PHYSICAL ASSET MANAGEMENT PROGRAM

An intensive 5-day course offered in partnership with the Faculty of Applied Science and Engineering

November 15-19, 2021

UNIVERSITY OF TORONTO
SCHOOL OF CONTINUING STUDIES

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

Contents

Proven Best Practices for Asset Management

Some organizations manage their assets well, while others do not. Why? Why are some outfits good at keeping costs low, reducing stoppages, spotting trouble, and achieving greater output, while others are not? How can you learn these skills? An excellent way to gain these skills is by attending this intensive five-day program. You'll join a group of like-minded professionals who are guaranteed to come away with the necessary tools to competently and profoundly upgrade their asset management practices. Participants at earlier sessions have been extremely impressed by the high calibre of the program.

Who Should Attend

Our November 2021 offering will mark the twentieth year that the Physical Asset Management (PAM) program has been run. Managers from all corners of the globe, and from a wide variety of industrial and governmental organizations, have attended our earlier sessions. Attendees have included line managers responsible for the maintenance of their machinery and equipment, reliability specialists who must recommend effective maintenance practices, asset managers responsible for their organizations' maintenance strategies, and plant managers who seek excellent and proven strategies that give them competitive advantage over their competitors. Much of the instruction focuses on cost-related issues, and makes PAM appropriate as well for those on the financial side of their organizations. If your responsibilities include any aspect at all of managing physical assets, we urge you to take a close look at this exceptional learning opportunity.

The Extraordinary Value of this Program

The five-day Physical Asset Management Program is offered in partnership with the Faculty of Science and Engineering at the University of Toronto, which has been designated the #1 Engineering school in Canada.

The program is taught by three world-class instructors who bring a wealth of experience to the classroom:

- a mastery of the subject matter;
- the ability to relate theory and practice;
- real-world experience with corporations and organizations;
- the ability to deliver material in an interesting and clear manner.

The program is led by Dr. Andrew Jardine, an international authority in the asset management field and a respected consultant, author, teacher and innovator in the area of reliability, replacement and equipment maintenance.

The program combines fundamental need-to-know material with new, but proven, leading-edge approaches that have shown measurable payoffs.

Participants will receive five full days of instruction over the course of five consecutive weekdays, including a wide range of case studies which demonstrate how these principles have been successfully and widely applied. You will come away equipped with a complete binder of notes on the program material, valuable hard-cover books, and an unparalleled learning experience.

The University of Toronto Faculty of Applied Science and Engineering is the

#1

Engineering School in Canada.

Program Dates, Location, Tuition Fee and Registration

Program Dates

The five full-day sessions will be held from Monday, November 15 to Friday, November 19, 2021.

Location

All program sessions will be held at the Faculty of Applied Science and Engineering on the University of Toronto's St. George campus.

Tuition Fee

The full tuition fee (including course materials) for the five-day program is CDN$3,500, plus applicable taxes.

How to register

For more information, or to register for the 2021 Physical Asset Management Program (SCS Course Number 3531), call **416.978.2400** or visit: https://learn.utoronto.ca/programs-courses/courses/3531-physical-asset-management

Engineering Professional Development

The University of Toronto School of Continuing Studies (SCS), in collaboration with the Faculty of Applied Science and Engineering, offers many courses and certificates for people with a background in engineering and applied science. Additional SCS courses include:

- **Building Science**
- **Facility Management**
- **Project Management**
- **Project Management Advanced**
- **Business Analysis**
- **Energy Management**
- **Environment & Sustainability**

For more detailed information about these and other programs, visit **www.learn.utoronto.ca**

Day 1

INSTRUCTOR: Donald Barry

Donald Barry is a Principal Consultant with Asset Acumen Consulting Inc., supporting Risk and Reliability Strategies, ISO55000 and Asset Management Strategy consulting, Enterprise Asset Management and Asset Performance Management solutions. Previously he was the Global Lead for IBM's Asset Management Center of Competency and an Associate Partner, leading IBM Canada's Maximo and Enterprise Asset Management Practice (for 15 years).

