

# PHYSICAL ASSET MANAGEMENT PROGRAM

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

November 13-17, 2023



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- RELIABILITY BY DESIGN
- RELIABILITY BY OPERATOR AND SYSTEMS SUPPORT

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- RELIABILITY THROUGH PREVENTIVE MAINTENANCE AND OPTIMAL SPARES STOCKING POLICIES
- RELIABILITY THROUGH INSPECTION & PREDICTIVE MAINTENANCE

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- OPTIMIZING METHODOLOGIES IN ASSET MANAGEMENT
- RELIABILITY THROUGH ASSET LIFECYCLE MANAGEMENT

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- IT AND IoT IN ASSET MANAGEMENT AND IMPLEMENTING AM EXCELLENCE

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## 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 caliber of the program.

## WHO SHOULD ATTEND

The Physical Asset Management program has been running since 2000. Managers from around the globe and from various 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 organization's maintenance strategies, and plant managers who seek excellent and proven strategies that give them a competitive advantage over their competitors.

Much of the instruction focuses on cost-related issues and makes PAM appropriate 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

This five-day Physical Asset Management Program is offered in partnership with the Faculty of Applied Science and Engineering at the University of Toronto, designated the #1 Engineering school in Canada\* according to Times Higher Education.

Taught by 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 straightforward 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, proven leading-edge approaches with measurable payoffs.

Participants will receive five full days of instruction throughout five consecutive weekdays, including a wide range of case studies demonstrating how these principles have been successfully and widely applied. In addition, you will be equipped with training materials and notes on the program, valuable hard-cover books, and an unparalleled learning experience.

## PROGRAM DATES, LOCATION, TUITION FEE AND REGISTRATION

### Program Dates

The five full-day sessions will be held from Monday, November 13, to Friday, November 17, 2023

### Delivery

Online delivery will use U of T's Learning Management System. It will include live, interactive, instructor-led webinars.

NOTE: To ensure appropriate interactions between participants and instructors, enrollment is limited to 20 participants. Please register early since the program is often oversubscribed.

### Tuition Fee

The full tuition fee (including the 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 2023 Physical Asset Management Program (SCS Course Number 3531), call 416.978.2400 or visit: [www.learn.utoronto.ca/programs-courses/courses/3531-physical-asset-management](http://www.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.

For more detailed information about these and other programs, visit [www.learn.utoronto.ca](http://www.learn.utoronto.ca)



UNIVERSITY OF TORONTO  
FACULTY OF APPLIED SCIENCE & ENGINEERING

# #1

# ENGINEERING SCHOOL IN CANADA\*

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



## DAY 1 - MONDAY NOVEMBER 13

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TIME: 9AM-5PM

INSTRUCTOR: DONALD BARRY

### SPONSORSHIP ALIGNMENT AND MANAGED SCOPE

#### Maintenance pyramid of excellence overview

- Sponsorship alignment, managed scope, stakeholder engagement, uber change
- Maintenance strategy, managing change, maintenance tactics, Maintenance, Repair and Operations (MRO) materials management, and performance metrics

#### The six critical steps of maintenance execution (planning and scheduling) resources effectively

- Planning and scheduling exercise, discussed remotely

#### Key elements of maintenance parts management

- Strategic cost reduction
- What does it mean in maintenance?
- What can we realistically achieve?

