

SHORT COURSE:

Maintenance Management Optimisation

When: Tuesday 31 August – Wednesday 1 September.

Where: Sheraton Santiago Hotel & Convention Center.

Professors: Dr. Andrew Jardine, University of Toronto, Canada; Dr. Darko Lout, Komatsu, Chile; and Dr. Rodrigo Pascual, Pontificia Universidad Católica de Chile.

Language: The course will be taught in English and Spanish with simultaneous translation.

OBJECTIVE

This course is designed to demonstrate how companies can optimise inspection and replacement intervals for components and equipment in accordance with solid economic and risk criteria. The course will show how maintenance history can be used to quantify the risk of a fault (in terms of cost for the company), which will lead to an effective evaluation of equipment's reliability and the resulting impact. The techniques covered in this course have been successfully applied in a large number of international companies. Case studies from a variety of industries will be discussed.

WHO SHOULD ATTEND?

Plant managers, maintenance managers, superintendents, supervisors, maintenance engineers, maintenance planners and reliability engineers should attend this course. It is intended for professionals who work in fields related to maintenance and reliability of industrial equipment.

MATERIALS

All participants will receive a binder with the course notes.

PROGRAMME

Day 1 (9:00am-6:00pm)

1. Introduction

1.1 Maintenance objectives

Process model (input, output)

Central elements (organisation, planning, control)

1.2 Maintenance strategies

Preventative, corrective, modification

Maintenance timing (TBM, CBM, RTF, etc.)

1.3 Cost structure

Direct costs
Indirect costs

1.4 Maintenance evaluation (KPI)

Effectiveness and efficiency indexes
Excellence in maintenance
Opportunities for improvement

2. Incorporating risk into maintenance decision making

2.1 What is risk?

Fault probability
Fault consequences

2.2 How can we estimate risk?

2.3 How does equipment develop faults?

Pareto/Jack Knife diagrams
HAZOP
FMEA/FMECA
RCM
RCFA

3. Analysing fault data

3.1 Modelling fault rate

The role of probability density and fault distribution

3.2 Weibull distribution

Weibull model
Estimating parameters
Censoring data
Case studies

Review of key concepts from day 1

Day 2 (09:00-18:00)

4. Optimising preventative maintenance decisions

4.1 Estimating life cycle costs

4.2 Opportunistic maintenance

4.3 Strategy optimisation

4.4 Case studies

5. Optimising inspection intervals and spare parts inventory

5.1 Optimising inspection intervals

Intervals A, B, C, D
Protective devices
Case study

5.2 Optimising spare parts inventory

Poisson distribution
Case study

6. Optimising maintenance decisions based on condition

6.1 CBM strategies

6.2 Estimation of remaining useful life based on maintenance data

6.3 EXAKT model

6.4 Case studies

Final review of key concepts

PROFESSORS



Andrew K.S. Jardine, Ph.D., is a professor and Chief Researcher at the Centre for Maintenance Optimization and Reliability Engineering (C-MORE) of the University of Toronto, Canada. Here, he has developed the software EXAKT, for maintenance optimization based on condition, as well as the software SMS, for the optimization of decisions regarding spare parts inventory. Additionally, Dr. Jardine is a consultant for the Centre for Excellence in Asset Management with IBM Global Business Services. He earned his Ph.D. from the University of Birmingham, England, specializing

in the development of mathematical models for decision making in equipment maintenance and replacement. He is the author of AGE/CON, a software designed to determine the economic life of mobile equipment, and he is also the author of the OREST software, designed to optimize the intervals of spare components' replacement. Professor Jardine has also written numerous articles for various publications, including *Maintenance Excellence: Optimizing Equipment Life-Cycle Costs*, co-edited by John D. Campbell, and *Maintenance, Replacement and Reliability: Theory and Applications*, written in conjunction with Albert H.C. Tsang. Dr. Jardine is regarded among the most well respected figures globally in the field of industrial maintenance and reliability.



Darko Louit Nevistic, Ph.D., is the Manager of Business and Projects at Komatsu Chile S.A. He earned his Ph.D. in Industrial Engineering from the Centre for Maintenance Optimization and Reliability Engineering (C-MORE) of the University of Toronto, Canada. Previously to this, he was a professor at the Mining Centre of the Pontificia Universidad Católica de Chile, where he dedicated himself to teaching and research in the fields of mining operations and maintenance and reliability of industrial equipment. Dr. Louit earned his M.Sc. en Mining Engineering from the Pontificia Universidad Católica de Chile, and is an industrial civil engineer. He has been a consultant to important mining and industrial companies in Chile, Argentina, Canada and Colombia. He has published many articles in journals and international conferences, and has also taught multiple courses on maintenance engineering.



Rodrigo Pascual, Ph.D., is a full-time professor at the Mining Centre of the Pontificia Universidad Católica de Chile. He earned his Ph.D. from the Laboratory of Aeronautical and Space Techniques of the Université de Liège, Belgium. He is a mechanical civil engineer, graduated from the Universidad de Concepción. He is specialized in the development and implementation of methods for optimizing physical asset management, most specifically in aspects related to life cycle management of industrial and military equipment. He is the director of the Management Laboratory of the Mining Centre at the Pontificia Universidad Católica de Chile. He has taught a series of courses and has participated in various consultancies within his area of expertise. He has published many articles in journals and international conferences, among some of which are *El Arte de Mantener*. He is a guest faculty member at the Mechanical Engineering Department of the University of Toronto, Canada. From 2000 to 2008 he was a professor at the Mechanical Engineering Department of the Universidad de Chile.