Planning For Reliability
BRCE 2016, Dortmund

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4 STEPS TO IMPROVE YOUR RELIABILITY

Reliability Value Chain

1 CLEAN YOUR DATA HOUSE

2 STEP UP YOUR INFORMATION

3 PUT IT ALL TOGETHER TO CREATE KNOWLEDGE

4 TAKE THE RIGHT ACTIONS AT THE RIGHT TIME

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Consulting & integrated technologies help clients connect silos of capabilities

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Planning & Scheduling - Roles and Responsibilities

- (Various maintenance professional definitions)
  - Planner
    - Focused on preparing future work for the most efficient and accurate performance.
  - Scheduler
    - Focused on scheduling and coordinating resources for planned work.
  - Maintenance Supervisor
    - Focused on the execution of weekly and daily schedules and emergency work for the most effective use of labor.
  - Crafts/Technicians/Trades
    - Focused on executing the actual work content for repairs and replacements.

Planning vs. Scheduling

- Separate the scheduling function from the planning function

Planners should review the open work order requests, and work orders generated from PM and PdM

Planning vs. Scheduling

Separation:

- Allows planners to spend more time planning
- Prevents dilution of the job plans
- Allows planner to keep the pipeline full
- Allows for fully integrated scheduling
- May not be feasible due to plant size

Justification for a Planner

- Craft Utilization Without Planning
  - 35% Power Utility Average *
  - 28% Cross-Industry Average
- Craft Utilization With Planning
  - 55% Cross-Industry Average *

* Maintenance Planning & Scheduling Handbook - by Doc Palmer

The Leverage of Planning

- Three Persons without “Planning”;
  => 3 X 35% = 105%

- Two Persons with “Planning”;
  =>1X0% + 2 X 55% = 110%

- Break Even is 3 Persons!
  55%/35% = 1.57 (57% Improvement)

- One planner can plan for 20 to 25 persons*
  25 persons X 1.57%
  = 36.75 persons (11.75 extra persons)

* Maintenance Planning & Scheduling Handbook
 - by Doc Palmer

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Ratios

- Planner Ratio
  - 1 Planner for 20 - 25 craftsmen*
- Maintenance Supervisor Ratio
  - 1 Supervisor for 20 craftsmen
- Scheduler Ratio
  - 1 Scheduler per plant or distributed function
- Notes:
  - These ratios apply best to a mature maintenance model
  - *1 to 10-15 during implementation and ramp up

Planner Responsibilities

- Understand the work request - complete information
- Develop the best method for performing the task
- Identify the proper tools & materials
- Apply proper time estimates to tasks
- Manage the backlog of work to be planned
- Sequence task for best efficiency and quality
- Ensure work requests have proper approval

Planner Responsibilities

- Keeper of the data - histories, manuals, BOM's etc.
- Apply proper priorities to planning backlog
- Maintain PM program integrity - frequencies, tasks, etc.
- Compile planning performance reports
- Approve stores and purchase requisitions for planned jobs
- Review actual vs. planned on completed work orders
- Identify recurring maintenance problems
- Assist with budget preparation

A Planner does not…..

- Plan emergency work
- Plan unscheduled repairs (except through standard job plans)
- Schedule - may indicate requested start dates
- Schedule routine activities
- Act as a relief supervisor

Note:

Establishing a Reactive Maintenance Planner /Coordinator function may be an effective way to improve efficiency of reactive work.

Summary of Planners Time

Task	% of Time
Job Scoping	25%
Plan Development	25%
Bill of Materials Preparation	15%
Maintaining Equipment Data	15%
Follow-up & Review	10%
Miscellaneous	10%

Scheduler...

- Fully understands all the plant or site priorities.
- Coordinates planned activities between maintenance, production, stores and purchasing.
- Balances the work schedule with the available labour and plant priorities.
- Runs the weekly scheduling meeting.
- Prepares weekly schedules.
- Prepares/updates daily schedules.

Scheduler...

- Coordinates material, equipment and contractors prior to the start of the job.
- Manages backlog of work that is already planned.
- Works with supervisors to reschedule work due to delays on a daily basis.
- Sequences jobs to minimize interference with operations & maximize efficiency.
- Assists in determining the use of OT or contractors.
- Print & distribute schedules.
- Generates and tracks schedule performance metrics.

The Maintenance Scheduler does not...