#### Metrics in asset management

- Key metrics and a method for developing metrics

## DAY 2 - TUESDAY NOVEMBER 14

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TIME: 9AM-1PM

INSTRUCTOR: DONALD BARRY

### RELIABILITY BY DESIGN

#### Introduction to reliability methods

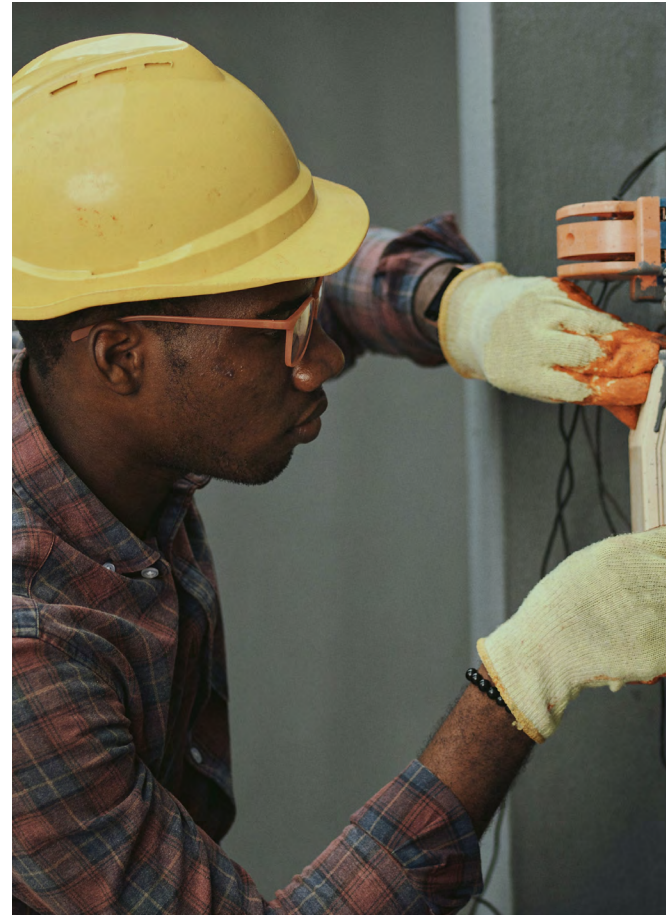
- HAZOPS, RBI, RCFA, RCM,

#### Reliability by design

- Executive introduction to RCM2 and RCM3 approach and methods
- FMEA methods, risk reduction, and continuous improvement methods

#### Data derived from RCM analysis and its role in the future

- Effective data management
- The importance of RCM leadership programs and discipline
- Why risk and reliability programs fail



TIME: 1-5PM

INSTRUCTOR: DONALD BARRY

### RELIABILITY BY OPERATOR AND SYSTEMS SUPPORT

#### Reliability by operator introduction

- People-centric improvement
- Total Productive Maintenance
- Autonomous Maintenance
- Other

#### Beyond RCM and TPM – Entrenching technology and uber change

#### The role of systems in supporting asset management

- EAM role, APM role
- Selecting a system
- Interaction of AM data sets for reliability

**DAY 3 - WEDNESDAY NOVEMBER 15**

TIME: 9AM-1PM

INSTRUCTOR: ANDREW JARDINE

**RELIABILITY THROUGH PREVENTIVE MAINTENANCE AND OPTIMAL SPARES STOCKING POLICIES**

**Analysis of component failure data**

- Probability density function
- Reliability function
- Hazard function
- Weibull density
- Infant mortality
- Bathtub curve

**Exercise in analyzing component failure data using Weibull distribution**

- Estimating Weibull parameters
- The role of the OREST software

**Dealing with censored data, the 3-parameter Weibull, and Kolomorgov-Smirnov test**

- Upper-end censoring
- Multiply censor group data
- Estimating the location parameter in a Weibull distribution
- Checking the goodness-of-fit of a distribution

**Component replacement procedures, including Galsser'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 replacement**

**Spare parts provisioning**

- Fast-moving spares
- Emergency (insurance spares)

**Case studies in spares provisioning**

TIME: 1-5PM

INSTRUCTOR: ANDREW JARDINE

**RELIABILITY THROUGH INSPECTION & PREDICTIVE MAINTENANCE**

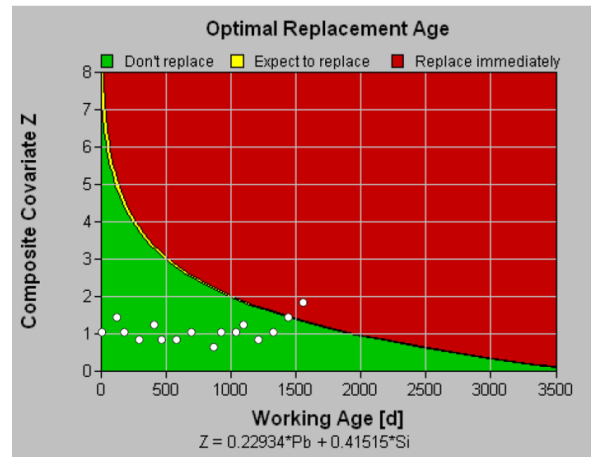
**Reliability improvement through inspection**

