



IAGT 2010 FALL COURSE

Sheraton, Hamilton Ontario

Oct. 21st & 22nd, 2010



## Our Mission

The Industrial Application of Gas Turbines (IAGT) Committee, formed in 1973 under the sponsorship of the National Research Council of Canada, is a Technical Advisory Group to Canadian Industry and Government. The group provides a forum for the exchange and dissemination of ideas and the communication of new developments related to the industrial application of gas turbines.

Presently under the sponsorship of the Canadian Gas Association and the National Research Council, the IAGT Committee's specific functions relate to the organization of a biennial technical symposium for the presentation of technical papers and discussion panels covering all aspects of industrial gas turbine operation as well as providing a forum for reviewing directives, guidelines, codes and practices, as issued by Regulatory Agencies, which impact directly on the application of gas turbines.

[www.iagtcommittee.com](http://www.iagtcommittee.com)

**Arnold, Darryl**  
Union Gas Limited

**Atkins, Greg**  
Aecon Industrial

**Barnwell, Ashleigh**  
Union Gas Limited

**Beadle, Aaron**  
Capital Power

**Bolhous, Aaron**  
Gryphon International  
Engineering Services Inc.

**Carter, Tom**  
Camfil Farr Power Systems

**Chishty, Wajid**  
NRC-CNRC

**Chung, Nhu**  
Gryphon International  
Engineering Services Inc.

**Crelia, Kimberly**  
Camfil Farr Power Systems

**Durocher, Jonathan**  
Standard Aero Energy

**Fairbrass, Adam**  
Enbridge Gas Distribution

**Flake, David**  
Camfil Farr Power Systems

**Fuller, Micah**  
CEM Engineering

**Gagne, Martine**  
Rolls Royce Canada

**Girard, Mario**  
Standard Aero Energy

**Golafshani, Hamid**  
IST

**Grochmal, Thomas**  
Union Gas Limited

**Hastie, Scott**  
Liburdi Turbine Services

**Hildebrand, Mike**  
Union Gas Limited

**Johnson, Michael**  
Rolls-Royce Canada

**Kaempffer, Lawrence**  
SIEMENS Energy

**Kaufmann, Christian**  
IST

**Klein, Manfred**  
National Research Council Canada

**Lavertu, Karine**  
Environment Canada

**Lavolette, Jean-Philippe**  
Rolls-Royce Canada

**Matthieu, Chris**  
Pristine Power Inc.

**McArthur, Jim**  
IST

**McCrary, Katherine**  
Aecon

**McDowell, Shane**  
Union Gas Limited

**McLean, Bob**  
London District Energy

**Morrison, Ross**  
TransCanada pipelines

**Naghdiane, Hossein**  
Environment Canada

**Noordermeer, Jim**  
Gryphon International  
Engineering Services Inc.

**Ould-Hamouda, Zahra**  
TransCanada

**Perrin, Martin**  
Imperial Oil Limited

**Potter, Allan J**  
TransCanada

**Samolczyk, Dennis**  
Aecon Industrial

**Stek, David**  
Union Gas Limited

**Stremlaw, John**  
PowerCon Inc.

**Sukhall, Dale**  
IST

**Szwarz, Michael**  
TransCanada

**Tombros, Thomas**  
Aecon Industrial

**Tong, James**  
IST

**Tsang, Gabriel**  
IST

**Wellington, Bob**  
Union Gas Limited

**Wong, Anita**  
Environment Canada

## Thursday October 21st

### Applications and Advancements of Gas Turbines

7:30 - 8:30 am (South & West Foyer)

#### Registration and Coffee

8:30 am - 8:45 am (Ballroom South/West)

#### Opening Remarks and Welcome

8:45 - 9:45 am (Ballroom South/West)

#### Session #1 - Introduction to Gas Turbines, Cogeneration and Combined Cycle Application

An introduction to aero-derivative and heavy-duty industrial gas turbines and their application into small, medium and large-scale cogeneration and combined-cycle projects.

*Jim Noordermeer, P.Eng.*

*Gryphon International Engineering Services Inc.*

9:45 - 10:00 am (South & West Foyer)

#### Refreshments

10:00 - 11:00 am (Ballroom South/West)

#### Session #2 - Gas Turbine Designs & Systems Applications (a Canadian Perspective) Part 1 / Part 2

A review of gas turbine selection and system designs for different applications in Canada from the 1950's to present day. Examples provided of advantages and disadvantages of differing turbine and system designs for various applications. A sample of interesting "lessons learned" will be presented.

*Lawrence Kaempffer, Siemens Energy*

*Manfred Klein, National Research Council*

11:00 am to Noon (Ballroom South/West)

#### Session #3 - Advancements in Gas Turbine Repair Technology Resulting from Gas Turbine Design Evolution

This session will examine how the advancements in gas turbine designs have impacted the repair process. To facilitate the explanation of these advancements, the repair process of a number of early gas turbine blade designs will be compared to the repair process of current aero derivative and "F Class" industrial turbine blades. The role of advanced coatings, cooling schemes, materials and geometries on developments in repair processes will be presented.

