



IPAMC – Energy Forum Understanding and Extracting the True Value of Maintenance

Ben Stevens – DataTrak Systems Inc - Canada

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Stevensb@kingston.net

Today's Agenda

1. Introduction
2. Objective of Maintenance & Reliability
3. Evolution of M&R
4. M&R Benefits – Equipment Management, Manpower Effectiveness, Materials Management
5. Demands on the Organization of an Effective M&R Team
6. Role of the Executive re M&R
7. From Theory into Practice
8. Call to Action and Questions

What is M&R?

- Historically
 - Fixing what has broken
 - Making sure Operations keeps operating
 - A cost centre
 - (therefore lower cost is better)

Now the Rules are Changing

- The critical KPI's for business success are:
 - ROI
 - Cash Flow
 - Risk
 - Profitability
 - Shareholder Value
- M&R is a critical part of Business
- Therefore.....

Objective of Maintenance & Reliability: to add maximum value to the organization

M&R Objective: Improve Business Value

1. Increase operational predictability, consistency and reliability, improve uptime duration, reduce downtime....
2. ...and therefore secure consistent revenue stream
3. Make intelligent business decisions about Run vs Repair, Balance Cost of Failure with Cost of Prevention and therefore protect ROI
4. Extend Equipment Economic Life, minimise Life Cycle Cost protect long term asset value
5. Balance Cost of Maintenance with revenue and profit through reliability and output
6. Ensure adequate resources are available and well managed to achieve required uptime and output (\$, Spare Parts, skills, contractors, vendors, tools, IT etc)

M&R ...Evolution ... EAM

<1980's

1990's

2000's

2010's

Phase 1:
Reactive – wait
til it breaks
then fixit

Phase 2:
Preventive work to
delay or stop failure
Planning ahead to
expedite repair

Phase 3:
Predictive work to
understand when
failure happens.
Condition analysis
to understand why.
Focus on forecasting
preventing or slowing
degradation

Phase 4:
Failure Analysis,
leading to Knowledge
Base development
Continuous improvement
Focus on Value,
When to allow failure

35%

40%

20%

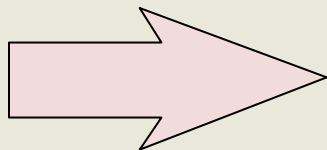
5%

Key Areas of M&R Benefit

1. Better Equipment Management = Higher Revenue = Higher ROI
2. Run to failure when Cost of Prevention exceeds Cost of failure
3. Risk → shutdown or run
4. Cash Flow – cheap spares, delayed procurement
5. Improved Design specs to reduce or prevent Maintenance
6. Others....

1. Benefits from better Equipment Management

Action	Results
<ul style="list-style-type: none">• Better Preventive & Predictive Maintenance• Smarter use of Run to failure• Meaningful KPI's• Better Planning• Smarter Budgeting• Timely Procurement• Improved analytical and business management capability	<p>Longer operating cycles + shorter maintenance cycles</p> <p>Fewer unplanned breakdowns</p> <p>Acceptance of planned breakdowns</p> <p>More uptime, More output, More revenue</p> <p>Faster mean time to repair, Faster return to service</p> <p>Smoother running equipment</p> <p>Lower power consumption</p> <p>Longer equipment productive life</p> <p>Higher quality product (less fluctuation in output)</p> <p>Focus on added value not cost</p>



**2 - 5% increase in revenue;
X% increase in ROI and
Shareholder value**

2. Run to failure is ~~bad~~ Maintenance –
good

Cost of Failure = \$2,500

Cost of Prevention = \$5,000

When the cost of prevention is higher than the cost of failure.

--> Value-based decision as to when to not waste money on PM's

3: Risk is the Business of M&R

Increased Risk = Decreased Value

$$\text{Run Risk} = \text{Cost of Failure} \times \text{Probability of Failure}$$

Cost of Failure

= Cost of Emergency Repair
+ Cost of Lost Revenue or Profit
+ Penalty Costs, Reputation Costs,
Fines and Reparations

Example:

\$2,500
+ \$35,000
+ \$250,000

Total = \$287,500

Probability of Failure needs:

% Probability +
Time frame +
Confidence levels

Example:

25% Probability of Failure
within the next 30 days
with 95% Confidence levels

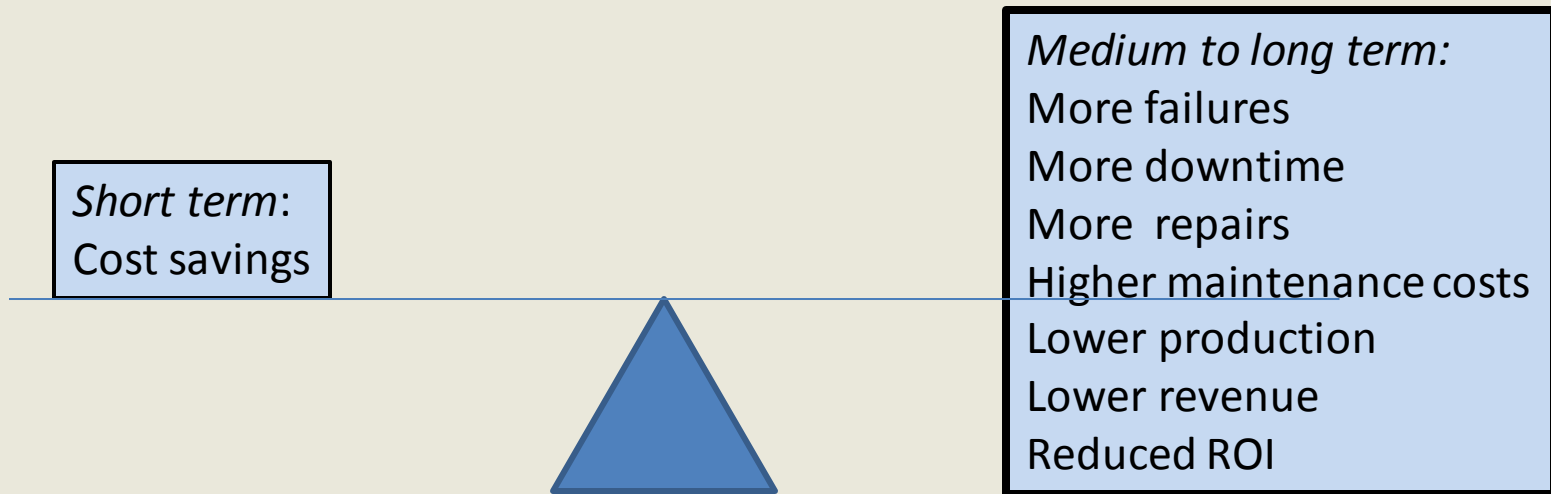
Risk of Running for the next 30 days is
= \$287,500 x 25% = \$71,875

- **Is the business prepared to run that risk?**
- **How much is it worth spending to reduce that risk?**
- **(what is the cost of PM)**
- **What happens to the risk as we delay action?**
- **How can we reduce that risk?**
 - **Reduce cost of failure**
 - **Reduce probability of failure**

4: Cash Flow....

Cheap spares and Delayed procurement

Budget restrictions prompt the substitution of cheap spares and/or delays in procurement



To find the balance point, we need to \$\$\$ the equation

5. M&R contribution to Design Practices

Inherent reliability values:

- Easy identification of impending failures --- in time to prevent failure
- Easy access when inspection is necessary
- Removal and replacement of vulnerable items without shutdown
- Commonly available instruments for monitoring of equipment status
- Essential equipment functions are protected by redundancy or by backup devices
- Short failure downtime and fast recovery

If we get M&R involved in design and selection of equipment....

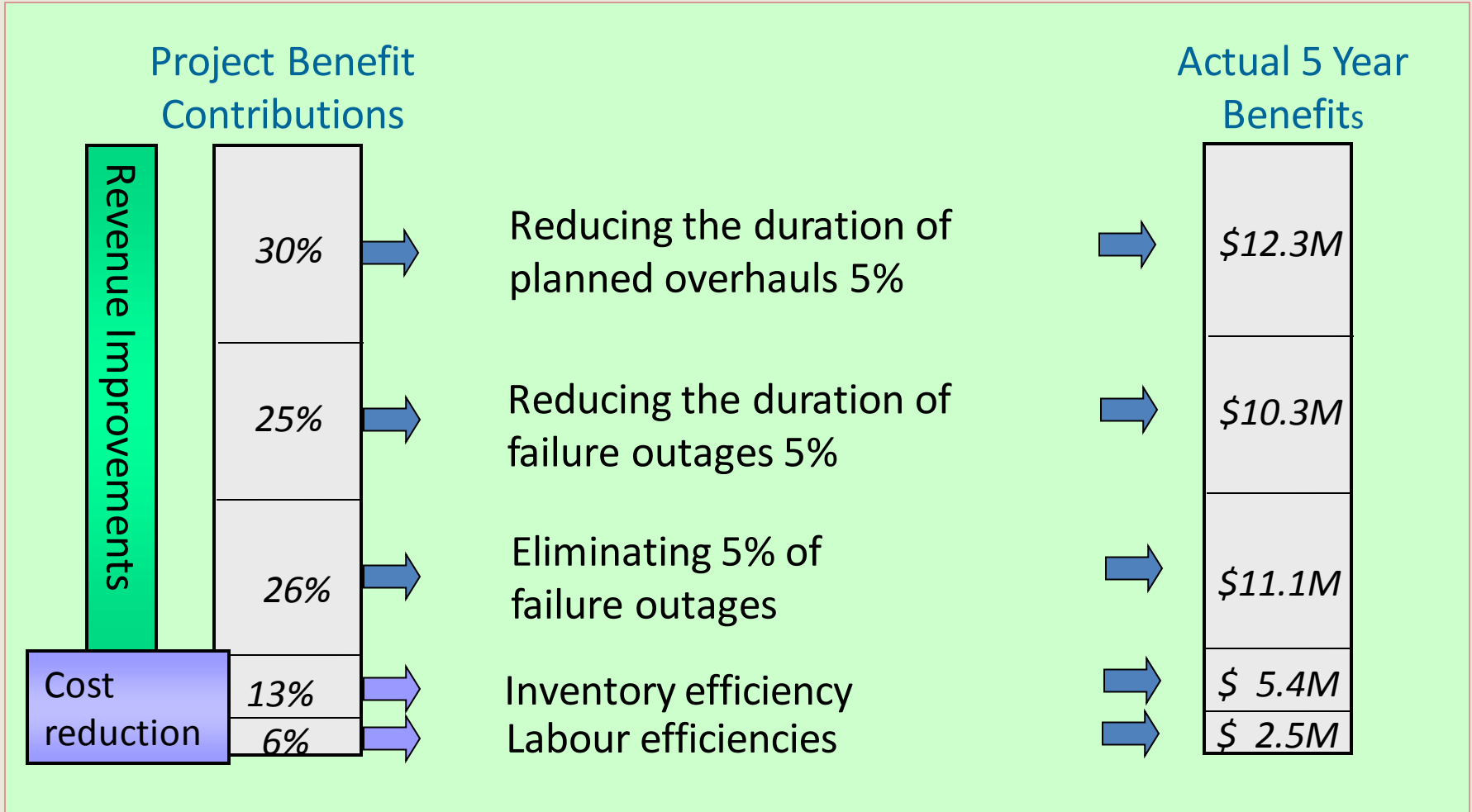
Net results: lower downtime costs, lower maintenance costs, more uptime , more revenue, higher ROI