He has over 40 years in asset management related service delivery support systems and application development including three years in field service management and 15 years directly in business process development and supply chain management.

Mr. Barry's direct client list has included industries such as: Upstream Oil and Gas, Pipelines, Power Generation and T&D Utilities, Mining, Forestry, Airlines, Electronics Manufacturers, Steel Manufacturers, Federal, Provincial and Municipal Governments.

He was a prime contributor to the 2nd edition of "Asset Management Excellence – Optimizing Equipment Life-cycle Decisions" published 2011, CRC Press.

Mr. Barry is a recipient of the Lifetime Achievement Award in Plant and Production Maintenance awarded by Federated Press.

What you will learn

Donald Barry's single-day presentation will examine principles such as leadership, managing risk, and maintenance optimizations. His session will cover:

- An introduction to the elements that contribute to a successful asset management organization;
- How to assess your organization's maturity in Asset Management;
- How to prioritize opportunities in your Maintenance Management organization;
- The key financial influences of asset management;
- Some of the leading practices in asset management;
- The value of properly executed planning and scheduling;
- The value of Reliability-Centred Maintenance (RCM2, RCM3);
- The evolution of a Risk and Reliability culture in Asset Management;
- Key initiatives to take back to your organization;

Day 1

Monday, November 15
9am–5pm

Leadership and Control

In-class Session

Faculty of Applied Science and Engineering

Maintenance pyramid of excellence overview

- Leadership, control, continuous improvement, and quantum leaps

Maintenance strategy, managing change, maintenance tactics, Maintenance, Repair and Operations (MRO) materials management, and performance measures

The six key steps to planning and scheduling resources effectively

- Planning and Scheduling exercise (discussed remotely)

Strategic cost reduction

- What does it really mean in maintenance?
- What can we realistically achieve?

Day 1 continued

Managing Risk and Reliability

Risk and management

- A discussion of the various Reliability-Centred Maintenance (RCM) methods, Root Cause Failure Analysis (RCFA), and PM optimization

Reliability-centred maintenance and failure modes and effects

- Asset-centric continuous improvement and risk reduction
- The Risk and Reliability Culture evolution in Asset Management

Total productive maintenance

- People-centric continuous improvement

Effective data management

- Information strategies for risk management

Introduction to ISO 55000

- What it is and how it can be used to leverage controlled change in asset management

Days 2, 3, 4

INSTRUCTOR: Dr. Andrew Jardine

Andrew K.S. Jardine, Ph.D., C.Eng., P.Eng. FCAE, FIISE, FEIC, FISEAM (Hon.), was the Founding Director of the University of Toronto's Centre for Maintenance Optimization and Reliability Engineering (C-MORE). During the period 1986-95. Dr. Jardine was Chair of the University's Department of Industrial Engineering.
He is the co-editor (with J.D. Campbell and J. McGlynn) of Asset Management Excellence: Optimizing Equipment Life Cycle Decisions, published by CRC Press in 2010. His most recent book is the 3rd edition of his earlier work, Maintenance, Replacement and Reliability: Theory and Applications, published by CRC Press in 2021 and co-authored with Dr. A.H.C. Tsang.
Professor Jardine has garnered an impressive array of awards, honours and tributes, including having been the Eminent Speaker to the Maintenance Engineering Society of Australia (now the Asset Management Council), as well as the first recipient of the Sergio Guy Memorial Award from the Plant Engineering and Maintenance Association of Canada. In 2013, he received the Lifetime Achievement Award from the International Society of Engineering Asset Management (ISEAM). In 2020 he was awarded Life Membership of PEMAC: Asset Management Association of Canada. Professor Jardine is listed in Who's Who in Canada.
He has been elected a Fellow of the Canadian Academy of Engineering, a Fellow of the Institute of Industrial and Systems Engineers, a Fellow of the Engineering Institute of Canada and an Honorary Fellow of the International Society of Engineering Asset Management.
Besides writing, researching, and teaching, Dr. Jardine has carried out innumerable consulting assignments with organizations around the world, including mines, government agencies, power and transit companies, and scores of others.