*Scott Hastie, Liburdi Turbine Services*

Noon - 1:00 pm (South & West Foyer)

#### Lunch

1:00 - 2:00 pm (Ballroom South/West)

#### Session #4 - Cogeneration Case Study: Cornell University - Combined Heat & Power Project

An outline of the recently-completed Cornell University 30 MW cogeneration project will be provided including the project development, challenges and execution method; the project scope, cost and schedule.

*Aaron Bolhous, P.Eng.*

*Gryphon International Engineering Services Inc.*

2:00 - 2:30 pm

#### Tour Briefing

3:00 pm (hotel lobby)

**Depart for Tour** - preregistration required for one of the tour.

#### Siemens Energy

This tour will be of the Siemens facility. Items of interest will be manufacturing of turbine discs from forgings, assembly of GT rotors, balancing of machines, complete gas turbines in assembly, viewed from above, prior to rail shipment out of plant.

5:00 pm tentative

#### Return to Hotel - Delegates Free Evening



## Friday October 22nd

### Fuels, Emissions and Life Cycle Considerations

7:30 - 8:30 am (South & West Foyer)

#### Registration and Coffee

8:30 - 8:45 am (Ballroom South/West)

#### Recap of Day One and Opening Remarks for Day Two

8:45 - 9:45 am (Ballroom South/West)

#### Session #5 - Fuel Flexibility Effects on Gas Turbine Operation

Traditional fossil fuels are being supplemented by alternative fuels obtained either from crude sources such as coal, tar sands and shale oil or from renewable sources like biomass. Changes in the type of fuel influence the performance and operability limits of the gas turbine along with changes to emissions and long term durability. This training session will address the effects of using synthetic gas fuel along with other gaseous fuels rich in hydrogen contents with respect to two aspects of gas turbine operation - performance and durability.

*Wajid Chishty, National Research Council*

9:45 - 10:00 am (South & West Foyer)

#### Refreshments

10:00 - 11:00 am (Ballroom South/West)

#### Session #6 - Gas Turbine Emissions and Regulatory Developments

This session will focus on a technical description of combustion emissions and their prevention, along with gas turbine system efficiency considerations. This session will also provide an overview of existing and proposed rules for air pollution and greenhouse gases from gas turbine systems in North America, including ongoing Clean Energy policy developments and research activities.

*Martine Gagne, Rolls-Royce Canada*

*Manfred Klein, National Research Council*

11:00 am to noon (Ballroom South/West)

#### Session #7 - Emission Reduction Case Study

This case study will focus on actual gas turbine combined cycle/cogeneration applications utilizing emission reduction technologies such as Selective Catalytic Reduction Catalysts (SCR) and Carbon Monoxide Catalysts (CO) to control NOx and CO emissions from gas turbines. Areas of concern such as capital cost, cycle complexity, efficiency, storage/handling of chemicals, ammonia slip and corrosion will all be considered.

*Christian Kaufmann, Innovative Steam Technologies*

Noon - 1:00 pm (South & West Foyer)

#### Lunch

1:00 - 2:00 pm (Ballroom South/West)

#### Session #8 - Life Cycle Cost Analysis

This training session will focus on typical life cycles of gas turbines as utilized for industrial applications. Specifically, it will focus on the capital investment requirements, ongoing maintenance costs (scheduled site and overhaul shop milestones), as well as fuel consumption. The study primarily will focus on Rolls-Royce and Solar mechanical drive packages, but would be applicable to other makers' equipment.

*Mike Hildebrand, Compressor Field Manager, Union Gas*

*Shane McDowell, Compressor Operations Engineer, Union Gas*

*Bob Wellington, Maintenance Engineer Compressor Operations, Union Gas*

*David Stek, Operations Manager Compression, Union Gas*

2:30 - 3:00 pm

#### Wrap Up and Closing Remarks

3:00 pm

#### Adjourn

### Aaron Bolhous

Aaron Bolhous is the Lead Mechanical Engineer at Gryphon International Engineering Services Inc. and has 12 years of experience in the preparation of feasibility studies, performance calculations, conceptual and detail design of thermal power plants and district heating and cooling systems, including equipment specification, evaluation and selection, conceptual and detail design of thermal power plant systems. As Lead Mechanical Engineer he is responsible for assignment of Engineer's work and schedules as well as their training and development, as well as the design procedures in the department. Aaron Bolhous holds a Bachelor of Applied Science, First Class Honours (Mechanical, 1999) from the University of Waterloo and is a Registered Professional Engineer in Ontario.

### Dr. Wajid A. Chishty

Dr. Wajid A. Chishty is a Research Officer and Technology Leader, Alternative Fuels at the National Research Council of Canada's Institute for Aerospace Research. He has over ten years of field experience in aircraft maintenance and aero-engine overhaul; four years of academic experience; and nine years experience in gas turbine combustion research. His research interests are in the areas of spray combustion and combustion control.