- Inspection frequency and depth for equipment in continuous operation
- Inspection intervals to maximize profit
- Maximizing equipment availability
- Inspection intervals for equipment used in emergencies (e.g., protective devices)
- Case studies include: transportation fleets (for inspection frequency), oil and gas field equipment such as pressure safety valves (for protective devices)

**Reliability improvement through health-monitoring procedures**

- Proportional hazards modeling
- Spectroscopic oil analysis programs
- Optimization of condition-based maintenance procedures
- Role of EXAKT software for Condition-based Maintenance (CBM) optimization
- Case studies include the 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)

**Demonstration of EXAKT software for optimizing condition-based maintenance decisions**



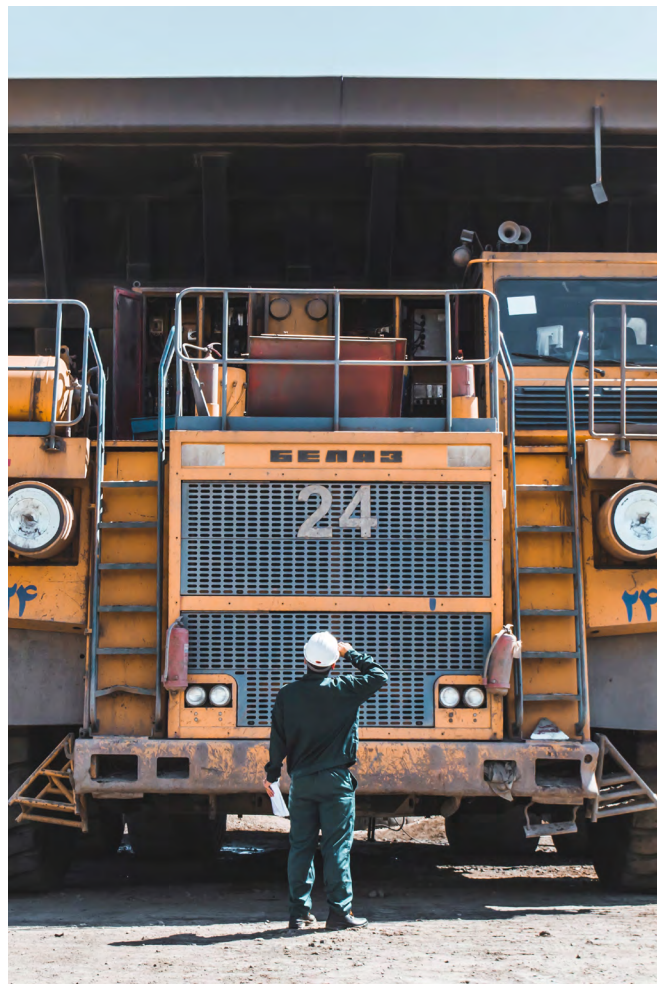
**DAY 4 - THURSDAY NOVEMBER 16**

TIME: 9AM-1PM  
 INSTRUCTOR: DONALD BARRY

**OPTIMIZING METHODOLOGIES IN ASSET MANAGEMENT**

**Re-Thinking the status quo in asset management**

- Creating uber change in process improvement – Redesigning maintenance and MRO processes for maximum efficiency and effectiveness.
- Exercise to create an asset management strategy
- Going deeper into KPI development and balanced scorecards, and benchmarking.
- Optimizing human and asset performance by focusing on behavior and results
- The role of change management in enabling asset management change success



TIME: 1-5PM  
 INSTRUCTOR: ANDREW JARDINE

**RELIABILITY THROUGH ASSET LIFECYCLE MANAGEMENT**

**Choosing the best buy in the long term**

- The concept of the time value of money
- Calculating the net present value of a decision

**Calculating the economic life of an asset**

- The trade-off between O & M costs and capital expenditures to establish the economic life of both fixed and mobile assets
- Fixed equipment includes internal combustion engines; mobile equipment includes a fleet of vehicles
- Establishing the economic life of mobile assets that are highly utilized when new, but are used for peak demands as they age

**Repairing an existing asset versus buying a new one**

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

**Technological improvement**

- How to calculate the best time to replace a current asset with a more technologically improved asset

**Case studies**

- Studies represent real-world examples where companies saved hundreds of millions of dollars by applying LCC management principles.