- Assign names to the jobs…
- Schedule reactive work
- Supervise craftsmen

“We are being ruined by best efforts”

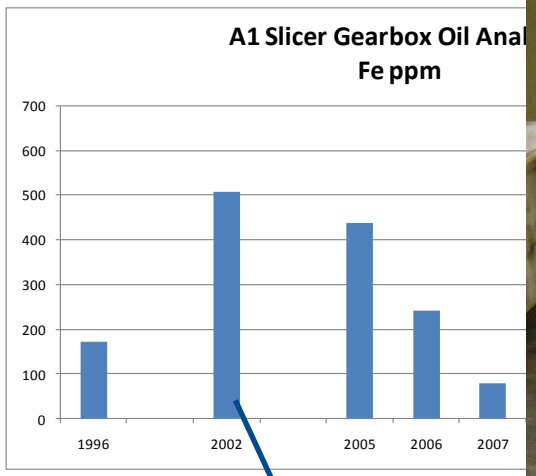
W. Edwards Deming

A1 Slicer Gearbox Failure – Putsch Epicyclic Gearbox

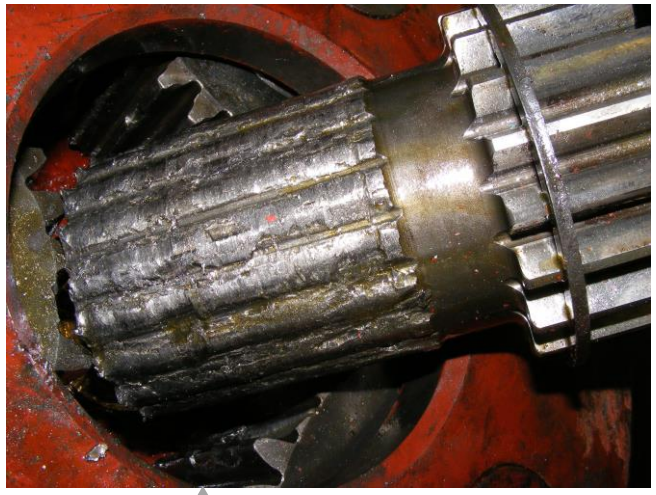
On the weekend of the 3rd January 2010, A1 Slicer Gearbox was reported as a problem, with “No drive, Gearbox U/S”.

Work was completed in replacing the gearbox, with the Company Spare, with the failed gearbox taken to the workshop for strip down and inspection – production rate reduced to 85% for 12 hours.

The strip down inspection identified the gearbox (Putsch 2P11947 epicyclic type, size NA2 FS40, ratio 26.1:1) sun gear (gear-shaft) had failed. An investigation into the root cause of the failure was initiated.



Oil Analysis shows Iron contamination at >500ppm,

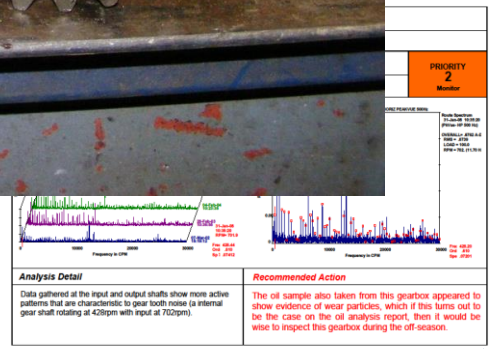


External vendor Inspection July 2001:

“The 19 tooth gear-shaft has started to flake metal from the case hardened surface. Mating gear wheels have slight indentations caused from the break up of the gear-shaft. However they will polish and dress and still have an excessive service life left.”

External vendor Inspection July 2002:

“Unit returned due to noise problem. Please note some of the internal gears showed slight surface markings only, polished & dressed & re-fitted, bearing are in good condition & re-fitted. Replaced oils seals with new and sundries. Generally unit is in good condition.”



