

3rd Annual Rotating Equipment Reliability Forum

Finding innovative ways to prevent failure and maximise reliability

Rendezvous Hotel, Melbourne

4th & 5th February 2008

'Intellectuals solve problems, geniuses prevent them.'

Albert Einstein

Introducing best practice reliability models and providing the most updated and innovative solutions to prevent fault and failure and increase your asset reliability.


marcusevans

Presenting a half-day workshop covering:

"Optimising Predictive Maintenance (PdM) for rotating equipment"

Facilitated by international expert:

James V. Reyes-Picknell Founder and President
Conscious Asset Management (Canada)

Former Engineer
Canadian Navy

Former Engineer

Exxon Chemicals (Canada)
Author

Uptime, Strategies for Excellence in Maintenance Management

Featuring keynote presentations by:

George McLagan Asset Reliability Manager
BHP Billiton

Bob Trask Technical Officer - Condition Monitoring
Boyne Smelters Ltd

Jonathon Deaker Mechanical Engineer
Meridian Energy (New Zealand)

Ray Beebe Senior Lecturer
Monash University

Author

Machine condition monitoring

Predictive maintenance of pumps using condition monitoring

- Winner of the 2004 Sir George Julius Medal by Engineers Australia

- Three times winner of the Collacott Prize from the Institution of Diagnostic Engineers

Attend this practical forum and gain insight into best practice rotating equipment management strategies including:

- **Optimising** CM strategy to reduce motor bearing failures
- **Examining** WOLCC (Whole of Life Cycle Cost) for rotating equipment to maximise return
- **Investigating** turbomachinery failures by Forensic Engineering Failure Analysis (FEFA): Interpreting the clues
- **Implementing** a Plant Asset Management (PAM) system to monitor the performance & health of hydro-turbines
- **Adopting** effective contamination control in fluid & drive systems
- **Predicting** maintenance of pumps using Condition Monitoring (CM)
- **Building** a benchmarking oil analysis programme for facilitating best practice condition monitoring
- **Examining** the inappropriate commissioning as a contributing factor to major failure of rotating equipment
- **Illustrating** the vibration analysis of cooling water pump motors
- **Increasing** the reliability of equipment with a long-run time between shutdowns through effective risk management

Offering case studies and expert presentations by:

- Gold Coast Water
- Qenos
- Heinz Australia
- BlueScope Steel
- OneSteel
- Pilkington

Testimonials from delegates of our 2006 event:

"I enjoyed the two days – course topics were interesting – opportunity to network with peers is very valuable"

Reliability Assurance Technician

Pilbara Iron

"It is a well organised and well presented event"

Reliability Engineer

Caltex

"This seminar enables companies to get a heads up on what is happening in industry at the moment and an idea on how they are performing against others."

Senior Condition Monitoring Officer

Hydro Tasmania

Each delegate will receive a copy of James V. Reyes-Picknell's latest book
Uptime, Strategies for Excellence in Maintenance Management

Associate Sponsors



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Monday 4th February 2008

0830 Registration and coffee

0845 Opening address from the Chair

**0900 Session One – Case Study
Optimising Condition Monitoring (CM) strategy to reduce motor bearing failures**

Almost all manufacturers today are experiencing unexpected loss of motors. Bearing failure is one of the major causes of motor breakdowns. In this session, Mark will present three case studies of defects that were detected and allowed to run due to production requirements and an assessment that the defects, some significant, were not likely to progress to catastrophic failure immediately.

- Addressing successive failure of polymer cage motor bearings on multi-stage wire drawing machine:
 - Reasons for failure
 - Replacement strategy
 - Preventative measures
- Analysing high level Ball Pass Outer Race (BPOR) defect indications on large barrel bearings and what was actually happening:
 - Cross referencing CM data
 - Mental models
 - Limits to action
- Examining large worm drive gearboxes
 - Examples of failures
 - Monitoring strategy
 - Preventative measures

Mark Copping Reliability Engineer
OneSteel

**0945 Session Two – International Keynote Case Study
Implementing a Plant Asset Management (PAM) system to monitor the performance & health of hydro-turbines**

- Examining the what, why, when & how of the PAM turbine model
- Setting up the system in a live operating environment
- Debugging - the system developer-client relationship
- Debating the pros & cons of online vs. offline analysis
- Setting alarm limits & machine variation - how much is too much?
- Discussing the accountability, ownership & buy-in
- Addressing the next step - "son of PAM"

Jonathon Deaker Mechanical Engineer
Meridian Energy (New Zealand)

