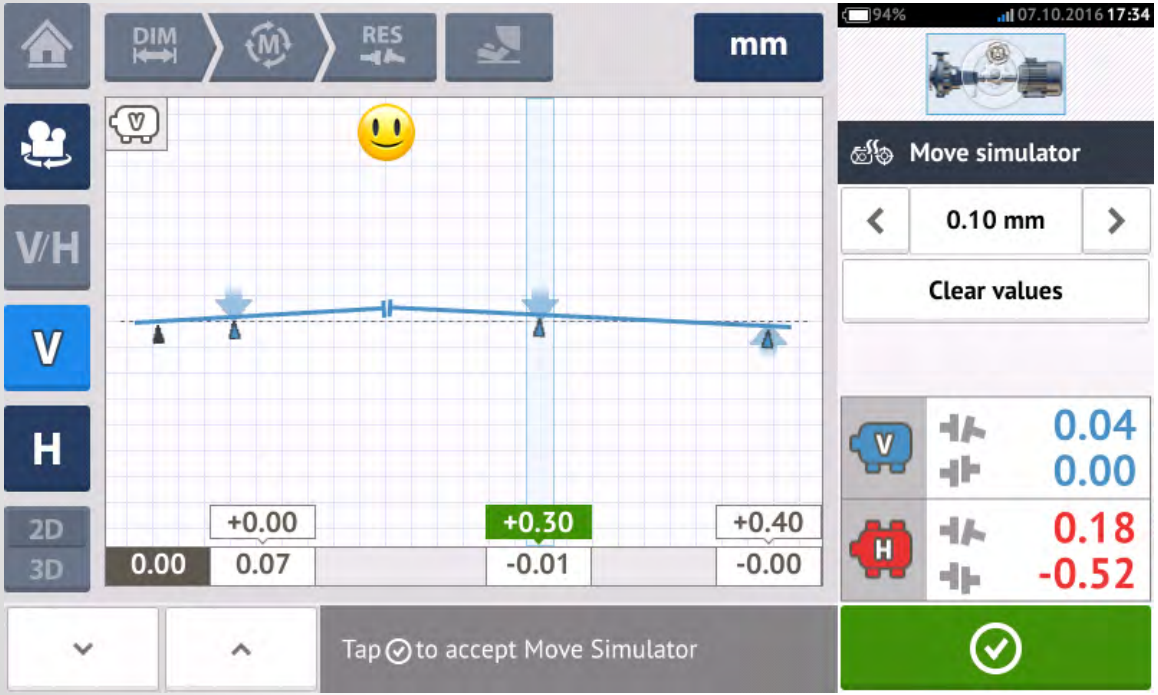


ROTALIGN touch Live Trend



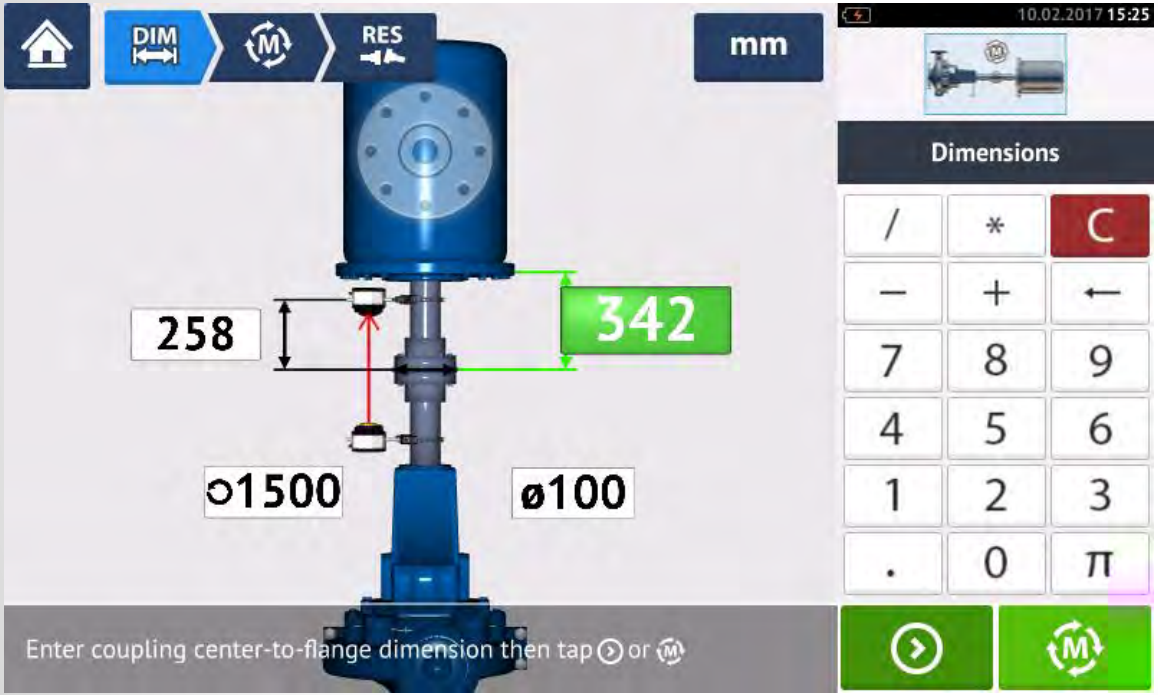
- **Live Trend** monitors thermal or process-related machine positional changes during run-up or coast-down phase.
- ROTALIGN touch then applies growth data to asset targets, ensuring accurate alignment for a running machine.

ROTALIGN touch Move Simulator



- Simulate corrections in advance to determine if the machines can be aligned with the shims on hand.
- Also prove that horizontal movement is possible if bolt bound.
- Save time and only make the moves necessary for proper alignment. (No more chasing your tail.)