Gearbox Failed

2001 2002 **Timeline of Events** 2006 2008 2010

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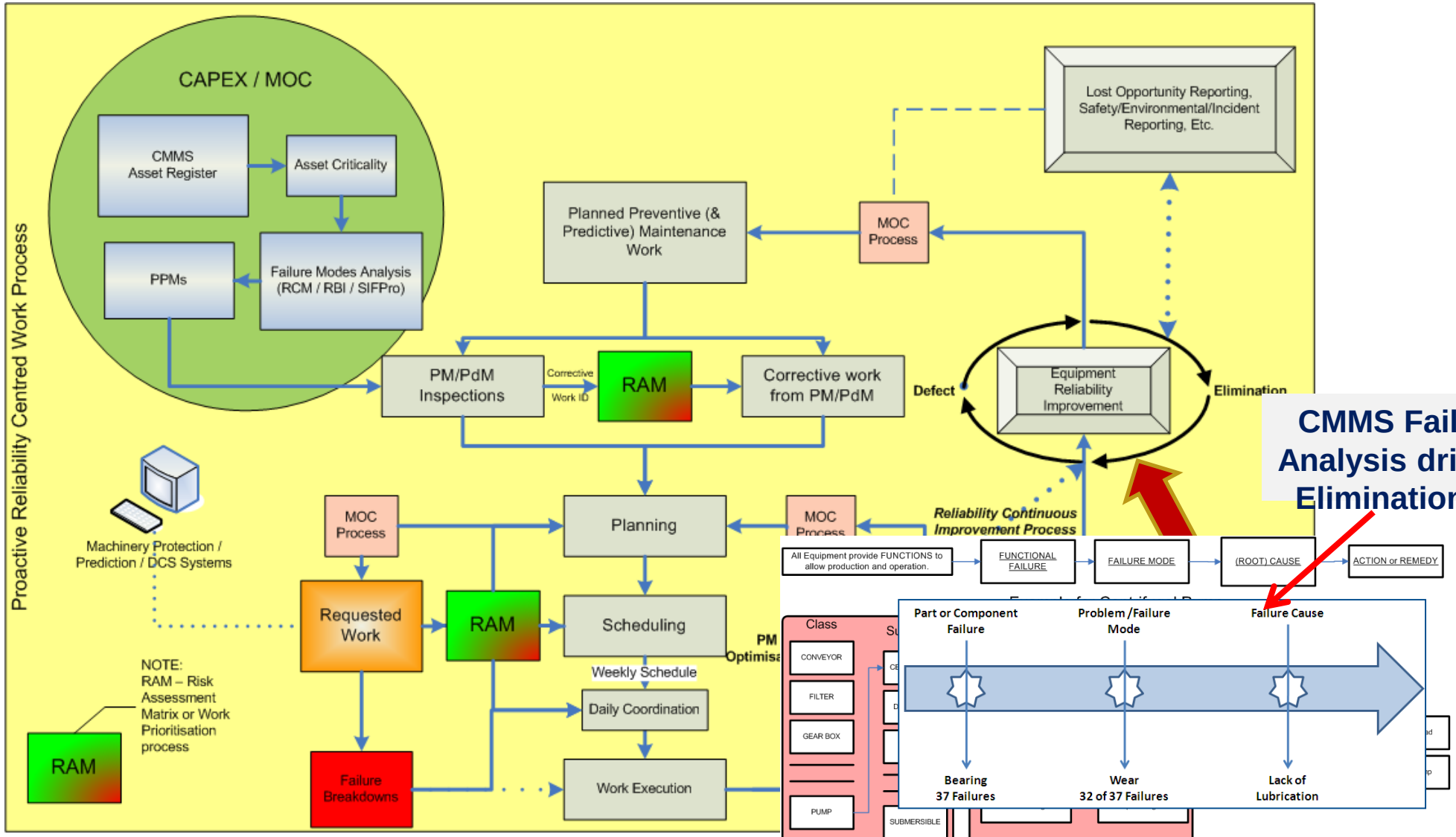
No single person or planning/reliability function had responsibility for collating, analysing or raising corrective work requests…….. The signs were there, but no one had the full picture!

Proactive Maintenance Model –

Identification of Opportunities for Continuous Improvement



CMMS Failure Code Analysis drives Defect Elimination Process

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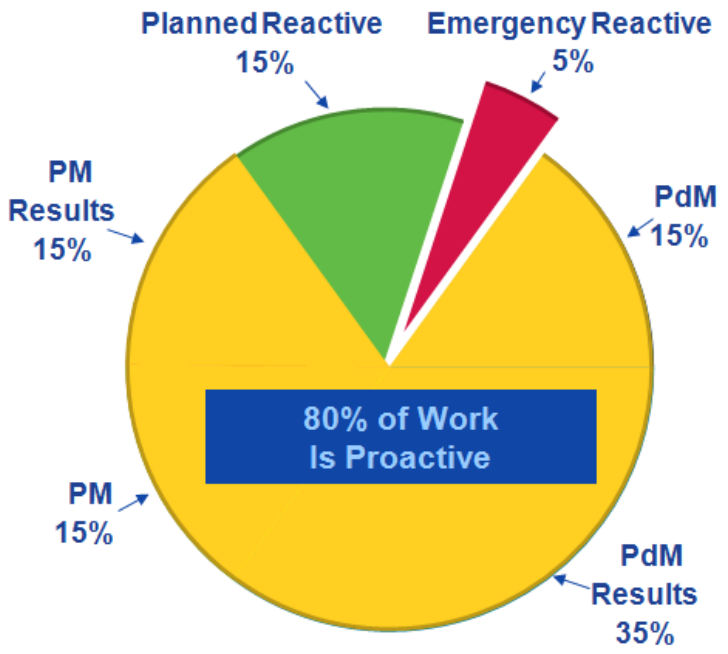
The Right Mix of Work