What you will learn

Dr. Andrew Jardine's three days provide an in-depth examination of preventive maintenance, spare parts provisioning, inspection policies, and much more:

- Which **equipment components** should be part of your preventive maintenance plan;
- Which components should be run to failure;
- Why **Weibull Analysis** is a must in analyzing equipment failure;
- The importance of the **Weibull shape parameter**;
- A sure-fire way to calculate your **spare part requirements**;
- Which **replacement policy** to use for critical components: the block replacement or age-based replacement times;
- How to deal with **limited data**;
- Steps you can take to improve your current preventive maintenance program;
- How to interpret the **Bath-Tub Curve**'s "three regions" and what the interpretation will tell you;
- How to use **OREST software** to optimize component preventive replacement times;
- How to use OREST software to forecast the **demand for spare parts** taking into account an optimal preventive replacement policy;
- The right way to establish the optimal inspection frequency for equipment in continuous operation;
- The right way to evaluate the current interval between classes of inspection, such as A, B, C, and D;
- How to establish the most appropriate **failure finding interval** for protective devices;
- How to come up with the failure risk of equipment that is subject to **condition-based maintenance**;
- What the University of Toronto's new **EXAKT software** (for condition-based maintenance) and **SMS software** (for provisioning of emergency/capital spares) may be able to do for you;
- Identify the **best buy** for capital equipment;
- Why you should incorporate **the time value of money** when establishing the economic life of an asset;
- How to arrive at the economic life of an asset where its **utilization declines** as it ages;
- The answer to optimizing the **repair-or-replace** decision;
- How to work with AGE/CON and PERDEC to perform **economic life calculations**;
- How **tax consideration** influence the economic life of an asset;
- Whether or not to take advantage of a **technologically-improved** asset;
- How to elicit **tacit knowledge** from specialists to improve economic life decisions;
- How to establish the optimal composition of a **maintenance crew**;
- How to decide quantitatively whether to **contract out** specified maintenance task;
- What goes into the design of an intelligent **computerized maintenance management system** (CMMS).

Day 2

Tuesday, November 16
9am–5pm

Reliability Improvement through Preventive Maintenance and Optimal Spares Stocking Policies

In-class Session
Faculty of Applied Science and Engineering

Analysis of component failure data
- Probability density function
- Reliability function
- Hazard function
- Weibull density
- Infant mortality
- Bath-Tub Curve

Exercise in analyzing component failure data using the Weibull distribution
- Estimating the Weibull parameters
- The role of the OREST software package

Dealing with censored data, the 3-Parameter Weibull, and the Kolomorgov-Smirnov Test
- Upper-end censoring
- Multiply censored group data
- Estimating the location parameter in the Weibull distribution
- Checking the goodness-of-fit of the distribution

Component replacement procedures including Glasser's Graph
- Block replacement policies
- Age-based replacement policy
- Setting policies based on safety constraints, cost-minimization and availability-maximization
- Repairable systems

Case studies in component preventive replacement
- Including boiler plant, bearings, transmissions, clutches, pumps, sugar feeds, compressor valves and centrifuges

Spare parts provisioning
- Fast-moving spares
- Emergency (insurance) spares

Case studies in spares provisioning
- Including line replaceable units (LRUs), cylinder heads, repairable electric motors and transformers

Day 3

Wednesday, November 17
9am–5pm

Reliability Improvement through Inspection & Predictive Maintenance

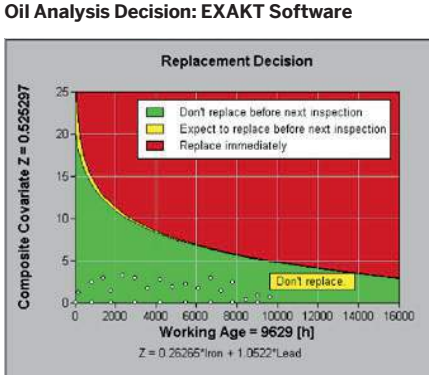
In-class Session
Faculty of Applied Science and Engineering