1030 Morning refreshments and networking break

**1100 Session Three – Case Study
Examining WOLCC (Whole of Life Cycle Cost) for rotating equipment to maximise return**

Whole of Life Cycle Cost (WOLCC) refers to the cost analysis of a machine cycle or facility cycle from acquisition to decommissioning over a finite life span. The goal to reduce costs is the focus of today's machine manufacturers and users. Calculation of whole of life-cycle costs can be assisted by the use of cost models which are normally implemented as computer programmes, enabling many different scenarios to be investigated without adding significantly to the time and effort expended. With these models, a manager can focus on the implications of the analysis for decision-making rather than just on the process of calculating the costs. This session will focus on the techniques to examine and manage WOLCC on the purpose for maximising profits. It will also focus on the significant difference between realistic WOLCC analysis compared to standard LCC analyses - the differences have the capacity to revolutionise a businesses' capacity to achieve real cost savings into the future through utilisation of higher quality equipment and reductions in the incidence of nasty little cost surprises in the acquisition of renewals phases.

- Understanding the connections between WOLCC and ROI
- Introducing current ways to estimate WOLCC
- Examining the impact of WOLCC on capital equipment
- Analysing the role of CM for efficient WOLCC Management

Peter Oliver Asset Creation Mechanical Specialist
Gold Coast Water

**1145 Session Four – Case Study
Investigating turbomachinery failures by Forensic Engineering Failure Analysis (FEFA): Interpreting the clues**

Turbomachinery failures can be extremely costly and replacements may see equipment laid up for 6 - 12 months, therefore it is imperative that failures are avoided. FEFA is a tool which can pinpoint root cause(s) to assist Asset Managers to ensure the correct actions are taken to avoid future failures. In this session Kerrie will share her past experiences based on a 25 year journey investigating turbomachinery failures including gas turbines, steam turbines, compressor & turbine end blading, plus selected ancillary turbomachinery issues.

- Understanding Forensic Engineering Failure Analysis (FEFA)
 - What is it?
 - Why do it?
 - What can it tell you?
 - When should it be done?
 - How is it done?
- Applying FEFA to investigation of turbomachinery failures

Kerrie Christian Materials and Quality Systems Manager
BlueScope Steel

**1330 Session Five – Case Study
Illustrating the vibration analysis of cooling water pump motor**

Monitoring and analysing the vibration signals can successfully detect damages and problems in pump motor, and corrective actions can be undertaken to prevent the unexpected breakdowns. In this session, Adrian will illustrate this by using photos, vibration data/graphs and applicable notes.

- Detecting and recording vibration signals
- Finding the primary cause of the incident
- Examining the long term fix for the pump set
- Analysing post stiffening plate installation and post motor bearing replacement vibration data

Adrian Guillot Machinery Specialist
Oenos Olefins

**1415 Session Six – Keynote Case Study
Adopting effective contamination control for rotating equipment**

Equipment today is more and more vulnerable for fluid contamination. Fluid contamination can cause additive depletion, oil oxidation, corrosion and accelerated components wear and tear, which will result in quick and costly breakdowns. That is why contamination control is so important in this day and age. It is found that clean, dry oil can extend equipment life between failures up to 8 - 10 times the normal operating life. In this session, the techniques for contamination control will be discussed in details.

- Identifying the usual causes and results of contamination
- Examining under what circumstances the risk of contamination is high
- Setting guiding criteria for the level of contamination
- Technologies applied for measuring contamination
- Ways and tools for the effective control over contamination

Bob Trask Technical Officer – Condition Monitoring
Boyne Smelters Ltd

1500 Afternoon refreshments and networking break

**1530 Session Seven - Case Study
Increasing the reliability of equipment with a long-run time between shutdowns through effective risk management**

It is fair to say that shutdowns are scheduled when it is believed that maintenance is required, because historically this is when they have always been performed, or major overhauls take place because they were penciled into the maintenance schedules years ago and always happened at this agreed interval. But is the shutdown really unavoidable and could the asset lifecycle not be extended? Organisations need to examine the main drivers for performing a shutdown and evaluate their validity, bearing in mind the potential for employees to be maimed or killed if safety is compromised through lack of maintenance, the likelihood of a major unplanned outage and the loss of production and profitability. Also, upper management need to be on-side if the maintenance strategy is going to change, the benefits needs to be sold to the stakeholders to ensure they understand the risks associated, benefits of asset lifecycle extension, the need for extra expenditure and the ROI if you establish the need for an increase in maintenance funds. This session will discuss:

- Evaluating maintenance costs during the life extension phase to evaluate ROI of delaying maintenance work
- Implementing an innovative technical risk assessment programme and identifying the business risks to your industry for suspending shutdowns and extending equipment life
- Addressing the mindset of an organisation to extend the life of equipment significantly to mitigate maintenance requirements
- Focusing on what your maintenance is actually achieving
- Identifying and highlighting areas for improvement

Dierk Meyer-Heinrich Maintenance Engineering Manager
Pilkington

1615 Closing remarks from Chair and end of Day One

1625 Networking drinks

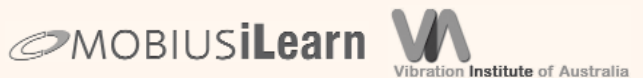
Why you must attend

Unexpected breakdown of rotating equipment can result in excessive production downtime, missed contract deadlines, costly machinery replacement, as well as safety problems and environmental concerns, which may cost millions of dollars. Organisations today are continually striving to source the most innovative technologies and practices to minimise those risks and improve their machinery reliability. Rotating equipment incidents are most critical and need to be investigated since they can result in total loss of the facility.