Source: Emerson Process Management Reliability Consulting Benchmarks

- **Effective Condition Based Maintenance…**
  - The most cost effective approach to managing failure modes (more failure modes per dollar investment).
- **Addressing asset degradation early-on…**
  - Avoids costly collateral damage.
- **The "Right mix" of PM & PdM…**
  - Promotes effective use of the EAM / CMMS
  - Helps get the most from value out of the investment
- **Maintenance activities predicted…**
  - Allows more effective spare parts management
- **Maintenance resources directed…**
  - When and Where they're best applied.
- **Promotes better synergy…**
  - Between Operations & Maintenance

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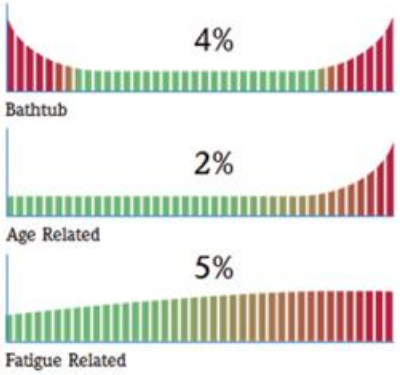
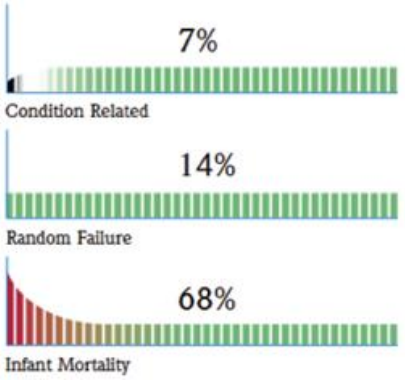
Leveraging Predictive & Condition-Based Maintenance