Reliability improvement through inspection
- Inspection frequency and depth for equipment in continuous operation
- Inspection intervals to maximize profit
- Maximizing equipment availability
- Inspection intervals for equipment used in emergency situations (e.g. protective devices)
- Case studies including transportation fleets (for inspection frequency) oil and gas field equipment such as pressure safely valves (for protective devices)

Reliability improvement through health-monitoring procedures
- Proportional hazards modelling
- Spectroscopic oil analysis programs
- Optimization of condition-based maintenance procedures
- Role of EXAKT software for Condition-Based Maintenance (CBM) optimization
- Case studies including food processing industry (vibration monitoring), pulp and paper and shipping equipment such as compressors (vibration monitoring) and diesel engines (oil analysis), turbines in an electrical generating station (pressure measurements)

Demonstrations of EXAKT software for optimizing condition-based maintenance decisions

Oil Analysis Decision: EXAKT Software



Day 4

Thursday, November 18
9am–5pm

Life Cycle Costing (LLC) Management

Organizations adopting Life Cycle Costing are rapidly increasing in number, as more of them recognize its role in making optimal long-term decisions. The idea of "buying the cheapest" is losing its appeal as more managers realize that, in the long run, the cheapest acquisition costs rarely coincide with the least expensive buy. This session combines Life Cycle Costing decisions with many real-world examples in an interactive and hands-on forum. It will help those responsible for LCC-related decisions to learn when to buy a new asset, how to determine the best time to replace an existing asset, and how to forecast the future life cycle costs of their fixed and mobile machinery and equipment.

The application of the models discussed in the workshop will be demonstrated by means of real case studies. We will introduce software packages called AGE/CON (for mobile equipment replacement decisions) and PERDEC (for fixed capital equipment decisions) and demonstrate how to use them to solve LCC problems.

Choosing the best buy in the long term

- The concept of the time value of money
- Defining cash flow diagram
- Calculating net present value of a decision
- Estimating the time value of money in practice

Calculating the economic life of an asset

- The trade-off between O & M costs and capital expenditures: establishing the economic life of fixed equipment such as an internal combustion engine
- Establishing the economic life of mobile equipment, including fleet vehicles and fork lift trucks
- Case study: establishing the economic life of mobile assets that are highly utilized when new, but used for peak demands as they age
- North American case studies: transportation
- Mining Shovel case study: how to calculate the best time to replace the current asset with a more technologically-improved asset

Repairing an existing asset versus buying a new one

- Case study: repair a leak or replace the damaged section of an underground pipe

Carrying out LCC analysis when there is limited (or no) data available

- Case study: establishing the economic life of linear assets such as the steel mains of a major gas distribution company

Case Studies

The case studies referred to above include internal combustion engines, fleet vehicles, forklift trucks, a loader, repair-or replace decision and a fleet of transformers. They represent real-world examples where comapnies saved hundreds of millions of dollars by applying LCC management principles.

Effective Use of Maintenance Resources

Organizational structure, crew sizes, workshop resource requirements

- Balancing maintenance costs against plant reliability
- Establishing the optimal number of machines to have in a workshop
- Resource requirements using queuing theory and simulation
- Utilization of outside resources
- Case studies including optimizing mobile fleet size to meet an annual demand, establishing optimal mix of machines to have in a steel mill maintenance workshop

Maintenance management information systems

- A discussion on CMMS data "fitness-for-purpose"

Day 5

INSTRUCTOR: Professor Sharareh Taghipour

Sharareh Taghipour joined the Department of Mechanical and Industrial Engineering at Ryerson University in August 2012. Before her appointment to Ryerson, she worked as a postdoctoral fellow for about a year at the Centre for Maintenance Optimization and Reliability Engineering (C-MORE) at the University of Toronto. She obtained her PhD in Industrial Engineering from the University of Toronto and both her BSc in Mathematics and Computer Science and her MASc in Industrial Engineering from Sharif University of Technology, Iran.