## DAY 5 - FRIDAY NOVEMBER 17

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TIME: 9AM-5PM

INSTRUCTOR: DONALD BARRY

### IT AND IoT IN ASSET MANAGEMENT AND IMPLEMENTING AM EXCELLENCE

#### Asset Management and IT Trends (Art of the possible)

- The evolving opportunities in Industry 4.0 and 5.0
- New and leading trends in maintenance practices, tools, and management – IoT, ML, AI, prescriptive analytics, and automation
- Positioning Machine Learning and Artificial Intelligence contributions to asset management

#### Overall IT strategy to support asset management

- The evolution of the maintenance organization. New directions in the 21st century: Moving from maintenance management to physical asset management with Industry 4.0 and 5.0 influences

#### Introduction to Global Asset Management Standards (e.g., GFMAM, ISO55000, UPTIME Elements)

#### Consolidating the learning from this program into action



Real Estate & Facilities

Plant & Production

Mobile Assets

Infrastructure

Information Technology

## DONALD BARRY



Donald Barry is a Principal Consultant with FAHM Technology Partners 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's Asset Management Practice (for 15 years).

Don Barry has over 40 years of asset management-related service delivery support systems and application development, including three years in field service management and 15 years 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, and Federal, Provincial and Municipal Governments.

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

Mr. Barry is leading the development of the 3rd edition of this same book, expected out in 2024.

He is the author of Maintenance Parts Management Excellence, A Holistic Anatomy, published in 2023 by CRC Press.

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

## WHAT YOU'LL LEARN

Donald Barry's 3.5 days interactive presentation will examine asset management fundamentals, sponsored alignment, managed maintenance scope, asset risk, reliability, and optimizing methodologies.

His session will cover the following:

- An introduction to the elements that contribute to a successful asset management organization
- How to assess your organization's maturity and prioritize opportunities in your asset management
- The key financial influences of asset management
- An introduction to leading practices in asset management
- The value of properly executed planning and scheduling
- The dynamic contributions to maintenance parts management success
- The value of Reliability-Centered Maintenance (RCM2, RCM3)
- The evolution of a risk and reliability culture in asset management; key initiatives to take back to your organization
- The role of EAM and APM in managing optimal asset production
- The role of total productive maintenance (TPM)
- Work on real case studies to practice the methods taught



## 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 (CMORE).

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 2022 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'LL LEARN

Dr. Andrew Jardine's one-and-a-half 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 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 parts 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 Bathtub curve's "three regions" and what the interpretation will tell you
- How to use OREST software to optimize component preventive replacement times and forecast the demand for spare parts, taking into account the optimal preventive maintenance 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 considerations influence the economic life of an asset
- Whether or not to take advantage of a technology-improved asset
- How to elicit tacit knowledge from specialists to improve economic life decisions

## JEAN-PIERRE PASCOLI



Jean-Pierre (J.P. Pascoli, P. Eng. CMRP, MMP, CAMA, CSAM) 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

## SHARAREH TAGHIPOUR



Sharareh Taghipour is Associate Professor and Canada Research Chair in Physical Asset Management at the Department of Mechanical and Industrial Engineering at Toronto Metropolitan University. She obtained her PhD in Industrial Engineering from the University of Toronto and received her BSc in Mathematics and Computer Science and her MSc in Industrial Engineering, both from Sharif University of Technology, Iran.

### 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 at the University of Toronto, J.P. is a professional engineer with 30 years of experience in a variety of primary resource industries. He is a certified maintenance and reliability professional with the Society for Maintenance & Reliability Professionals (SMRP), a certified asset management assessor through World Partners in Asset Management (WPiAM), and an accredited maintenance management professional and a certified senior principal in asset management with the Asset Management Association of Canada (PEMAC). JP also sits on the PEMAC board of directors, currently serving as president.

JP’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 Industry 4.0 technologies such as AI/ML for predictive maintenance, IIoT, and mobility.

### ASSET MANAGEMENT AND EMERGING TECHNOLOGIES

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, Flix, Alstom France, Nova Chemicals, Manitoba Hydro, ArcelorMittal Dofasco, Axiom Group, and Enbridge Gas. She is currently serving as the Regional Editor-North America of the Journal of Quality in Maintenance Engineering and as the Associate Editor of the Proceedings of the Reliability and Maintainability Symposium (RAMS) as well as the Journal of Prognostics and Health Management.