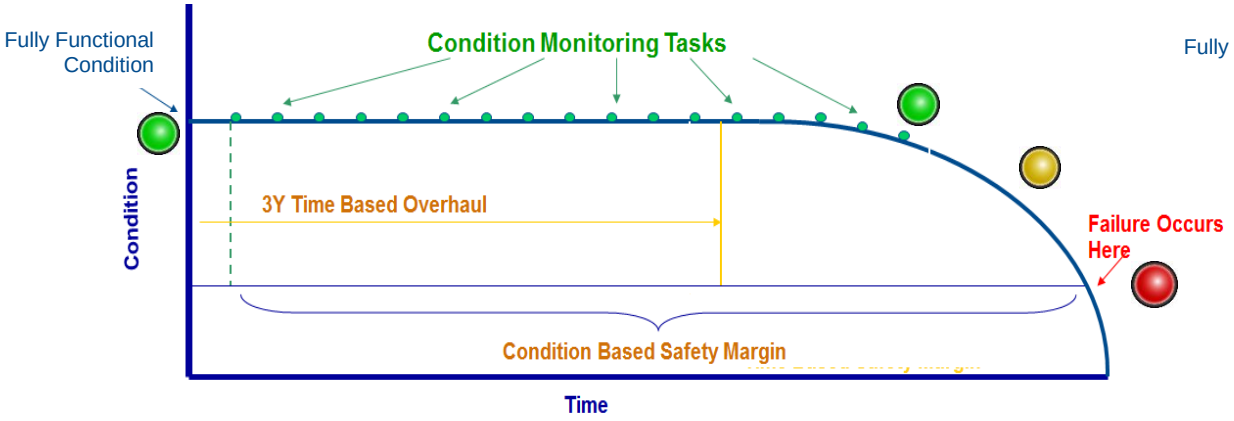
Looking at the six failure patterns

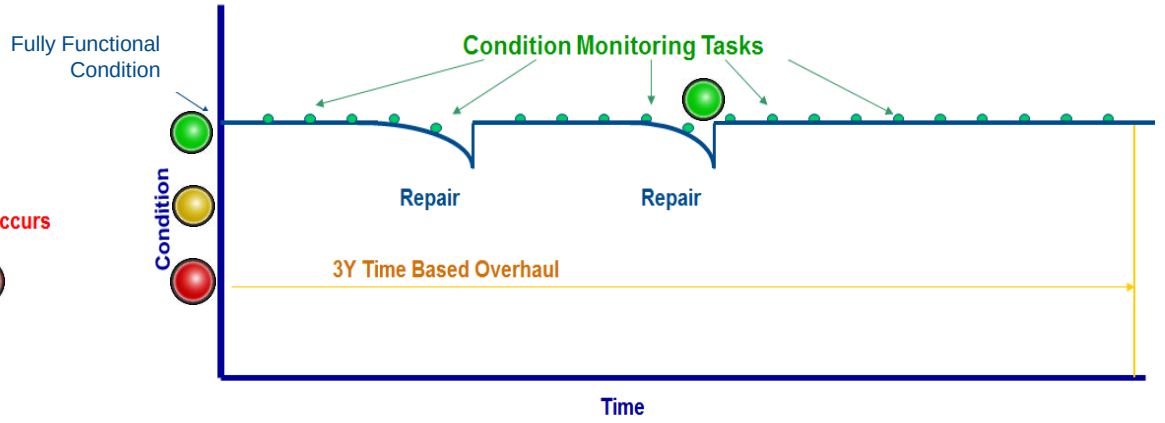
<20% time based



>80% random







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It's Time to

LOOK AT RELIABILITY DIFFERENTLY

Top performing companies have revolutionized their reliability practices, shortening the both scheduled and unscheduled unproductive time of their machinery. The combination of predictive intelligence and visionary reliability program can drive down maintenance costs, while improving safety and availability.

Reliability means...

SAFETY

A typical refining facility will spend less than 10% of its time in transient operations. However, 50% of all process safety incidents occur during this time.

-Tame Your Transient Operations, Chemical Processing June 2010.

1/2

ACCIDENTS
DURING TRANSIENT TIME

PROFITABILITY

50%
MORE
REPAIR COSTS

It costs approximately 50% more to repair a failed asset than if the problem had been addressed prior to failure.

- U.S. National Response Center

$8.4 Million
PER YEAR

Every 1% gain in availability is worth $8.4 million of additional margin capture per year in a typical 200,000 bpd refinery.

- Doug White, Emerson Industry Expert – Based on Current Refinery Economics.

AVAILABILITY

5%
PRODUCTION
CAPACITY LOST

Production capacity is lost to as much as 5% every year as a result of unplanned shutdowns.

- Aidan Nadkarni, "Engineering & Maintenance: Prevention Is Better Than Cure," Oil & Gas IQ, October 2011.

43%
DOWNTIME

As much as 43% of unplanned downtime is caused by equipment failure.

- Large Property Damage Losses in the Hydrocarbon-Chemical Industries, 17th Edition.

Improve Your Reliability to Achieve Bottom Line Results

Studies* show that companies reach the top-performing quartile when they have less than 3 percent unplanned downtime and maintenance costs less than 2 percent of plant replacement value (PRV). For example, a $1 billion top-performing plant spends $12 to $20 million per year on maintenance expense. By contrast, poor performers spend two to four times more per year.

Taking on what may be the greatest cause of excessive operational cost and unrealized profit, Emerson Process Management's reliability consulting guides leaders on how to better manage maintenance costs, improve reliability, and increase profitability. Emerson experts advises global customers on enterprise-wide reliability management programs that leverage technology solutions such as pervasive sensing to connect the millions of data points collected in a plant, providing actionable information to trigger maintenance activities before equipment fails. Just as importantly, Emerson helps companies minimize resistance to change and make a culture shift toward more proactive, cooperative behavior.

Emerson's success stories include Corbion, a global food and biochemical company. Corbion implemented standardized best practices of reliability over several years and reduced its global maintenance expense by one third while dramatically increasing availability. These actions enabled the company to capture millions of euros in increased profits and sustained increases in capacity and production.

**2013 Solomon RAM Study, Solomon Associates, LLC.*

By reducing scheduled and unscheduled downtime, companies can reduce their maintenance spend by 50 percent or more.

– Solomon Associates

Make the cultural shift in reliability to improve bottom line results:
www.emersonprocess.com/morereliable

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EMERSON. CONSIDER IT SOLVED

When they say

IT'S NEVER BEEN DONE BEFORE

We say

CONSIDER IT SOLVED

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