PRELIMINARY PROGRAM

CIMAC CONGRESS 19

VANCOUVER, JUNE 10-14, 2019

Meeting the Future of Combustion Engines

29th CIMAC WORLD CONGRESS

Combustion Engine Technology for Ship Propulsion | Power Generation | Rail Traction

CONTENT

Join us in Vancouver

The International Council on Combustion Engines – CIMAC – cordially invites you to the 29th CIMAC Congress from 10 to 14 June 2019 in Vancouver, Canada.

This is the first time that the Congress is taking place in Canada, and 46 years have passed since the Congress was last held in North America (Washington) in 1973. During that time, the combustion engine has been advanced into a stronger position than ever, as one of the chief sources of energy conversion for powering ships, power plants and rail locomotives, among others. Nowadays our industry is facing tremendous challenges, however: In addition to increasing requirements regarding emissions, we must deal with the upcoming revolution of shipping through digitalisation, while the most important (and most challenging) change will likely come from the matter of climate change. It is the responsibility of our industry to find CO2-neutral solutions for ship and rail propulsion as well as power generation, in particular for those applications in which the flexibility and high power of internal-combustion engines is necessary. Although we know it is possible in principle, such as with synthetic fuels, a great deal still needs to be developed – and the Congress in Vancouver will give us the opportunity to discuss the best solutions for the future.

The 2019 Congress will once again bring together the leading experts from engine manufacturers, component and system suppliers, rail, marine and power plant operators and users, technical universities, classification societies, and oil companies around the globe. The presentations will highlight the latest developments in products and technologies and the value that they bring to the customer; they will elaborate on the scientific research that creates the foundation for the next generation of engines and address the needs of the markets to ensure a sustainable, environmentally and economically sound future. Additionally, the Congress offers a unique opportunity to generate business and build lasting networks. In panel discussions and keynote speeches, we will be challenged to broaden our perspectives. Customer benefits and value will be strongly emphasized during the Congress. This is clearly an opportunity that will help in making the right decisions for the future.

Vancouver welcomes you in mid-June. It is a city on the sea with influences from both east and west, full of potential, and surrounded by natural beauty. The Congress venue is located on the beautiful waterfront of downtown Vancouver, with a view of the mountains of British Columbia. While the optional tours will give you the chance to visit this natural beauty as well as a vivid city, the technical tours will showcase a number of interesting companies and places in and around Vancouver, the global maritime business hub.

CIMAC as well as the US NMA and our Canadian corporate members are looking forward to welcoming all of you to the 2019 Congress in Vancouver. In addition to providing the opportunity to experience British Columbia and its natural beauty, we will do our utmost to meet your expectations regarding the Congress.

Once again – Welcome!

Hanny Mäntymaa
Vice-President Technical Program

Marko Dekena
Vice-President Technical Program

Day	Time	Acitivties
Monday June 10, 2019	**10:00 – 11:30**	**Opening Ceremony**
	12:00 – 13:00	Lunch
	13:30 – 15:00	Technical Sessions
	15:00 – 15:30	Coffee Break
	15:30 – 17:00	Technical Sessions
	18:30	**Welcome Reception in the Vancouver Aquarium**
Tuesday June 11, 2019	09:00 – 17:00	Poster Sessions
	09:00 – 10:30	Technical Sessions
	10:30 – 11:00	Coffee Break
	11:00 – 12:30	Technical Sessions
	12:30 – 13:30	Lunch
	13:30 – 15:00	Technical Sessions
	15:00 – 15:30	Coffee Break
	15:30 – 17:00	**PANEL - Sulphur Cap 2020**
	18:30	**ABB Evening**
Wednesday June 12, 2019	09:00 – 17:00	Poster Sessions
	09:00 – 10:30	Technical Sessions
	10:30 – 11:00	Coffee Break
	11:00 – 12:30	Technical Sessions
	12:30 – 13:30	Lunch
	13:30 – 15:00	**PANEL - Digitalization**
	15:00 – 15:30	Coffee Break
	15:30 – 16:30	**COLLIN TRUST sponsored Keynote Speech**
	16:30 – 17:00	**PANEL - Defossilization**
Thursday June 13, 2019	09:00 – 17:00	Poster Sessions
	09:00 – 10:30	Technical Sessions
	10:30 – 11:00	Coffee Break
	11:00 – 12:30	Technical Sessions
	12:30 – 13:30	Lunch
	13:30 – 15:00	Technical Sessions
	15:00 – 15:30	Coffee Break
	15:30 – 17:00	**FINAL PANEL**
	18:30	**Gala Dinner**
Friday June 14, 2019	09:00 – 14:00	Half-day Technical Tours
	09:00 – 17:00	Full-day Technical Tours

Optional Tours
June 11 – 13, 2019

TOPICS AND SESSIONS

1. Digitalization and Connectivity - What it means to different applications

1.1 Session 1

1.2 Session 2

1.3 PANEL - Digitalization

2. System Integration, Electrification and Hybridization - for Rail, Power, and Marine applications

2.1 Hybrid Drives - Basic technologies

2.2 Performance Improvement Technologies

2.3 Marine Hybrid Applications

3. Electronic Support - Controls, Automation, Measurement & Monitoring

3.1 Measurement & Monitoring

3.2 Performance Optimizations

3.3 Control Systems

4. Emission Reduction Technologies - What's in store for the future

4.1 PM Reduction

4.2 Engine Measures 1

4.3 Engine Measures 2

4.4 Methane

4.5 SCR 1

4.6 SCR 2

5. Low Carbon Combustion - What are the alternative fuels for the future

5.1 Low Flashpoint Fuels

5.2 Liquid and Hydrogen

5.3 Renewable Fuels

5.4 PANEL - Defossilization

6. Sulphur Cap 2020 - Strategies to deal with regulatory requirements

6.1 New Scrubbing & Lubricant Technologies

6.2 Fuels 2020 & Expected Performance

6.3 PANEL - Sulphur Cap 2020

7. Case Studies from Operators - Lessons to be learned

7.1 Sulphur Cap

7.2 Users Experience

8. Future Challenges and Ideas for Future Developments - Regulations, Environment, Global Trends

8.1 Session 1

8.2 Session 2

9. New Engine Developments

9.1 Diesel - Medium and High-Speed Engines

9.2 Diesel - Low Speed Engines

9.3 Diesel - Locomotive Engines

9.4 Gas & Dual Fuel - Engine and System Level Development

9.5 Gas & Dual Fuel - Field Experience and Application Challenges

9.6 Gas & Dual Fuel - Dual Fuel Combustion

9.7 Gas & Dual Fuel - Engine Development I

9.8 Gas & Dual Fuel - Engine Development II

10. Latest Engine Component Developments

10.1 Fuel Injection & Gas Admission - Common Rail Developments

10.2 Fuel Injection & Gas Admission - Gas Applications

10.3 Components & Tribology - Piston and Liner

10.4 Components & Tribology - Different Components

10.5 Components & Tribology - Engine Systems

10.6 Components & Tribology - Lubricants

10.7 Turbochargers & Air-/Exhaust Management - Advanced Air Management and Methodologies

10.8 Turbochargers & Air-/Exhaust Management - New Products and Aplications

11. Basic Research & Advanced Engineering - Technologies, Materials & Tools for Future Engines

11.1 Visualizations

11.2 Mechanics

11.3 Simulation

11.4 Ignition Concepts

Monday - June 10, 2019 (13:30 – 15:00)

Ballroom A

9 New Engine Developments - Diesel

9-1 Medium- and High-Speed Engines

Chair: Beran, Robert (AVL List GmbH)

293
MAN ES – The new 4x/60 Engine Family - The Energy Driver for All Applications
Alexander Rest, MAN Energy Solutions

163
Development of NIIGATA new slow-speed diesel engine 34RT -"The evolution of the Galapagos engine"-
Tatsuya Kitajima, Niigata Power Systems Co.,Ltd.