ROTALIGN touch vertiSWEEP



- Alignment of vertically coupled machines made easy using vertiSWEEP.
- vertiSWEEP provides a no-stopping alternative to vertical alignments.
- sensALIGN inclinometers provide the opportunity to speed up vertical alignment jobs and ditch static clock-position measurements.

ROTALIGN touch Cardan Shaft Alignments

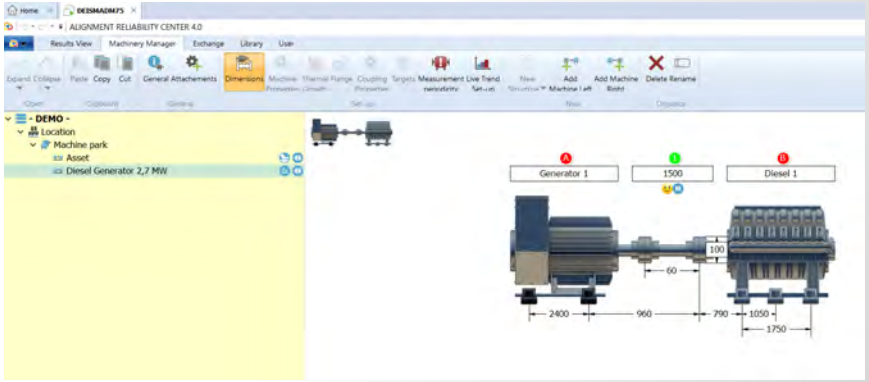
- Precision alignment of cardan-coupled machines ensures longer component lifetime.
- ROTALIGN touch implements unique procedures and hardware for aligning cardan shafts.
- Rotating arm brackets save downtime – no need to remove the cardan shaft.