Dr. Taghipour will provide an introduction to 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.



## 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 challenges will be addressed (or responded to outside of classroom time).

Case studies drawn from 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 electrical generation. In addition, Dr. Jardine will guide participants through several exercises using three software packages developed explicitly 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).

Highlights of Don Barry's sessions are the always popular Planning and Scheduling game (discussed in a remotely presented session), insights on Reliability Centered Maintenance (RCM), asset management metric development, and how IT and IoT can help drive a leading asset management organization and operational excellence. In addition, Mr. Barry will provide the students with a hands-on opportunity to use the maintenance excellence elements in an asset management strategy workshop.

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

[learn.utoronto.ca](http://learn.utoronto.ca)

## DELIVERABLES

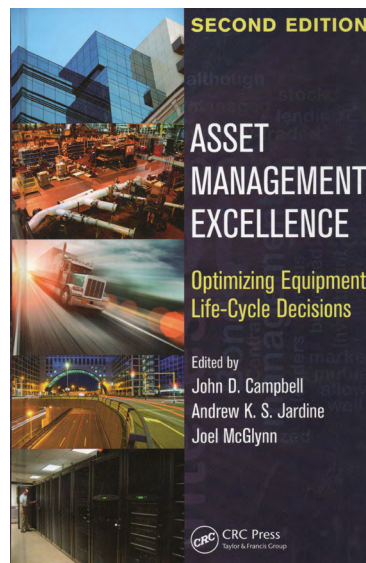
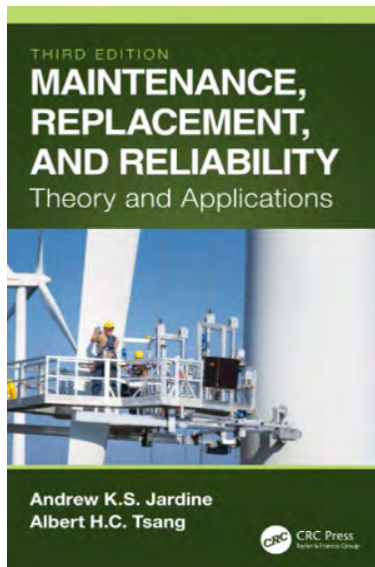
### WHAT YOU WILL RECEIVE

The five intensive, day-long remote 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 the following:

- 35 hours of lecture time
- Two impressive hard-cover books (pictured below) co-authored by Dr. Jardine.
- Asset Management Excellence with primary contributions from Mr. Barry
- Knowledgeable guest speakers who will talk about current research in AI and machine learning, effective asset databases, and establishing corporate excellence.
- A program certificate from the University of Toronto acknowledging your completion of the program.





## EXAMPLES OF THE PROGRAM'S LEADING-EDGE THINKING

Our classroom sessions cover the essential fundamentals 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 experienced instructors are 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 acknowledged as genuine advances by experts in the field. Two key advances that will be covered in depth are 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 asset management area? We think it should, which is why we strongly recommend that decisions made today should 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 that, very often, seemingly thin data records or ostensibly ill-defined numbers can uncover an abundance of useful information with the inventive application of certain algorithms.

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 modeling parameters and fill gaps in available stored data.

These are only two examples of the type of unique learning you can expect to come away with at the end of our intensive five-day training.





**HERE'S WHAT EARLIER ATTENDEES HAVE SAID:**

“REAL INDUSTRY EXAMPLES AND CASES ON THE 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 IN 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 COULD 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 LEADERS’ WEALTH OF EXPERIENCE AND COMMUNICATORS.”

“A DIFFICULT SUBJECT – WELL PRESENTED, INSTRUCTORS ARE EXCELLENT COMMUNICATORS”

“LOTS OF MATERIAL. I CAN USE IT TO IMPROVE MY COMPANY”

“THOUGHT-PROVOKING. WE’VE COME A LONG WAY, BUT THIS COURSE HAS ENCOURAGED EVEN MORE FUTURE DEVELOPMENT”



This is a partial list of organizations that have sponsored participants attending our physical asset management programs.

These organizations come from corporate and public service sectors – from outfits that deal with various products and services and from various countries around the world.

Agrium

Accenture Canada

Astra Zanece 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

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

Ont. Min. 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

# THE FIRST STEP IS THE BRAVEST

Your future self awaits.