415
Operational in Service Experiences and Extension of the Rolls-Royce Bergen B3x:45 Engine Family
Leif-Arne Skarbø, Bergen Engines AS, a Rolls-Royce Power Systems Company

301
Next Generation High Speed Engines – Advanced Design Features Enabling Highest Engine Efficiency
Guenter Figer, AVL List GmbH

272
MAN175D - High Speed Engine Family
Thomas Seidl, MAN Energy Solutions

Ballroom B

11 Basic Research & Advanced Engineering - Technologies, Materials & Tools for Future Engines

11-1 Visualizations

Chair: Wimmer, Andreas (LEC (Large Engines Competence Center))

404
Fuel Flexible Injection System – How to handle a fuel spectrum from diesel-like fuels to alcohols
Andreas Schmid, Winterthur Gas & Diesel

166
Interpretation of Ignition and Combustion in a Full-Optical High-Pressure-Dual-Fuel (HPDF) Engine using 3D-CFD Methods
Stephanie Frankl, Technical University of Munich

439
Identification and Quantification of Abnormal Combustion in Natural Gas Engines
Garrett Anderson, Southwest Research Institute

397
Simultaneous visualization of Chemiluminescence and Natural Luminosity of Dual Fuel combustion in an Optical Diesel Engine
Qiang Cheng, Aalto University

ABB Room (1st Floor)

10 Latest Engine Component Developments - Components & Tribology

10-3 Tribology: Piston and Liner

Chair: Flynn, Paul (HorsePower Consulting)

416
Tribological development of piston assembly in marine diesel engines based on theoretical analysis and experimental verification (revised and final released)
yihu tang, Shanghai Marine Diesel Engine Research Institue

363
MAHLE Power Cell Units, piston-pin-rings-liner for high speed Diesel- and Gas Engines
Christof Geissler, MAHLE Industriemotoren-Komponenten GmbH

384
Distribution and Influence on Lubrication Performance of Gas Pressure in Groove of Piston Ring Pack
Xiuyi Lv, Harbin Engineering University

031
A Comparative Study on Scuffing Properties of Plasma Spray Coating and HVOF Coating on Piston Ring Sliding Surface
Minoru Kawanishi, RIKEN Corporation

478
Cylinder Head development for High Speed Diesel Engines - Methodology and Challenges
Bechir Mokdad, Liebherr-Components Colmar SAS

AVL Room (1st Floor)

10 Latest Engine Component Developments - Fuel Injection & Gas Admission

10-1 Common Rail Developments

Chair: Takahata, Yasuyuki (Yanmar)

073
Investigation and Evaluation of a New Double -Valves Controlled Fuel Pressure Amplification Common Rail System on Hydraulic Test Bench and 2-Stroke Engine
Frank Zhang, China Shipbuilding Power Engineering Institute Co., Ltd. China

267
Detailed Characterisation and Service Experience of OMT Injectors for Dual-Fuel Medium- and Low-Speed Engines
Marco Coppo, OMT - Officine Meccaniche Torino SpA

477
250 MPa Common Rail Injector for the EMD 1010J3 Tier 4 Locomotive Application (#318 Reviewed)
Ricardo Cadavid, Woodward

119
New Injector Family for High Pressure Gas and Low Caloric Liquid Fuels
Clemens Senghaas, Woodward L'Orange GmbH

15:00 – 15:30 Coffee Break

Monday - June 10, 2019 (15:30 – 17:00)

Ballroom A

9 New Engine Developments - Diesel

9-2 Low Speed Engines

Chair: Takasaki, Koji (Kyushu Univ.)

223
Development and maturing of MAN B&W two-stroke Mk 10 design platform and alternative fuel design
Susanne Kindt, MAN Energy Solutions

357
Increasing the Efficiency of Large Two-Stroke Diesel Engines for lower GHG Emissions
Daniel Schaepper, Winterthur Gas & Diesel

137
THE LATEST TECHNOLOGIES OF J-ENG UE ENGINE
Chikara Matsuda, Japan Engine Corporation

169
Performance and Emission results from the MAN B&W LGI-P low-speed engine operating on LPG
Stefan Mayer, MAN Energy Solutions

Ballroom B

11 Basic Research & Advanced Engineering - Technologies, Materials & Tools for Future Engines

11-2 Mechanics

Chair: Schlemmer-Kelling, Udo (FEV GmbH)

087
Online coupled piston ring dynamics in quasi 2D and 3D CFD simulations of the piston ring pack
Stefan Held, Technical University of Munich, Chair of Internal Combustion Engines

049
Capabilities of Transient Simulations in the Torsional Vibration Damper Selection
Klaus Prenninger, Geislinger GmbH

092
eta-up – Reduction of Friction Losses of Medium-Speed Marine Diesel Engines
Marko Püschel, FVTR GmbH

424
The development of a variable compression ratio (VCR) on a large 2-stroke slow speed engine; the joint development approach of IHI, DU and WinGD
Dominik Schneiter, Winterthur Gas & Diesel

257
Variable Compression Ratio Technology for Dual-Fuel Engines
Christopher Marten, Institute for Combustion Engines VKA RWTH Aachen University

ABB Room (1st Floor)

10 Latest Engine Component Developments - Components & Tribology

10-4 Tribology: Different Components

Chair: Rabe, Rom (Uni Flensburg)

408
A novel approach to estimate valve wear: Numerical simulation based on test series using a unique tribological test rig
Jan-Peter Edelmann, Märkisches Werk GmbH

338
Increasing Safety with SOLAS compliant Cladding Insulation Systems – A Retrofit Case Study
Dirk Balthasar, Thermamax Inc.

412
Future of static sealing solutions in engine industry -Short history of static sealing, best practices learned and a look at future solutions
Ari Kesti, TT Gaskets

282
Correlation between flow and fluid parameters for hydraulic filter element's lifetime
Jaganmohan Rao Gorle, Parker Hannifin

454
Influence of Topring Coating and Oil Specification on Crank Angle Resolved Piston Group Friction in Medium Duty Diesel Engines
Florian Pohlmann-Tasche, Institut für Technische Verbrennung, Universität Hannover

AVL Room (1st Floor)

10 Latest Engine Component Developments - Fuel Injection & Gas Admission

10-2 Gas Applications

Chair: Nordrik, Rune (Rolls-Royce Power Systems)

392
Design of a new condensate gas fuel injection system for Wärtsilä engines
Gilles Monnet, Wärtsilä

277
Novel LPG fuel supply system for MAN B&W LGI-P engines: design challenges and performance results
Roberto Comelli, Alfa Laval Tumba AB

292
Current challenges in operation of MPI valves for Large Engines – Derived benefits for engine application by usage of an integrated development approach
Peter Christiner, Robert Bosch AG

179
Detailed Assessment of an Innovative Combined Gas-Diesel Injector for Diesel Ignited High-pressure Gas Direct Injection Combustion Concepts
Christoph Redtenbacher, LEC GmbH

18:30 Welcome Reception

Tuesday - June 11, 2019 (09:00 – 10:30)

Ballroom A

6 Sulphur Cap 2020 - Strategies to deal with regulatory requirements

6-1 New Scrubbing & Lubricant Technologies

Chair: Wik, Christer (Wärtsilä)

294
Dry Scrubbing Technology: Improvement of Desulfurization Agent and Cleaning Technology
Uwe Etzien, FVTR GmbH

015
The science of compliance
David Atkinson, Parker Kittiwake

230
Optimization study of exhaust gas cleaning system based on sodium-alkali method
JingJing Huang, China Shipbuilding Power Engineering Institute Co.,Ltd

047
Additive and Lubricant Solutions Enabling a New Era of Cleaner Emission Compliance
Ian Bown, The Lubrizol Corporation

Ballroom B

9 New Engine Developments - Gas & Dual Fuel

9-4 Engine and System Level Development

Chair: Schneiter, Dominik (WINGD)

050
Study on the Influence of Prechamber Structure on the Knock of a Marine Low-Speed Dual-Fuel Engine
Guo Hao, Harbin Engineering University