Alignment Reliability Center 4.0

Alignment job preparation in advance – includes:

- Coupling type support with coupling library – gear, disk, tire, cardan, etc.
- Coupling type optimized tolerances
- Machinery type support with asset library
- Bearing type with automatic selection of best measurement mode
- Asset history and trending of alignments
- Customized reports and report templates
- Touch screen compatible (Windows 8 and 10)

ALIGNMENT
RELIABILITY CENTER 4.0



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ROTALIGN touch Customer Support

Customer Support

- Regular free-of-charge firmware upgrades that add additional powerful features
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Leadership Challenges: Developing a Digital Culture Across the Enterprise

by Mary Bunzel,
General Manager, Intel Manufacturing Industry Solutions Group

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Unlocking a Digital Culture

Key Points:

1. Leadership needed to enable digital transformation
2. Organizational barriers to data driven decision making
3. Attributes needed to build Industry 4.0 workforce

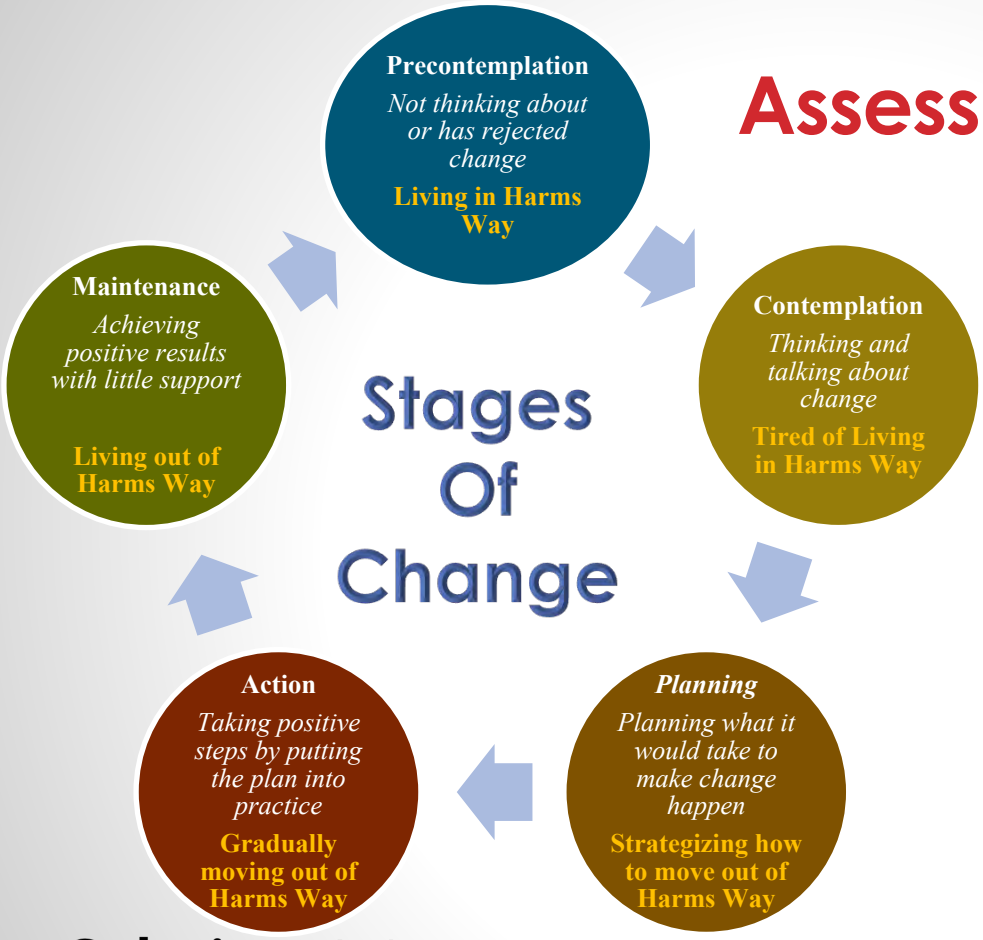
What is a Digital Culture?