The focus of Dr. Taghipour's research has been on physical asset management, and she is currently Tier 2 Canada Research Chair in Physical Asset Management at Ryerson University. Dr. Taghipour has well-established partnerships and research collaborations with various industry partners from healthcare to energy, mining, transportation, utilities, and manufacturing, including the Toronto General Hospital, Admira Distributed Hybrid Energy Systems Inc., Vale Canada Ltd. CHEP Canada, Fiix, Alstom France, Nova Chemicals, Manitoba Hydro, and ArcelorMittal Dofasco. She is currently serving as the Regional Editor-North America of the Journal of Quality in Maintenance Engineering and Associate Editor of the Proceedings of the Reliability and Maintainability Symposium (RAMS).

Dr. Taghipour has received numerous awards, including Ontario Ministry of Research and Innovation – Early Researcher Award (2019), Ryerson Faculty of Engineering and Architectural Science Teaching Award (2018) , Ryerson University Early Research Career Excellence Award (2017), American Society for Quality (ASQ)-Reliability Division (RD) Best Paper Award (2016), Ryerson Faculty of Engineering and Architectural Science Scholarly Research and Creative Activity (SRC) Award (2015), The Best Student Paper Award of the Tom Fagan Reliability & Maintainability Symposium (2011), The Best Student Paper Award of the American College of Clinical Engineering (2010), and Asset Management Council postgraduate Research Award (2010) from Australia.

What you will learn

Dr. Sharareh Taghipour will provide an in-depth examination of current developments in new technologies, those already being applied by organizations seeking excellence in physical asset management and those at the research stage that are expected to provide valuable benefits to PAM decision-making in the future. Her sessions will cover the following:

- **Emerging technologies**, such as artificial intelligence (AI), big data analytics, augmented reality/virtual reality (AR/VR), digital twin, IoT enabled devices, blockchain, and edge computing, and their impact on the management of physical assets;
- **Maintenance 4.0** and **Cyber-Physical Systems** in Industry 4.0;
- **Machine learning algorithms** and a step-by-step guide to build a machine learning model for predicting the remaining useful life of a machine;
- **Deep learning algorithms** and **predictive maintenance**;
- **Applications of various emerging technologies** in sectors such as transportation, manufacturing and mining.

Day 5

Friday, November 19
9am–5pm

Role of Emerging Technologies in Physical Asset Management

In-class Session
Faculty of Applied Science and Engineering

Emerging Technologies and Physical Asset Management

- Top strategic technology trends, such as artificial intelligence (AI), big data analytics, augmented reality/virtual reality (AR/VR), digital twin, IoT enabled devices, blockchain, and edge computing
- How these technologies are revolutionizing physical asset management
  Cases studies in various industries such as
- manufacturing, mining, and transportation

Maintenance 4.0 and Cyber-Physical Systems

- What are cyber-physical systems?
- Industry 4.0
- Predictive and prescriptive maintenance
- Cyber-physical systems for maintenance
- Maintenance of cyber-physical systems

Machine Learning for Predictive Maintenance

- Data analytics and predictive analytics
- AI machine learning algoritms
- How machine learning can be used for predictive maintenance
- How to build a machine learning model to predict the Remaining Useful Life (RUL). Steps include feature engineering, model training, and model evaluation and improvement. NASA Turbofan engine data will be used for illustration.

Deep Learning Algorithms for Predictive Maintenance

- The difference between machine learning and deep learning algorithms
- How deep learning algorithms can enhance predictive maintenance
- Step-by-step construction of a deep learning algorithm for predictive maintenance

GUEST SPEAKER: Professor Chi-Gun Lee

Dr. Chi-Guhn Lee is a Professor of Industrial Engineering and the Director of the Centre for Maintenance Optimization and Reliability Engineering (C-MORE) at the University of Toronto.