071
An Investigation into the Gas-Mode Start Strategies for a Marine Medium-Speed Micro-Pilot-Ignition Dual-Fuel Engine
Xianquan Zheng, Wuhan University of Technology

079
Numerical Study on Ignition Delay of Lubricating Oil Droplet Auto-Ignition Under Natural Gas Engine In-cylinder Conditions
Zixin Wang, Dalian University of Technology

258
Optimization of the Dual Fuel micro pilot combustion process for commercial applications
Marius Hoff, Caterpillar Motoren GmbH

ABB Room (1st Floor)

4 Emission Reduction Technologies - What's in store for the future

4-1 PM Reduction

Chair: Ralf Marquard

007
Particulate Emission Characteristics of Tugboat Main Engine based on Real Ship Test
Dengguo Liu, School of Automotive Studies, Tongji University,Shanghai Environmental Monitoring Center

361
Integration and matching of Diesel Particulate Filters for ABC medium speed engines
Koen Christianen, Anglo Belgian Corporation

209
CFD Simulation of Particle Deposition in EGT Systems
Conrad Gierow, FVTR GmbH

323
Characteristics of Particulate Matter Emissions from a Low-Speed Marine Diesel Engine
Hao Jiang, Shanghai Jiao Tong University

395
Investigation on particle size distribution in transient operating strategies on a medium-speed four-stroke large diesel engine
Michael Reska, University of Rostock Chair of Technical Thermodynamics

AVL Room (1st Floor)

3 Electronic Support - Controls, Automation, Measurement & Monitoring

3-1 Measurement & Monitoring

Chair: Östman, Fredrik (Wärtsilä)

026
Improving efficiency and emissions of Otto gas engines, by continuously monitoring fuel gas quality.
Patrice FLOT, CMR Group

016
New development of an extremely robust cylinder pressure sensor for thermodynamic control concepts on high efficient gas engines
Stefan Neumann, IMES GmbH

285
Development and Application of a Physically-assisted Virtual Sensor (PVS) for NOx Emissions
Panagiotis Kyrtatos, Vir2sense GmbH

220
A New Technological Approach to On-board Bearing Condition Monitoring
Thomas Breiteneder, LEC GmbH

10:30 – 11:00 Coffee Break

Tuesday - June 11, 2019 (11:00 – 12:30)

Ballroom A

6 Sulphur Cap 2020 - Strategies to deal with regulatory requirements

6-2 Fuels 2020 & Expected Performance

Chair: Aabo, Kjeld (MAN Energy Solutions)

374
Fuel 2020 – Are you ready for the 0.50%S fuel cap?
Dorthe Marie Sveistrup Jacobsen, MAN Energy Solutions

090
Estimation of ignition and combustion quality of low-sulfur marine fuel after 2020
Koji Takasaki, Kyushu Univ.

450
Effect of sulphur content on bunker fuels performance in the medium speed engine
Sami Nyyssönen, VTT Technical Research Centre of Finland LTD

203
ClassNK's Actions on advising the use of Very Low Sulphur Fuel Oil compliant with the SOx regulation from 2020
Sho Ichikawa, Nippon Kaiji Kyokai

Ballroom B

9 New Engine Developments - Gas & Dual Fuel

9-5 Field Experience and Application Challenges

Chair: Osborne, Dustin (SWRI)

093
Enhanced flexibility in gas engine operation for marine and power generation demanding applications
Diego Delneri, Wärtsilä

094
Impact of liquefied natural gas quality and weathering on engine performances over a journey using a thermodynamic fuel system model
Jonas Thiaucourt, LHEEA research lab. - Ecole Centrale Nantes (Eng. School, France)

423
Service experience of WinGD's Low Pressure Dual-Fuel 2stroke engines - the X-DF engine generation in the field
Adrian Siegfried, Winterthur Gas & Diesel

457
The M46 DFready, a Dual Fuel Engine concept for a high efficient liquid mode operation during or before the installation of the gas supply system
Eike Joachim Sixel, Caterpillar

ABB Room (1st Floor)

3 Electronic Support - Controls, Automation, Measurement & Monitoring

3-2 Performance Optimizations

Chair: Boom, Rick (Woodward)

086
On-board vessel power generation in four maritime futures: scenarios for vessel propulsion in 2040
Sebastiaan Bleuanus, Wärtsilä

006
GE Transportation Tier 4 Marine Diesel Engine Development
Jason Ozolins, GE Transportation

296
Potential of Pilot- and Post-Injection Strategies in Large Diesel Engines Using Maritime Fuels
Benjamin Stengel, University of Rostock

060
A China I-compliant medium-speed marine diesel engine using two-stage turbocharging system
Xiannan Li, Shanghai Marine Diesel Engine Research Institute

168
NOx reduction to Tier III levels on MAN B&W LGI low-speed engines by water addition to either methanol or conventional diesel fuel oil
Stefan Mayer, MAN Energy Solutions

AVL Room (1st Floor)

4 Emission Reduction Technologies - What's in store for the future

4-2 Engine Measures 1

Chair: Heuser, Peter (FEV Group GmbH)

224
Field Experience of KAWASAKI Green Gas Engine and Maintenance System utilizing Predictive Diagnosis System
Takayuki Imai, KAWASAKI Heavy Industries, Ltd.

210
Engine controls as part of a Smart Marine Ecosystem
Jonatan Rösgren, Wärtsilä

246
Control system development and performance optimization for micro-pilot ignited gas engine
Guofeng Zhao, Harbin Engineering University

109
Gas online quality measurement for optimized engine control
Kaj Portin, Wärtsilä

12:30 – 13:30 Lunch

Tuesday - June 11, 2019 (13:30 – 15:00)

Ballroom A

7 Case Studies from Operators - Lessons to be learned

7-1 Sulphur Cap

Chair: Rojgaard, Charlotte (Bureau Veritas VeriFuel)

095
An Investigation into the cause of high wear-rates in jerk type fuel injection pumps on engines burning an ultra-low sulphur fuel oil with elevated TAN levels.
Joseph Stainsby, LLoyd's Register EMEA

353
Exhaust gas emissions characterization of medium speed stationary engines burning low sulphur RMG380, using gravimetric methods
Francisco Fernandez-Vacas, ENDESA GENERACION

264
Fuel of the future - service experience with a new 0.5% sulfur marine fuel
Ron Jukes, Chevron Oronite

055
MAN-ES laboratory, engine and injection investigations of representative 0.50% sulfur fuel blends
Johann Wloka, MAN Energy Solutions

Ballroom B

9 New Engine Developments - Gas & Dual Fuel

9-6 Dual Fuel Combustion

Chair: Hiltner, Joel (Hiltner Combustion)

204
Simulation study on the influence of natural gas and diesel injector position on combustion and emission of marine dual fuel engine
Lu Rui, Jiangsu University

317
Controlled Multi-staged Combustion Strategy for Overcoming Load Limitations of Fuel Flexible Gas / Diesel Engines
Suraj Nair, Woodward Inc.

364
Investigation of the Dual Fuel Combustion Process with different Pilot Injector Positions
Björn Henke, University of Rostock

407
Impact of Cetane Number on a Lean Diesel-Methane Dual Fuel Combustion
Zeeshan Ahmad, Department of Mechanical engineering, Aalto University, Finland

ABB Room (1st Floor)

4 Emission Reduction Technologies - What's in store for the future

4-3 Engine Measures 2

Chair: Frigge, Patrick (Innio)

008
Research and optimization of low-speed two-stroke engines using high pressure EGR with cylinder bypass
Dawei Wang, Shanghai Jiao Tong University

186
The latest technologies of nox emission control for ue engines
Takahiro Nakagawa, Japan Engine Corporation

399
Particle and gaseous emissions from marine engines utilizing various fuels and after-treatment systems
Kati Lehtoranta, VTT Technical Research Centre of Finland

144
Tier III Emission Development of Marine Medium Speed Diesel Engine Base on Virtual Calibration Method
Dongming Zhang, Shanghai Marine Diesel Engine Research Institute

159
EPA Tier 4, Euro Stage 5 and beyond. What Diesel Engine Emissions are feasible with State of the Art Fuel Injection Systems and existing Exhaust After Treatment
Christoph Kendlbacher, Robert Bosch Powertrain Solutions

AVL Room (1st Floor)

3 Electronic Support - Controls, Automation, Measurement & Monitoring

3-3 Control Systems

Chair: Åkerman, Jonas (Wärtsilä)

165
WiCE – New Engine Control System for 2-stroke Engines
Wolfgang Östreicher, Winterthur Gas & Diesel

385
LECM as the Next Gen Engine Control Platform for changing times in Large Engine Market.
Sai Venkataramanan, Woodward, Inc.