This conference is designed to help you increase condition monitoring practices, gain a better understanding of equipment life cycles and create a comprehensive predictive maintenance plan. A broad range of case studies will be presented by leading industry players across different fields. Most updated maintenance techniques and solutions will also be discussed by both Australian and international experts on the purpose of minimising risks of possible breakdowns, and maximising Return on Investment.

marcus evans Rotating Equipment Reliability Forum will provide you with an opportunity to share experiences and learn from industry leaders through case studies, networking and workshop. It will provide a series of practical and technological solutions aimed at optimising rotating equipment reliability.

About the Associate Sponsor



The team of **Vibration Institute of Australia**, **Mobius iLearn**, and **Vitech Reliability** can make your vibration program a success. Our training will improve the analyst's skill and confidence level. You can choose between computer-based courses, distance learning, and public or on-site live training. The courses and certification exams follow the ISO 18436-2 and ASNT standards. Thousands of people have been trained worldwide, thanks in most part to the innovative simulations - they make vibration understandable. Please visit www.viaustralia.com.au to learn more.

Who must attend

Managers, Heads, Supervisors, Engineers, Planners and Directors of:

- Rotating Equipment
- Vibration
- Plant
- Maintenance
- Operations
- Reliability
- Condition Monitoring
- Asset
- Planning and Scheduling

Tuesday 5th February 2008

0830 Registration & Coffee

0845 Opening address from the Chair

0900 Session One – Award Winning Keynote Presentation

Predicting maintenance of pumps using Condition Monitoring (CM)

After motors, pumps are arguably the most common machine in virtually all industries. Wear results in increased energy consumption/greenhouse gas production and failure can result in total production loss and substantial repair costs. This session will show several case studies related to pump condition monitoring and successful diagnosis

- Reviewing the role of CM throughout the pump life cycle
- Identifying the most common faults and failures of pump performance
- Applying effective Non-Destructive Testing (NDT), vibration and lubricant wear particle analysis for pumps
- Optimising overhaul of pumps by applying CM

Ray Beebe Senior Lecturer

Monash University

Author

Machine condition monitoring

Predictive maintenance of pumps using condition monitoring

As a professional engineer in power generation for 28 years, Ray had many technical and managerial achievements in power stations and central specialist units in Australia. He received the Collcott Prize three times from the Institution of Diagnostic Engineers. His second book, Predictive maintenance of pumps using condition monitoring, resulted in Engineers Australia awarding the George Julius Medal for the best publication in mechanical engineering of 2004. His 6 years service in the Royal Australian Engineers (CMF) was recognised in 2007 with the Australian Defence Medal.

0945 Session Two – Case Study

Building a benchmarking oil analysis programme for facilitating best practice condition monitoring

Oil analysis is an integral part of any condition-based maintenance program. When used effectively, it can warn of impending failure, direct us to the root cause of a problem and assist in improving rotating equipment reliability and performance.

Developing an effective oil analysis program requires careful planning. All too often when plant personnel decide to invest in oil analysis, they choose a lab and start sending samples without identifying what they are trying to achieve from the exercise. The oil sampling and analysis program should be developed with a careful game plan in place based on a stated series of reliability goals. This session will address:

- Applying on-site particle analysis to eliminate lubrication-related machinery failures
- Selecting the correct service provider to perform oil analysis procedures
- Identifying a procedure manual for entire process of oil analysis to maximise end results including:
 - Initial program setup
 - Sampling strategy - Data logging and sample analysis
 - Data diagnosis and prognosis
 - Performance tracking and cost benefit analysis

Jeff Naylor Engineering Manager

Heinz Australia

1030 Morning refreshments and networking break

1100 Session Three – Keynote Case Study

Examining the inappropriate commissioning as a contributing factor to major failure of rotating equipment

Inappropriate commissioning can be an important factor contributing breakdowns. In the mining process, BHP Billiton experienced the failure of a 450kW Bucket wheel drive transmission on a Bucket Wheel Reclaimer. The transmission was commissioned in November 2003 and failed in December 2005. The subsequent RCA found that all critical protections on the bucket wheel drive had not been commissioned, thus preventing the detection of symptoms of failure which would have allowed for early intervention which may have prevented a catastrophic failure.