### Martine Gagné

Martine Gagné joined Rolls-Royce in 1995, after graduating with Honours from University of Ottawa (BASc. 1993) and TUNS (MASc. 1996). She was appointed Chief Engineer, RB211 and Fleet Engines, for the Energy Business in 2005. In this role, she is accountable for the design and development of the RB211 industrial product portfolio, including the recently launched H63 engine.

### Scott Hastie

Scott Hastie is the Engineering Manager at Liburdi Turbine Services. Scott has over 11 years of experience in developing new processes for the manufacture and repair of gas turbine components. He and his team are responsible for new repair development and continuous improvement for Industrial, Aero Derivative and Flight gas turbine components.

### Mike Hildebrand

Mike Hildebrand received his Bachelor's Degree in Aerospace Engineering in 2003 from Carleton University. Mike has spent the last five years with Union Gas in both the Distribution Operations and the Storage/Transmissions Operations sides of the business. Mike is currently working as a Compressor Field Manager at the Dawn Operations Centre near Dresden Ontario. His primary area of responsibility is the mechanical maintenance of the Rolls Royce equipment at that facility.

### Lawrence Kaempffer

Lawrence Kaempffer is a Principal Engineer with Siemens Canada Ltd, Energy Service Division. A Mechanical Engineer (UBC BASc 1975), Lawrence has 33 years of gas turbine experience providing customer solutions as a Utility Maintenance Supervisor and as an OEM Applications, Project, Marketing Support, and Design Engineer. He assisted in developing the CCME National Emission Guidelines for Gas Turbines.

### Christian Kaufmann

Christian Kaufmann is a Sr. Development Engineer at Innovative Steam Technologies. Christian's current duties are primarily involved in the simulation and implementation of startup methods for rapidly dispatched/cycled OTSG based power plants. Christian has been involved with the integration of pollution control systems, such as AIG/SCR/CO catalyst systems into the OTSG as well as aftermarket studies into the performance of boilers equipped with pollution control equipment.

### Manfred Klein

Manfred Klein joined the National Research Council of Canada in 2007, working on industrial gas turbine research, alternative fuels and energy business development. Prior to this, he spent 16 years with Environment Canada, involved in industrial energy solutions to air pollution and greenhouse gases. He developed emission standards and measurement practices. He was also involved in environmental assessments, taxation incentives and various training functions. Mr. Klein authored with industry in 1992 the National Emission Guidelines for Gas Turbines, with energy-output based environmental standards. Manfred was involved extensively in industrial cogeneration and district energy incentives and policies. Prior to that Manfred Klein was with the National Energy Board for 11 years, dealing with natural gas pipeline and compressor station certification and inspection.

### Shane McDowell

Shane McDowell received his Bachelors Degree in Aerospace Engineering from Carleton University in 2004. In 2005, after a short time at Natural Resources Canada he started with Union Gas in the Distribution Planning department doing network analysis for Union Gas' distribution system. Since 2007, he has been working as a Compressor Operations Engineer providing engineering support for Union Gas' new and existing compression facilities and related equipment.

### Jim Noordermeer

Jim Noordermeer is a Principal Engineer at Gryphon International Engineering Services Inc. and has 30 years of international experience in the design, layout, installation and construction, commissioning, startup and servicing of gas turbine power and steam turbine generator power plants, including cogeneration, and combined-cycle plants and associated equipment. Prior to joining Gryphon in 1991, Mr. Noordermeer was a Senior Mechanical Engineer at SNC-WP London, and prior to that a Field Installation Engineer and Senior Engineer – Customer Order Engineering at Westinghouse Canada – Turbine & Generator Division, working on several large gas turbine installations in California, Texas, Africa, and South America. Jim holds a Bachelor of Science Degree (Mechanical, 1980) from the University of Waterloo and is a Registered Professional Engineer in provinces of Ontario, Alberta and New Brunswick, and a designated Consulting Engineer in Ontario. Mr. Noordermeer is a member and past-Chairman of the Industrial Application of Gas Turbines (IAGT) Committee.

### David Stek

David Stek graduated from McMaster University in 1995 from Civil Engineering and completed a Master's Degree in Civil Engineering in 1997. He spent 5 years out west working in BC and Alberta in the upstream oil and gas industry. David started at Union Gas in 2001 and has had a number of both technical and managerial roles. His current role is Operations Mgr (Compression) in the Storage and Transmission Operations group. He is also registered as a Professional Engineer in both Alberta and Ontario. When not busy at work, David is occupied at home with his three boys, all under the age of 6.

### Bob Wellington

Bob Wellington was born in 1979 in Thunder Bay, Ontario. He obtained his Diploma in Engineering Technology from Lakehead University in 2000, followed by a Bachelors Degree in Mechanical Engineering, which he also received from Lakehead University in 2002. In May of 2002, Bob began his career with Union Gas in Chatham, Ontario and has worked in various engineering roles for Union Gas since that time. He currently resides in London, Ontario, and his most recent role with Union gas is Maintenance Engineer for Compressor Operations. His primary function in this role is program management for maintenance of Union Gas's rotating machinery and ancillary systems.