061
Active Disturbance Rejection Control for Rail Pressure of Common Rail System on Marine Diesel Engine
Jiancun Hu, Shanghai Jiao Tong University

172
Emissions reduction through sophisticated control strategies
Mathias Moser, MAN Energy Solutions

15:00 – 15:30 Coffee Break

Tuesday - June 11, 2019 (15:30 – 17:00)

Ballroom A

6 Sulphur Cap 2020 - Strategies to deal with regulatory requirements

PANEL - Sulphur Cap 2020

Ballroom B

4 Emission Reduction Technologies - What's in store for the future

4-4 Methane

Chair: Vlaskos, Ioannis (WINGD)

240
Pre-Turbine Catalytic Methane Oxidation for Lean Burn Natural Gas Engines
Christoph Haas, MTU Friedrichshafen

214
Catalytic Oxidation of Ultra-lean CH4 in the exhaust of Natural Gas Engine
Ke Li, Shanghai JiaoTong University

196
Measures for reducing the methane slip of open chamber lean burn gas engines with focus on a novel patent pending after-treatment concept
Peter Koch, Western Norway University of Applied Sciences

110
Controlling methane slip from marine low pressure lean-burn dual fuel engines using a non-thermal plasma catalyst system
Majed Shreka, Harbin Engineering University

398
Recent insights into how catalytic after-treatment can be used to resolve Methane Slip from Lean Burn Natural Gas Engines
Joseph McCarney, ABB Turbo Systems

ABB Room (1st Floor)

10 Latest Engine Component Developments - Components & Tribology

10-5 Tribology: Engine Systems

Chair: Aufischer, Rainer (Miba Gleitlager Austria GmbH)

005
WinGD X-DF engine tribology research: Impact of Cylinder Oil Formulation Parameters
Konrad Räss, Winterthur Gas & Diesel

326
Enterprise: a reduced-scale, flexible fuel, single-cylinder crosshead marine diesel research engine
Brian Kaul, Oak Ridge National Laboratory

329
Key device technologies to realize the Unprecedented Variable Compression Ratio System of 2 stroke engine
Yutaka Masuda, IHI Corporation

437
Impact of sulphur cap 2020 on 2-stroke engine tribology aspects
Konrad Räss, Winterthur Gas & Diesel

273
Retrofit technologies to comply with new legislation
Thomas Thurnheer, Wärtsilä

AVL Room (1st Floor)

18:30 ABB Evening

Tuesday - June 11, 2019

Exhibition Hall

Speakers Corner

381 **Turbocharging technology as an enabler in the path towards zero emissions for the 2-stroke marine propulsion segment**
Stam Achillas, ABB Turbo Systems

076 **Pushing the limits in turbocharger development with advanced numerical simulations**
Stefan Weihard, MAN Energy Solutions

251 **R&D for the next 100 years in Niigata Power Systems**
Shinsuke Takahashi, Niigata Power Systems Co., Ltd.

288 **Various applications with DUATRON electronic engine control unit**
Erich Vogt, DUAP Ltd.

034 **Simulation of transient operation of a large two-stroke marine diesel engine equipped with a high-pressure SCR aftertreatment system in heavy weather conditions**
Michael Foteinos, National Technical University of Athens

367 **Methane catalyst regeneration with hydrogen addition**
Sonja Heikkilä, University of Vaasa

455 **Medium speed engine with low NOx & PM emissions for EPA Tier 4 and EU Stage V**
Daniel Peitz, Hug Engineering

343 **Minimizing Black Carbon Emissions by Optimizing Fuel Injection and Enhancing Ignition and Combustion with Multi-functional, Organometallic Fuel Additives**
Albert Leyson, Drew Marine

430 **WinGD X-engine portfolio evolution – Sustainable design for 2-stroke propulsion**
Alexander Brueckl, Winterthur Gas & Diesel

Tuesday - June 11, 2019 (09:00 – 17:00)

Exhibition Hall

6 Sulphur Cap 2020 – Strategies to deal with regulatory requirements
- Poster Session

181 **Evaluation of Combustion Characteristics of Ultra Low Sulphur Fuel Oil by Using OCA (Optical Combustion Analyzer) and a Two Stroke Test Diesel Engine**
Eiji TOMITA, Okayama University

369 **"The impact of emission regulations and technologies on the specifications and on the use of marine lubricants. - View from CIMAC WG Marine Lubricants."**
Dorthe Marie Sveistrup Jacobsen, MAN Energy Solutions

9 New Engine Developments – Gas & Dual Fuel Engine Development
- Poster Session

009 **Improvement of the NOx-thermal efficiency trade off and keept the fluctuation level of the COV_IMEP by Lean mixture pre-chamber**
Yoshinori Kaji, Daihatsu deisel MFG.CO.,LTD.

100 **Pre-combustion chamber design scheme analysis for a typical marine low speed duel fuel engine**
Teng Liu , China Shipbuilding Power Engineering Institute Co., Ltd.

162 **Development of Low Speed Four Stroke Gas Engine**
Satoru Higashikawa, The Hanshin Diesel Works, LTD.

167 **Dynamic behavior research of marine natural gas engine propulsion system based on knocking prediction**
La Xiang, Harbin Engineering University

171 **The effects of injection timing on low-speed marine engines fueled with HPDI natural gas**
Haifeng Liu, Tianjin University

173 **Development of stable combustion technology for the world's largest bore diameter gas engine**
Tomoaki Kizuka, Kawasaki Heavy Industries, Ltd.

175 **Performance Development of High Efficient Low Emission Marine Gas Engine - M23G**
Xiang Li, Shanghai Marine Diesel Engine Research Institute

190 **GHG Reduction Strategy Using Throttle and EGR in a Heavy-Duty Dual-Fuel Engine**
Choongsik Bae, KAIST (Korea Advanced Institute of Science and Technology)

208 **Pre-chamber Ignition and Flame Development Process on a Large 2-stroke Dual Fuel Engine**
Ying Ye, Tianjin University

234 **Effects of pre-chamber configuration on Jet Controlled Compression Ignition engine performance**
Hua Tian, Dalian University of Technology

242 **EXPERIMENTAL INVESTIGATIONS OF CYLINDER-TO-CYLINDER VARIATIONS IN MARINE HYDROGEN-NATURAL GAS ENGINES**
Harsh Sapra, Delft University of Technology

383 **NMHC and NMNEHC Measurements of a Spark-Ignited CNG-Fueled EMD GP38-2 Switch Locomotive**
Dustin Osborne, Southwest Research Institute

393 **Research on Dynamic Performance Optimization of Marine LNG Engine Propulsion Power System**
Liwen Xu, Shanghai Marine Diesel Engine Research Institute

422 **COST EFFECTIVE AND RELIABLE SOLUTIONS FOR GAS ENGINES IN STATIONARY AND MOBILE APPLICATIONS USING ADVANCED PASSIVE PRECHAMBER TECHNOLOGIES**
Emmanuella Sotiropoulou, Prometheus Applied Technologies, LLC

443 **Experimental Study on Torch Flame Behavior and Abnormal Combustion Process in Pre-Chamber Type Gas Engines**
Hiroshi Tashima, Kyushu University

463 **An analysis of gas valve injection characteristics for marine gas engines**
Xiyu Yang, Harbin Engineering University

Tuesday - June 11, 2019 (09:00 – 17:00)