Approximately 2 months after commissioning of the new transmission, early signs of failure of the gear train were observed. The manufacturers warranty was only effective from date of delivery as opposed to date of installation, hence very little support was provided by the OEM.

In this session, George will discuss the actions and strategies introduced to preserve the transmission until it could be upgraded. These strategies included oil filtration, vibration analysis, visual inspections, monitoring of drive torque and changes to the operating strategy for the reclamation of the iron ore stockpile so as to manage the number of overloads seen by the drive and how these combined actions have prolonged the service life of the transmission.

George McIagan Asset Reliability Manager

BHP Billiton

1145 Session Four – Case Study

Effectively employing CM tools to detect and reduce bearing defects

The key to success of any predictive maintenance programme is the early detection of rolling element bearing defects; however, one of the keys to success of any reliability centered maintenance programme should be the reduction of bearing defects. This session will discuss how high-frequency detection methods are used to detect the first stage of the bearing defect, and how vibration analysis can be used to track the degradation of the condition until ultimate failure. The main reasons why many vibration programmes fail to successfully utilise vibration analysis to detect rolling element bearing defects will also be explored. Furthermore, Jason will 'close the loop' by discussing how the vibration programme can be used to reduce the number of bearing defects. Vibration analysis is grossly underutilised in most programmes: analysts are focused solely on detecting faults and not preventing them. Some tips on how these can be changed will be provided. Key issues of this session are:

- Understanding the four stages of bearing failure
- Learning how high frequency detection can be used to detect rolling element bearing faults at the earliest stage
- Learning how time waveform and spectrum analysis can be successfully applied to bearing fault detection
- Reviewing the mistakes made by many vibration monitoring programmes
- Examining how vibration analysis can be utilised to reduce bearing defects through acceptance testing, root cause failure analysis, and the detection and correction of misalignment, unbalance and resonance control

Jason Tranter Founder

Mobius Institute

Co-founder

Vibration Institute of Australia

Creator

iLearnVibration

1230 Luncheon

1330 Session Five – Workshop

Optimising Predictive Maintenance (PdM) for rotating equipment

Background

Predictive Maintenance (PdM) is a very powerful maintenance strategy. It involves monitoring for evidence of changed conditions within the rotating equipment. The amount of change and the rate of change are tracked and used to predict the time of failure. By using PdM management strategy, most problems can be spotted and timely actions can be taken before a failure occurs and results in operational shutdown. This workshop will help the delegates to get a full understanding of PdM and make use of it to increase machine reliability. Key topics will cover:

Part I

- Understanding PdM and its fit within an overall asset management programme
- Reviewing PdM tools/techniques and their functions including:
 - oil analysis
 - vibration analysis
 - infrared thermography
 - sight, sound, touch and smell
 - ultrasonic testing
- Introducing some of the latest technologies and innovative solutions

Part II

- Developing and implementing a reliability improvement programme incorporating PdM
- Evaluating the effectiveness of PdM management
- Managing a preventive and predictive maintenance programme using maintenance management software
- Understanding how continuous condition monitoring enhances a PdM programme
- Optimising your PdM programme

Part III

- Is PdM worth the investment?
- Developing the true cost of equipment failure
- Examining the savings generated by PdM
- Assessing the cost for implementing PdM programme

Facilitated by:

James V. Reyes-Picknell Founder and President

Conscious Asset Management (Canada)

Former Engineer

Canadian Navy

Former Engineer

Exxon Chemicals (Canada)

Author

Uptime, Strategies for Excellence in Maintenance Management

James is the founder and President of Conscious Group Inc. of Toronto, Canada. He is an author, the most recent published work being the 2nd edition of *Uptime, Strategies for Excellence in Maintenance Management*. With over 30 years of experience in the field, he is a frequent speaker, a teacher and advisor to companies in the realm of physical asset (maintenance) management and corporate transformation in asset intensive industries. Prior to founding Conscious Group Inc. he was:

- Leader of the Canadian Enterprise Asset Management consulting practice of IBM Business Consulting Services
- Global leader for the Physical Asset Management practice of PwC Consulting
- Logistics Support Manager for a Helicopter design program and a Microwave Landing System development program
- Maintenance and Support Planning Manager for the Canadian Patrol Frigate Program
- Specialist machinery engineer with Esso Chemicals in Canada,
- Marine Engineer in the Canadian Navy

There will be an afternoon tea break from 1445 to 1515

1630 Closing remarks from the Chair and end of conference

marcus evans would like to thank everyone who has helped with the research and organisation of this event, particularly the speakers and their staff for their support and commitment.

About the Collaborative Sponsor



APMM Group Pty Ltd is a nationally accredited training provider and a leader in the areas of Project and Maintenance Management training. APMM Group continues to grow and is expanding in local, interstate and overseas markets. This growth can be directly attributed to our excellent reputation in providing training and consultancy services and our long-term commitment to our clients.

About the Endorser



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