Industry applications of machine learning to optimize physical asset management decisions

Professor Lee has been active in such areas as Optimal Process Control, Supply Chain Management and Financial Engineering. Dr. Lee and his team adopt dynamic optimization theory combined with machine learning to tackle optimization problems facing dynamic and uncertain environment. Recent research projects include a Bayesian combination approach to reinforcement learning with multiple reward shaping functions, deep recurrent neural network-based reinforcement learning for dynamic portfolio management, and Bayesian Thompson Sampling for non-stationary multi-armed bandid problems. He has worked closely with private firms, including IBM, General Motors, Magna International, and State Grid Corp of China to name a few.
Professor Lee's presentation will focus on machine learning for maintenance applications, including a case study such as clustering of generating units in a hydro power plant, and deep learning to detect anomalies along TTC's rail network along with the role of domain experts to obtain improved insight into data. Additionally, comments about common mistakes associated with applying machine learning will be presented.

GUEST SPEAKER: Joseph Ashun

Joseph Ashun is a former Senior Manager, Global Maintenance Systems & Proceses (Asset Management), Barrick Gold Corporation.

Industry expertise: CMMS & Asset Bills of Materials

Joe Ashun is a subject Matter Expert in Maintenance Management, Reliability, Business Process Improvement, and ERP Implementations. His specialties include Maintenance Management Consulting, Business Process Improvement, Marine Propulsion Machinery, Diesel Engines & Boilers, Mining Equipment, Supply Chain Management and CMMS Selection and Implementation. Joe is a certified Professional Engineer in the province of Ontario.
Joe graduated with a degree in Marine Mechanical Engineering from Alexandria Maritime Academy, Egypt and subsequently served as a senior marine engineer in the merchant navy in both the US & Singapore. Joe also graduated with a master's degree in Engineering and Project Management from the University of Southern Queensland, Australia. Prior to joining Barrick Gold Joe was a Managing Consultant with PriceWaterhouseCoopers and later IBM's Asset Management Consulting Practice.
Joe was also a Maintenance Manager with Marietta Canada, a Leading Manufacturer in Hotel Amenities.

GUEST SPEAKER: Jean-Pierre Pascoli

Jean-Pierre (J.P.) Pascoli, P.Eng, CMRP, CAMA, MMP, is the director of physical asset management & reliability for Cameco Corporation, a Canadian uranium mining and nuclear fuel manufacturer with operations in both Saskatchewan and Ontario.

Digital transformation for operational excellence in asset management

Holding a degree in mechanical engineering from Queen's University, and a certificate in physical asset management program the University of Toronto, J.P. is a professional engineer with over 25 years of experience in a variety of primary resource industries. He is a certified maintenance and reliability professional with SMRP, and a certified asset management assessor through World Partners in Asset Management (WPiAM). J.P. is also an accredited maintenance management professional with the Asset Management Association of Canada (PEMAC) and sits on their board of directors, currently serving as president.

J.P.'s presentation will describe Cameco's journey to excellence in Asset Management & Reliability at its operations through a lens of digital transformation initiatives that leverage IIoT and mobility.

Evidence-Based Asset Management

Examples of the program's leading-edge thinking

Our classroom sessions cover the important fundamentals in the field of physical asset management, including the decision-making principles for inspections, scheduling, repair vs. replacement, spare parts, etc. These principles are presented in an innovative and refreshing manner.