Exhibition Hall

9	New Engine Developments – Diesel Engines - Poster Session	103	**Analysis and Optimization of Residual Heat Utilization of Marine Diesel Engine Exhaust Gas** Tianpeng Zhang, Harbin Engineering University
		201	**12MV390MF—Development of the New 10MW Class Medium Speed Engine for Genset Use** Qian Xia, China Shipbuilding Power Engineering Institute CO., LTD.
		048	**Research on vibration characteristics and vibration reduction method of free-piston linear generator** Jingyi Tian, Beijing Institute of Technology
		177	**Movement and heat transfer characteristics of oil oscillating in cooling oil cavity** Yang Liu, Beijing Institute of Technology
		429	**Performance Test Development of New Medium Speed Power Station Diesel Engine** Liang Zheng, Shanghai Marine Diesel Engine Research Institute
		269	**Analysis of Fluctuation of Cycle Fuel Injection Quantity in Multiple Injection Cycles of the High Pressure Common Rail Injection System** Wei yunpeng, Harbin Engineering University
10	Latest Engine Component Developments – Turbochargers & Air-/Exhaust Management - Poster Session	078	**Multi-mode turbocharging system for low-speed two-stroke engines with low BSFC and Tier III** Lei Shi, Shanghai Jiaotong University
10	Latest Engine Component Developments – Fuel Injection & Gas Admission - Poster Session	038	**Simulation modeling of a high pressure common rail injector based on bond graph theory** Yun Bai, Harbin Engineering University
		098	**Effects of gas injection strategy on the injection residue and combustion characteristics of natural gas engine** Zhenting Liu, Harbin Engineering University
		120	**Study of three-component surrogate of diesel on sprays and atomization under transcritical and supercritical conditions** Xingcai Lu, Shanghai Jiao Tong University
		085	**Development of Hydraulic-Driven High Pressure LNG Pump for Fuel Gas Supply System of ME-GI Engine** Kouichi Namba, Mitsui E&S Machinery Co., Ltd.
		161	**Retrofitting with cutting-edge electronic fuel injection technology creates new horizons for vintage icebreaker main engines** Mario Kühfusz, Heinzmann GmbH & Co. KG
		185	**Hole-to-hole injection characteristics simulation of a double layer 8-hole diesel engine injector** Fuqiang Luo, jiangsu university
		289	**Simulation Characteristics Analysis of Ultra-High-Pressure Common Rail Fuel Injection System for Marine Medium Speed Diesel Engine** Wang Yingjie, WuHan University of Technology
		304	**Optical study on liquid-phase penetration and ignition characteristics of wall-impinging diesel spray under different altitudes** Chengguan Wang, tongji university
		448	**Experimental and Numerical Investigation of String-Type Cavitation and Spray in Multi-Nozzle Diesel Nozzles** Genmiao Guo, Jiangsu University

Wednesday - June 12, 2019 (09:00 – 10:30)

Ballroom A

5 Low Carbon Combustion - What are the alternative fuels for the future

5-1 Low Flashpoint Fuels

Chair: Rojgaard, Charlotte (Bureau Veritas VeriFuel)

362
ABC's dual fuel engines running on renewable fuels like methanol and hydrogen
Koen Christianen, Anglo Belgian Corporation

013
Using Methanol in Dual Fuel Operation in a Compression Ignition Engine: Results of Bench Tests
Jeroen Dierickx, Ghent University

438
A Numerical Investigation on the Combustion of a Turbulent Jet Ignition Marine Engine Fueled with Methanol
Xianyin Leng, Jiangsu University

189
Combustion of biofuel and biogas in a marine engine
Sumito Nishio, National Institute of Maritime, Port and Aviation Technology

063
Methane slip summarized: lab vs. field data
Sergey Ushakov, Norwegian University of Science and Technology

Ballroom B

1 Digitalization and Connectivity - What it means to different applications

1-1 Digitalization - Session 1

Chair: Steigert, Tim (Innio)

228
Digitalization & IoT technologies drives development of Large two-stroke Marine Diesel Engines
Torbjoern Moeller, MAN Energy Solutions

275
Two- and Four-Stroke Engine Manuals of 2019 3D maintenance instructions with augmented reality - the next generation of engine manuals
Peter Dan Petersen, MAN Energy Solutions

435
MAN Energy Solutions digital offerings for 4-stroke marine- and stationary applications
Gerhard Stix, MAN Energy Solutions

266
Fuel Injection 4.0: The Intelligent Injector and Data Analytics by OMT Enable Performance Drift Compensation and Condition-Based Maintenance
Marco Coppo, OMT - Officine Meccaniche Torino SpA

444
Advanced Virtual Power Plants optimizing Gas engine revenue
Martin Greve, AVAT Automation

ABB Room (1st Floor)

4 Emission Reduction Tech-nologies - What's in store for the future

4-5 SCR 1

Chair: Chatterjee, Daniel (Rolls-Royce Power Systems)

081
MAN Energy Solutions – meeting current & future NOx emission limit
Daniel Struckmeier, MAN Energy Solutions

276
YANMAR solutions for environmental regulations after 2020
Shunji Hamaoka, Yanmar

401
"Marine Application: Meeting IMO III / EPA Tier 4 Regulations Challenges And Solutions From The View Of A Solution Provider"
Michael Drews, Rolls-Royce Power Systems

452
SCR for high sulfur HFO post 2020
Kristoffer Sandelin, Hug Engineering

265
Development of New Compact-type SCR System for Two-stroke Diesel Engines
Hideyuki Fujita, Hitachi Zosen Corporation

AVL Room (1st Floor)

10 Latest Engine Component Developments - Turbocharg-ers & Air-/Exhaust Manage-ment

10-7 Advanced Air Management and Methodologies

Chair: Rofka, Christoph (ABB Turbo Systems)

176
Modeling turbocharging solutions: Impact on highly transient lean-burn gas engine operation
Dino Imhof, ABB Turbo Systems

302
How to develop containment safety for turbochargers
Frank Grießhaber, MAN Energy Solutions

313
Fully Variable Intake Valve Train – Advanced Air Management for Improved Dynamic Performance of Large Bore Gas Engines
Jan Zelenka, LEC GmbH

158
Engine enhancement possibilities with modern air management systems
Raphael Ryser, ABB Turbo Systems

227
Development of New Generation Turbo Hydraulic System Optimized for Electronically Controlled Engines
Nobuyuki Sakairi, Mitsui E&S Co., Ltd.

10:30 – 11:00 Coffee Break

Wednesday - June 12, 2019 (11:00 – 12:30)

Ballroom A

5 Low Carbon Combustion - What are the alternative fuels for the future

5-2 Liquid and Hydrogen

Chair: Tanaka, Ichiro (Mitsui)

099
Research and Development of Marine and Power Generation Diesel Engine Operated with Biofuel
Seishi Nakao, Yanmar Co., Ltd.

211
Impact of alternative fuels on marine engine performance
Michal Wojcieszyk, Aalto University (Research Group of Thermodynamics and Combustion Technology)

054
Hydrogen as future fuel for gas engines
Stephan Laiminger, Innio

447
Stephan Laiminger, Innio
Xiongbo Duan, Hunan University

473
Minimizing greenhouse gas emissions for an LNG powered coastal vessel through operational changes
David Sommer, University of British Columbia

Ballroom B

1 Digitalization and Connectivity - What it means to different applications

1-2 Digitalization - Session 2

Chair: Ritscher, Bert (Caterpillar Marine)

274
The Future of Condition Monitoring of Large Engines – Towards Digitalization, Big Data Tools, Cloud Intelligence and Digital Twins
Martin Abart, AVL List GmbH

180
Future Requirements on Marine Combustion Engines
Fredrik Östman, Wärtsilä

342
In-service Remote monitoring of engine performance to increase locomotive availability.
Chirag Parikh, FEV North America Inc.