A Culture where the workers are able to:

- See data
- Can anticipate or think about what it means
- Who trust the data enough to make a decision

The digital fusion of IT and OT

Assess Behaviors



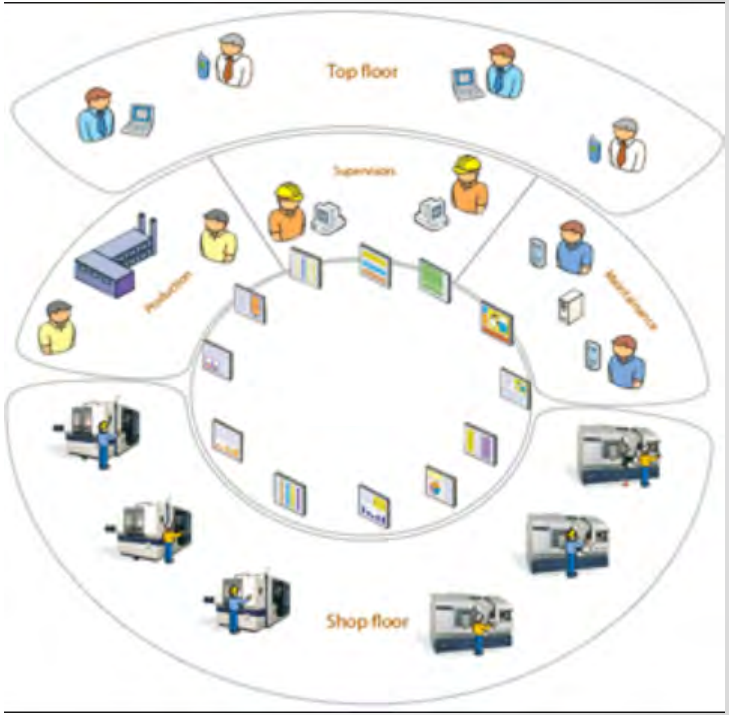
- Is data changing the way workers interact?
- Shift from Lagging to Leading reactions?
- Sense of trust?
- Embrace importance of Fast Failure?

Most Impactful Area of Focus

Which is most critical?

- Shop Floor
- Top Floor

" Actually, middle managers will also create push-back, particularly as their decisions will be more easily questioned in a data-driven climate."



Implementation Guidelines

Talk about it

Factory Floor

Operations

Larger Organization

Position as an enabler for how their roles will GROW, CHANGE and IMPROVE

Actively Engage

People Impacted

by the

Transformation

Ask what makes a great experience And What obstacles stand in the way

Connect

Connect and Integrate processes and people

Inside and Outside of Organization

Then execute in an integrated fashion

"Walk the Talk"

Implementation Guidelines

Keep Learning

Involve

everyone in

active learning

Education is foundational in relationship to culture and behavior

Be

Humble

Vulnerable

Authentic

Set expectations that some changes will fail

Institute retrospective dialogs about transformation

Change

Be ready to change as transformation matures

Visionary Leaders may morph into educator/role model

Top 10 Best Practices

1. Make Data an enabler of Strategy
2. Turn the conversation around and get past the fear
3. Help the factory floor learn what to do with the data and identify who is willing to change
4. Build trust in the data thru education and user experience.
5. Identify your skill gaps
6. Proactively prioritize where to spend your time & resources
7. Be a role model
8. Find the metrics and data to drive the desired behaviors
9. Take an iterative approach
10. Make it fun

Final Thoughts

- Understand Trends
- Create a data-based vision
- Communicate Why
- Foster a culture of trust
- Grow agility
- Ask

Questions?

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Questions & Answers

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Next Webinar

Date: Wednesday, October 18

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Keynote

Understanding Leading and Lagging Metrics

by Rich Overman, Core Principles, LLC

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Sealing Systems for Mechanical Seal Reliability

by Cathy Wilson, Reliability Technology Manager, Sunair Co.

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We'd love to hear your feedback!
Email your questions or comments to
sean@reliabilityweb.com

Thank You for Joining Us!

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