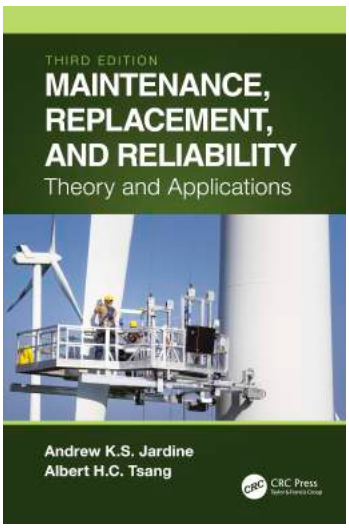
You will learn that *hunches*, *rules of thumb*, *intuition*, and *years of experience* are no longer effective tools for making important asset management decisions. Our team of experienced instructors is solidly committed to today's prevailing acceptance of decision making based on **evidence** and **data collection**. They demonstrate this by presenting innovative concepts that have been proven in practice and which are acknowledged as true advances by experts in the field. Two key advances that will be covered in depth are the principles of evidence-based asset management and tacit knowledge.

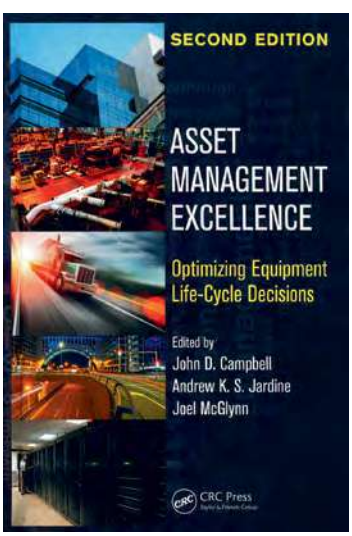
Evidence-Based Asset Management (EBAM)
Dr. Jardine describes evidence-based asset management this way: "Evidence-based medicine is considered the gold standard in modern medical practice. Why shouldn't evidence occupy the same rank in the costly, critical area of asset management? We think it should, which is why we so strongly recommend that decisions made today be based on the solid foundation of EBAM."

Where does this evidence reside? Where can we find it, and how can we identify and extract it?

Tacit Knowledge
New work on tacit knowledge has already produced tangible results. It started as a concept — the idea that, very often, seemingly thin data records or ostensibly ill-defined numbers can, with the inventive application of certain algorithms, uncover an abundance of useful information. Tacit knowledge has now progressed beyond the notional stage to yield valuable information that allows proper analysis to be carried out. Tacit knowledge is gained through the employment of a technique known as **knowledge elicitation**, which calls for the enlistment of colleagues in operations, maintenance, engineering and finance to determine modelling parameters and fill gaps in the available stored data.

These are but two examples of the kind of unique learning you can expect to come away with at the end of our intensive five-day program.





Real-World Experience

The five sessions will feature a variety of instructional modes and interactivity. Dialogue is encouraged and specific questions relating to one's own challenges will be addressed (or responded to outside of classroom time).

Case studies drawn from actual industry experience will be used extensively, supplemented by individual and group problem-solving sessions.

Unique elements will enhance the learning experience. For example, Dr. Jardine will combine the presentation of EBAM (evidence-based asset management) methodologies and tools with many applications of their use in multiple asset management settings such as steel making, food processing, military, mining, oil and gas, pulp and paper, railway systems, transportation, and electricity generation, transmission and distribution.

In addition, Dr. Jardine will guide participants through several exercises using three software packages specifically developed for optimizing preventive replacement decisions and forecasting the demand for fast-moving spare parts (OREST), establishing the optimal number of critical spares to stock (SMS), and optimizing CBM decisions (EXAKT).

A highlight of Don Barry's session is the always popular Planning and Scheduling Game that will help participants understand the real value of maintenance planning and scheduling and the importance of good execution (to be discussed in a remotely presented session).

In her session, Dr. Sharareh Taghipour will introduce emerging technologies, some already in use and others still in the development stage. Those who want their companies to be leaders rather than followers stand to learn a great deal!

Course details are subject to change. For the most up to date information, please see our website at:

learn.utoronto.ca

Deliverables

What you will receive

The five intensive, day-long classroom sessions are the centerpiece of your experience at the Physical Asset Management Program. However, *much more* is provided, creating an overall package that will engage you while you're here, and deliver long-lasting results that will pay off when applied within your organization.