349
A real time comprehensive analysis of the main engine and ship data for creating value to ship operators
Carmelo Cartalemi, Winterthur Gas & Diesel

069
HiEMS®, Development of engine management solution based on IoT Technology
Younho Kang, Hyundai Heavy Industries

ABB Room (1st Floor)

4 4 - Emission Reduction Technologies - What's in store for the future

4-6 SCR 2

Chair: Wachtmeister, Georg (TU Munich)

056
NOx Tier III Update: Choices and challenges for compliance
Fabian Kock, DNV GL

020
Compact Integration on upgraded HHI's no NOx SCR Systems
Hong-Won Kim, Hyundai Heavy Industries

405
Compact marine high pressure SCR system technology development
Dirk Kadau, Winterthur Gas & Diesel

075
Development of LP-SCR system for two-stroke low speed marine diesel engine
Xinna Tian, China Shipbuilding Power Engineering Institute Co.,Ltd.

426
Green House Gas (GHG) emissions from LNG engines, review of the 2-stroke engine emission footprint.
Dominik Schneiter, Winterthur Gas & Diesel

AVL Room (1st Floor)

10 Latest Engine Component Developments - Turbocharg-ers & Air-/Exhaust Manage-ment

10-8 New Products and Aplications

Chair: Bartholomä, Klaus (MAN Energy Solutions)

365
Two-stage turbocharging module dedicated to a high-speed diesel engine on a cyclical application for operation flexibility and durability
David Ruch, ABB Turbo Systems

341
A200-H – the new benchmark in single-stage turbocharging
Dirk Wunderwald, ABB Turbo Systems

436
TPX44-H – New High Pressure Single Stage TC proved its reliability on engine tests
Michael Gisiger, ABB Turbo Systems

123
Turbocharger innovations for compliance with Tier III emission limits
Stefan Mayr, MAN Energy Solutions

359
Experiences with two-stage turbo-charging for medium-speed engines
Paolo Tremuli, ABB Turbo Systems

280
KBB's new single-stage turbocharger series for highest pressure ratio requirements
Silvio Risse, Kompressorenbau Bannewitz GmbH

386
Development of New Radial Turbocharger MET-ER Series
Yushi Ono, Mitsubishi Heavy Industries

259
Development of New Generation MET Turbocharger
Yoshikazu Ito, Mitsubishi Heavy Industries

12:30 – 13:30 Lunch

Wednesday - June 12, 2019 (13:30 – 15:00)

Ballroom A	Ballroom B	ABB Room (1st Floor)	AVL Room (1st Floor)
5 Low Carbon Combustion - What are the alternative fuels for the future	1 Digitalization and Connectivity - What it means to different applications		
5-3 Renewable Fuels	PANEL - Digitalization		

Chair: Knafl, Alexander (MAN Energy Solutions)

461
Alternative fuels and technologies
Torsten Mundt, DNVGL

449
Power-to-X: The Key for the Maritime Energy Transition
Matthias Auer, MAN Energy Solutions

104
The HyMethShip Project: Innovative Emission Free Propulsion for Ships
Jan Zelenka, LEC GmbH

458
Potential of Paraffinic Fuels for the Maritime Energy Transition
Bert Buchholz, Universität Rostock

13:30 – 15:00	PANEL - Digitalization
15:00 – 15:30	Coffee Break
15:30 – 16:30	Ballroom Options for Decarbonization of Marine Transport COLLIN TRUST sponsored Keynote Speech
16:30 – 17:00	Ballroom PANEL - Defossilization

Wednesday - June 12, 2019

Exhibition Hall

Speakers Corner (Gas & DF)

096 **A Universal Stationary Gas Engine Oil**
Virginia Carrick, The Lubrizol Corporation

215 **Latest Solution for Utilizing Various Types of Gas Fuel in Daihatsu Diesel**
Yoshitaka Takayama, Daihatsu Diesel. mfg.Co.,ltd.

221 **Caterpillar Motoren - MaK - medium speed engine portfolio for marine and electric power applications**
Andreas Banck, Caterpillar Motoren GmbH Co.KG

225 **Development of next generation high performance KG version2 gas engine with two stage turbocharging system**
Takashi Horie, Kawasaki Heavy Industries,Ltd.

233 **the new development and the overview features of M23G medium speed gas engine,Combustion system design, air-fuel ratio control and engine safety control**
Lan Yan, Shanghai marine diesel engine research institute

295 **Development of dual fuel engine (EY26DF)**
Koichi Hirose, YANMAR

305 **Unique Dual Fuel IMO TIER III engines: L23/30DF & L28/32DF**
Hans-Philipp Walther, MAN Energy Solutions

350 **X-DF low gas pressure low-speed main engines: the game changer for LNG-fuelled shipping. Low emissions, low investment costs, low operating costs.**
Carmelo Cartalemi, Winterthur Gas & Diesel

421 **Smart solutions based on Wärtsilä 31 for the future Marine Industry**
Ulf Astrand, Wärtsilä

434 **Development of a New Lubricating Oil for use in Modern High Efficiency Gas Engines**
Jonathan Hughes, Infineum UK

Wednesday - June 12, 2019 (09:00 – 17:00)

Exhibition Hall

3	Electronic Support – Controls, Automation, Measurement & Monitoring - Poster Session	344	**Fault Diagnosis Study on Combustion Chamber Components of a Marine Diesel Engine by using Acoustic Emission Technology** Yonghua Yu, Wuhan University of Technology
		027	**Reducing instrumentation system cost on engine thanks to digital sensors** Patrice FLOT, CMR Group
		052	**Research on Faults Diagnosis for Diesel Engine Injector Based on EEMD-AR Spectrum Technology** Hongzi Fei, Harbin Engineering University
		346	**Development of a Hardware-in-the-Loop simulation platform for a Marine Dual-fuel Engine** Qinpeng Wang, Wuhan University of Technology
4	Emission Reduction Technologies – What's in store for the future - Poster Session 1	291	**Behavior of a water droplet colliding with a vortex ring in non-steady gas flow** Toshio Takiya, Hitachi Zosen Corporation
		097	**Multi-mode Combustion strategies of an Inland River Marine Dual Fuel Engine** Liping Yang, Harbin Engineering University
		339	**"Effect of Fuel-Air Mixing on the Combustion and Emission of a Low-Speed Two-Stroke Marine Diesel Engine"** Huaiyin Wang, Tianjin University
		147	**Design and analysis of the waste heat recovery systems for marine low-speed two-stroke diesel engine with high pressure selective catalytic reduction system** Zukang Hu, Harbin Engineering University
		080	**Hardware-in-the-Loop Simulation of the Control Strategy for Marine SCR System** Hui Zhao, Harbin Engineering University
		018	**Effectiveness of bipolar charged coagulation on ultrafine particle emissions from compression ignition internal combustion engine exhaust** Junheng Liu, Jiangsu University
		043	**Numerical investigation of NOx reduction technology lines under large two-stroke marine diesel engine using integrated CFD-chemical kinetics** Xiuxiu Sun, Tianjin university
		143	**Numerical Study on the Technical Routines to Meet Tier III Regulation of a Low-speed Marine Diesel Engine** Hu Wang, Tianjin University
		197	**Experimental study on the combustion and emission characteristics of the marine LNG engine with reformed exhaust gas recirculation** Gesheng Li, Wuhan University of Technology
		278	**The Performance Analysis of Selective Catalytic Reduction System in a Pre-Turbo Position for Low-Speed 2-Stroke Engine** XINGYU LIANG, Tianjin University
		184	**Gas injection timing optimization for combustion and emission improvement in a multi-point injection marine gas engine under low load** Changhao Lu, Harbin Engineering University
		445	**Performance and Emission Results of the Premixed Diffusion Collaborative Combustion Engine Fueled with Methanol/Diesel Dual Fuel** YANG WANG, Dalian University of Technology
		333	**Water Cooled Internal EGR, a novel technology for reaching IMO Tier III emission** Martin Axelsson, Wärtsilä

POSTER SESSION

Wednesday - June 12, 2019 (09:00 – 17:00)