6. Further Values of Maintenance

1. Re-ordering of Spares and Materials based on:
 1. Required Plant reliability
 2. The operating and maintenance cycle
 3. The planning cycle and the parts delivery cycle
2. Increasing in-house maintenance capabilities to supplant expensive contractors
3. Deciding when OEM warranties are a waste of money
4. Pre-buying replacement equipment to allow time to resolve infant mortality on a test bed
5. Life Cycle Management – optimise whole life costs of large capital equipments – from design to disposal
6. Eliminating unnecessary PM's
7. Calculating Economic Annual Cost as the basis for asset replacement

Case Study – Maintenance Value Contribution

70 mixed Gen Plants (mainly Hydro, Gas, Coal), 15Gw
Average Benefits over 5 years:



5 year Benefit ---- \$41.6M

Demands on the Organization of an Effective M&R Function

1. On-Going Executive Sponsorship to secure resources and recognise results
2. Maintenance Business Management
3. Recognition by IT, Finance, Procurement and HR that M&R is their customer and requires support (not obstruction)
4. Effective, on-going training in M&R Management and techniques
5. Meaningful Executive (Financial) KPI's and follow-up action
6. Accurate and up to date plans and data from Operations
7. Smart Inspections

Transferring from Maintenance into Business Decision Making – To Do List

1. Calculate paybacks, talk in terms the Executive use (Risk and ROI)
2. Develop the reliability concepts in terms Executives understand
3. Define risk and cost in \$\$\$, probabilities and confidence levels
4. Use Executive KPI's (eg. not MTBF and OEE, but Cost of Failure and ROI)
5. Measure the value that Maintenance tasks add (cost versus risk reduction)
6. Re-evaluate/eliminate KPI's that do not pass this value test
7. Formally build on accumulated experience and knowledge

Role of the Executive in Maintenance

- 1. Develop the role of the Maintenance Manager into the Maintenance BUSINESS Manager**
 - a) Executive KPI's ----- Not just OEE but ROI
 - b) Not just Cost reduction, but Cash Flow, Payback and Profitability
 - c) Not just MTBF and MTTR, but Risk, Cost and Probability of Failure
 - d) Not just More PM's, but only those that add value
- 2. Lead the development of Maintenance Strategy, Adequate Resourcing, Smart Budgeting, Work Priority**
- 3. Regular review of results (KPI's) and feedback action**
- 4. Demands for better quality reports – eg:**
 - a) Maintenance Business Value KPI's
 - b) Cost of Failure versus Cost of Prevention
 - c) "Value" contribution (not just cost reduction)
- 5. Consistent on-going support for Continuous Maintenance Improvement**
- 6. Encourage support teams to work with Maintenance Managers to plant more seeds, grow more profits (HR, IT, Finance, Procurement)**

Call to Action

1. A well-managed M&R team will return huge value: investment >> ROI – measure it and reward it
2. Set specific goals and targets for improvement projects
3. Require meaningful reports on useful Executive KPI's
4. Good Cost Analysis >> Good Budgeting >> Good Investment in Maintenance >> Cost Reduction + Increased value
5. Executive Leadership must provide motivation and momentum + forum for M&R inputs
6. Ensure implementation and (on-going) training is high quality
7. Increased commercial instinct and motivation within M&R will make for higher profitability



Questions and Comments Welcomed
Email me!!!

- Ben Stevens - Stevensb@kingston.net