You will receive:

- 35 hours of lecture time
- Two impressive hard-cover books (pictured at left): both co-authored by Dr. Jardine
- Three knowledge guest speakers who will talk about machine learning, Asset Bills of Material, effective asset databases, and establishing corporate excellence.
- A program certificate from University of Toronto acknowledging your completion of the program

Accolades from past attendees

Here's what earlier attendees have said:

"Real industry examples and cases on application of theory."

"It presents an overall view and provides tools for management."

"Good blend of theory and practical applications."

"Liked the C-MORE case studies."

"Very much appreciated the course material reviews at the beginning and end of the day."

"Wide-ranging..."

"Touched on all areas."

"Learned the differences between supplier, manufacturer and user-based maintenance plans and strategies."

"The sharing of attendees' experiences added a lot."

"The leaders had the ability to relate complicated formulas to the applications needed back at work."

"The instructors had lots of hands-on experience to draw from."

"Good mix of academic material with practical applications."

"Combines asset management ideals with maintenance realities."

"There were lots of examples that included real companies' experiences."

"Constantly brought together theory."

"It was great — learned from the leaders' wealth of experience and real-world examples."

"A difficult subject — well presented, instructors are excellent communicators."

"Lots of material. I can use it to improve our company."

"Thought provoking. We've come a long way, but this course has encouraged even more future development."

Previous participants

Participating Organizations

This is a partial list of organizations which have sponsored participants attending our physical asset management programs. These organizations come from both the corporate and public service sectors — from outfits that deal with a wide variety of products and services and from various countries around the world.

Agrium
Accenture Canada
Astra Zaneca Canada Inc.
ATCO Electric
Babcock Canada
Barrick Gold Corporation
BC Hydro
Bell Canada
BP America Production Inc.
British Airport Authority
British American Tobacco
Canadian Forest Products Ltd.
Celanese Canada Inc.
Chevron Australia Ltd.
City of Niagara Falls
Clark
Con Cast Pipe
Department of National Defence
Department of Defence (Navy)
ExxonMobil Corporation
GO Transit
Great Lakes Power Ltd
HaasKorea Corporation
Horizon Utilities
Hydro Electric System Ltd.
Inco Ltd.
Irving Pulp and Paper
J.D. Irving Limited

Kennecott Copper Corp. Kimberly
Kinross Gold Corporation
Komatsu Canada Ltd.
Krupp Engineering Australia
Loblaw Companies Toronto
Machine Diagnostic Inc.
Manitoba Hydro
Newfoundland & Labrador Hydro
Novartis Pharmaceuticals
Ontario Clean Water Agency
Ontario Ministry of Natural Resources
Ontario Power Generation
Pacific Power
Petroleum Co. of T&T Ltd.
Placer Dome Inc.
Purolator Courier Limited
Queensland Alumina
Rockwell Automation
Saint-Gobain Glass UK
Sherritt International Corp.
Shin Etsu Handotai Europe
SKF Canada Inc.
SLH Transport Inc.
Smurfit-Stone Container Corp.
Terasen Gas Inc.
Tillsonburg Fire Services
Toyota Motor Manufacturing UK
TXU Electric
Unilever Canada
Weyerhaeuser Canada

Toronto: A great destination

If you're from out-of-town, you'll find that Toronto itself is an exciting "extra". Our vibrant and cosmopolitan city attracts visitors from around the world who come to experience Toronto's rich and fascinating multi-cultural character, its delicious international cuisines, and its compelling choice of arts, architecture, live theatre and music offerings. Not to mention sporting events — your chance to see the Maple Leafs in action! You'll have a whole weekend between course sessions to experience our city and all it has to offer.

Visit **toronto.com** or **seetorontonow.com** for exciting ideas that will make your visit to Toronto delightfully memorable.

CHANGE STARTS WITHIN

Embrace the unknown and start your journey here.

UofT SCHOOL of CONTINUING STUDIES

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