Exhibition Hall

4	Emission Reduction Technologies - What's in store for the future - Poster Session 2	195	**Research on EGR Mechanism of NOx Reduction on a Large-bore Marine Diesel Engine by 3D-CFD Simulation** XINGYU LIANG, Tianjin University
		118	**A study on soot formation and oxidation characteristics of diesel jet flame and the dominant factor affecting the length of diesel jet flame** AKIHIKO AZETSU, Tokai University
		064	**Removal of NOx and SOx from Simulated Ship Emissions by Combing Electrolyzed Seawater with Ultraviolet Irradiation** Shaolong Yang, Huazhong University of Science and Technology
		188	**Reduction of PM and BC Emissions from Marine Diesel Engines Using ESP-Cyclone System** Hidetsugu Sasaki, Tokyo University of Marine Science and Technology
		260	**Experimental study on the effects on de-NOx performance and Catalyst regeneration with application of Plasma burner in marine SCR system** JAEHWAN JANG, STX Engine Co., Ltd.
		046	**Simulation and evaluation on the vaporizermixer of high-pressure SCR system in a marine diesel** Chong Xia, Harbin engineering university
		182	**Next-generation concept engines to meet stronger environmental restrictions** Kazuyuki Maeda, National Fisheries University
		111	**umerical analysis of the influence of intake composition on combustion and emission performance in a two-stroke marine diesel engine** Xingcai Lu, Shanghai Jiao Tong University
		033	**Simulation study of stratified EGR system using high pressure exhaust gas recirculation** Zhanguang Wang, Harbin Engineering University China
5	Low Carbon Combustion – What are the alternative fuels for the future - Poster Session	121	**Ignition studies of liquid marine fuels with different ignition analyzers** Michaela Hissa, University of Vaasa
		370	**How the need for Alternative Fuels drives the Simulation – Validation Chain** Daniel Schaepper, Winterthur Gas & Diesel
		402	**Optical characterization of novel engine fuels: propane, hexane, kerosene, and methanol** Ossi Kaario, Aalto University
		475	**Experimental Study of Combustion Instability of LPG as Marine Fuel** Junfeng Yang, University of Leeds
		360	**Tailored Fuels for Marine and Locomotive Applications** Benedikt Heuser, FEV Europe GmbH
10	Latest Engine Component Developments – Components & Tribology - Poster Session / Simulation	468	**Modeling fuel economy in crosshead marine diesel engines** Andrew Satterfield, Exxonmobil
		237	**Integrated Multi-Disciplines Simulation Applied to Piston in R&D Process** Mei Li, Shanghai marine diesel engine research institutd
		253	**A numerical analysis and profile design for piston skirt to enhance the tribological performance of heavy duty diesel engine** Xuan Ma, Harbin Engineering University
		325	**Finite Element Structure Simulation Intergrated Casting Information** Yunqing Dong, Shanghai marine diesel engine research insitute
		351	Thermal Load Analysis Using CFD-FEA Method of An Oscillating Cooling Diesel Engine Piston Jinlong Mao, Shanghai Marine Diesel Engine Research Insititute
		112	**Fatigue Reliability Analysis of Bolts of a Low Speed Machine Piston** Jianan Xu, College of mechanical & electrical engineering,Harbin Engineering University
		479	**Investigation of lubricant transport along cylinder liner in large two-stroke marine diesel engines** Rathesan Ravendran, Aalborg University

Thursday - June 13, 2019 (09:00 – 10:30)

Ballroom A

7 Case Studies from Operators - Lessons to be learned

7-2 Users Experience

Chair: Jakobsen, Ole Graa (Maersk Line A/S)

469
SHORT ROUTE LNG FERRIES, Field Experience with 'Salish' Class Ferries
Magnus Kronholm, Wärtsilä

300
Service experience on G95ME-C9.5 MAN B&W two-stroke engines in relation to cylinder condition
Jesper Mark Pedersen, MAN Energy Solutions

281
Increasing performance in the dawn of a digital area. A chemical tankers' shipowner experience
Jose Gonzalez, Stolt Tankers

409
The early experience of using SCR technology to meet IMO Tier III NOx requirements
Joseph Mc Carney, IACCSEA

465
Hybrid marine propulsion systems for demanding applications – The challenge of integrating new technologies to bring innovation and value to operators
Leonardo Ferrero, Wärtsilä

286
The latest field experience of Mitsubishi Gas engines
Hiroshi Yoshizumi, Mitsubishi Heavy Industries Engine & Turbochargers

Ballroom B

2 System Integration, Electrification and Hybridization - for Rail, Power, and Marine applications

2-1 Hybrid Drives - Basic technologies

Chair: Müller, Stefan (MTU Friedrichshafen)

117
Hybrid energy- and propulsion system for vessels in timetable operation
Martin Einsiedler, Shiptec AG

193
Electric Drive Systems For Marine Propulsion – What Can We Learn From The Vehicle Business?
Udo Schlemmer Kelling, FEV Europe GmbH

311
A Perspective on Energy Storage in Heavy Haul Ground Freight Transport Applications
Thomas Lavertu, GE Global Research

389
Application and Evaluation of Marine Hybrid Propulsion System
Huan Tu, China Classification Society

391
SOFC Systems for Marine Applications
Juergen Rechberger, AVL List GmbH

ABB Room (1st Floor)

9 New Engine Developments - Gas & Dual Fuel

9-7 Gas & Dual Fuel Engine Development

Chair: Montgomery, David (CATERPILLAR)

331
MTU Series 4000 for Natural Gas Operation in Ships - Challenges for high Speed Gas Engines in Mobile Applications
Stephan Menzel, Rolls-Royce Power Systems

380
Increased output and reduced operating costs for a stoichiometric gas engine through miller cycle combustion, improved components cooling, and updated controls
Robert McDowell, GE Distributed Power

396
Highly transient load response
Alexander Leitner-Audoui, Innio

425
WinGD 12X92DF, the development of the most powerful Otto engine ever
Dominik Schneiter, Winterthur Gas & Diesel

AVL Room (1st Floor)

11 Basic Research & Advanced Engineering - Technologies, Materials & Tools for Future Engines

11-3 Simulation

Chair: Weisser, German (WINGD)

019
Phenomenological combustion description for medium-speed dual-fuel engines
Hyunchun Park, Hyundai Heavy Industries / ETH Zurich

241
A Simplified Kinetic Auto-Ignition Model for Cycle Simulation of Gas Engines
Kevin Hoag, Southwest Research Institute

356
Auto-ignition Characteristics of Various Gaseous Fuels and Prediction Model of Ignition Delay for Gas Engines
Kenta Miyauchi, IHI Corporation

417
Large-eddy simulation on the influence of diesel pilot quantity on the methane-air ignition process in dual-fuel engines
Heikki Kahila, Aalto University, School of Engineering

10:30 – 11:00 Coffee Break

Thursday - June 13, 2019 (11:00 – 12:30)

Ballroom A

8 Future Challenges and Ideas for Future Developments - Regulations, Environment, Global Trends

8-1 Session 1

Chair: Gust, Edgar (Zollern BHW Gleitlager GmbH Co.KG)

366
Bearing Challenges on High Performance Gas Engines
Gunther Hager, Miba Gleitlager Austria Gmbh

433
The Next Generation of High Speed Engines: Targets and Enablers
Erwin Reichert, FEV Europe GmbH

428
Statistical method for lifetime estimation of engine components with large fluctuations in loading
Rune Nordrik, Rolls-Royce Power Systems

032
Simulation of Marine Hybrid Systems: An Effective Tool in Streamlining Design, Operation and Classification
Ben Rogers, Ricardo

216
Large Diesel- and Gas-engines: too aged to be modern?
Christoph Mathey, ABB Turbo Systems

Ballroom B

2 System Integration, Electrification and Hybridization - for Rail, Power, and Marine applications

2-2 Performance Improvement Technologies

Chair: Boletis, Elias (Wärtsilä)

024
CHP - market demand and optimized solutions with the Caterpillar G20CM34 10 MW gas engine
Michael Sturm, Caterpillar Motoren GmbH & Co. KG

068
Model-based control system development and virtual pre-calibration for a medium-speed marine diesel engine with HPCR system
Ying Hu, Wuhan University of Technology

141
Design and Application of Ship Propulsion System Matching Platform with Low Speed Engine
Yu Ding, Harbin Engineering University

337
Influence of Power Management on Energy Effectiveness and Exhaust Emissions of Ocean-going Cargo Ship
Congbiao Sui, Delft University of Technology

464
Hybridization of engines and batteries at MAN Energy Solutions
Moritz Henke, MAN Energy Solutions

474
Combining fuzzy modelling and Bayesian Network (BN) approach to assess two-stroke engine performance
Muhammad Usman, Lloyds Register EMEA

ABB Room (1st Floor)

9 New Engine Developments - Gas & Dual Fuel

9-8 Gas and Dual Fuel Engine Development II

Chair: Blythe, Neil (GE)

207
Performance improvement of spark-ignited medium speed gas engine 28AGS
Takanori Kuroiwa, Niigata Power Systems Co.,Ltd.

017
New Development HiMSEN Engine with 2-Stage Turbocharging System, H54DFV & H32CV
SEONGHUN LEE, Hyundai Heavy Industries

262
Advanced Combustion Strategy for Medium Speed Dual Fuel Engine
Masaki Kuribayashi, Yanmar

446
Development of dual fuel engine ignited by electronic micro pilot fuel injection system
Lei Wang, Ningbo C.S.I. Power & Machinery Group Co., Ltd.

AVL Room (1st Floor)

11 Basic Research & Advanced Engineering - Technologies, Materials & Tools for Future Engines

11-4 Ignition Concepts

Chair: Buchholz, Bert (University of Rostock)

314
Ignition Concepts for Large Bore Gas Engines – A Comparison of Spark, Laser and Diesel Pilot Ignition
Jan Zelenka, LEC GmbH

133
Modeling and Measurement of Combustion and Emissions Formation in Gas Engine Pre-Chambers
Joel Hiltner, Hiltner Combustion Systems

187
Direct measurement of heat loss on combustion chamber wall in gas engine with pre-chamber
Kazuyuki Koda, YANMAR CO., LTD.

255
Visulization study on ignition and combustion processes of natural gas premixture ignited by a pre-chamber
Jiangping Tian, Dalian University of Technology

12:30 – 13:30 Lunch

Thursday - June 13, 2019 (13:30 – 15:00)

Ballroom A

8 Future Challenges and Ideas for Future Developments - Regulations, Environment, Global Trends

8-2 Session 2

Chair: Tonon, Paolo (ABB Turbo Systems)

470
Canadian Port Authority Perspective and Role in the Adoption of a Cleaner Supply Chain within the Port of Vancouver
Gary Olszewski, Vancouver Fraser Port Authority

125
Particulate emissions – evaluations of measurement setups and different fuels
Christer Wik, Wärtsilä

283
Novel Water Cleaning System for NOx Reduction by Exhaust Gas Recirculation (EGR)
Shinya Tanehashi, Alfa Laval Tumba AB

460
Overcoming the conflict of EEDI and minimum power for save operation in adverse weather, the Shaft Power Limitation - concept
Torsten Mundt, DNVGL

377
The weight of the operation to achieve 2050 target from a liner perspective.
Philippe RENAUD, CMA Ships - CMA CGM Group

Ballroom B

2 System Integration, Electrification and Hybridization - for Rail, Power, and Marine applications

2-3 Marine Hybrid Applications

Chair: Mohr, Hinrich (AVL List GmbH)

011
Battery hybrid ocean going cargo ships
Carina Kern, MAN Energy Solutions

153
Simulation-driven design of a fully integrated vessel hybrid power system
Juho Könnö, Wärtsilä

263
Optimizing Marine Hybrid Propulsion Systems by Multi-Domain System Simulation
Robert Strasser, AVL

411
Holistic functional design and system testing: Hybrid road ferry
Erik-Jan Boonen, Damen Shipyards BV

431
Study: Increased System Efficiency and Operational Flexibility through X-DF Hybrid Propulsion Solutions
Stefan Goranov, Winterthur Gas & Diesel

ABB Room (1st Floor)

9 New Engine Developments - Diesel

9-3 Locomotive Engines

Chair: Itoh, Yasuhiro (Niigata Power Systems Co.,Ltd)

051
Development of Low-fuel Consumption and Low-emission Locomotive Engine
Youfeng Li, CRRC QISHUYAN Co,LTD

376
The all-New D180 Engine – a World-Class, high Performance Engine
Thomas Kammerdiener, AVL List GmbH

316
Improving the Performance of the General Electric Transportation 7FDL Diesel Engine
Justin Brumberg, GE Transportation

178
Exhaust Temperature Boost for EMD 2-Stroke Engines to Make Tier 4 Feasible
Mike Riley, Yelir, Inc

239
GE Transportation Dual Fuel Locomotive Development
Daniel Yerace, GE Transportation

AVL Room (1st Floor)

10 Latest Engine Component Developments - Components & Tribology

10-6 Tribology: Lubricants

Chair: Koch, Franz (hofer powertrain)

035
Lubrication of marine diesel engines in a complex fuel world
Luc Verbeeke, Chevron

232
Lubricant for Natural Gas and Diesel Engines
Isabella Goldmints, Infineum

238
Engine Oils for Improved Fuel Economy and Oil Consumption in Railroad Service
Fred Girshick, Infineum USA, L.P.

306
The Development of a 40 BN Cylinder Oil and Experience with a Variety of Low Sulphur Marine Fuels Meeting IMO's 2020 Sulphur Cap – Shell Alexia 40.
Luis Garcia, Shell Global Solutions

309
Latest generation of high performance gas engine oils – Tackling reliability challenges and extending oil life in modern highly efficient gas engines
Luis Garcia, Shell Global Solutions

358
Meeting New Performance Challenges - The Additive Contribution
Marco Corradi, Infineum UK Ltd.

226
The challenge of CO2 emissions reduction: the contribution of a new lubricant designed for improved fuel efficiency in 4-stroke medium speed marine engine
CATHERINE AMBLARD, TOTAL

030
Development of fuel-efficient marine engine oils that help reduce CO2 emissions
Akira Koyama, JXTG Nippon oil & Energy Corporation

15:00 – 15:30	Coffee Break
15:30 – 17:00	FINAL PANEL
18:30	Gala Dinner

Thursday - June 13, 2019

Exhibition Hall

Speakers Corner

010
Closed Crankcase Ventilation (CCV) for large engines generates substantial benefits: Technically, economically as well as ecologically.
Remo Oppliger, UT99 AG

324
Low Temperature Ammonia Formation for SCR of NOx
Mansour Masoudi, Emissol

312
Evaluation of Machine Learning and Genetic Algorithms for Piston Bowl Design
Adam Klingbeil, GE Global Research

308
Integrated analysis approach for large gas engine development
Jan Majer, Ricardo

004
The HERCULES (2004-2018) program of R&D in large engine technologies
Nikolaos Kyrtatos, National Technical University of Athens

252
Research on fatigue fracture caused by wear phenomena of internal thread of a diagonally split connecting rod
Takehiro Noda, Yanmar

347
Additives Fuels and Ships a Case Study
Michael Banning, innospec ltd

066
Service Experience of MEGI Engines
Stig Baungaard Jakobsen, MAN Energy Solutions

023
Service experience with ester based EAL for stern tubes - investigations on lubrication and statistics from used oil analysis.
Jean-Philippe Roman, TOTAL LUBMARINE

Thursday - June 13, 2019 (09:00 – 17:00)

Exhibition Hall

2	System Integration, Electrification and Hybridization – for Rail, Power, and Marine applications - Poster Session	021	**"Diagnosis of Abnormal Operational Conditions and Performance Enhancement of Marine Fuel Cells"** Tatsumi Kitahara, Kyushu University
		029	**Research on Safety Protection System of Deep Sea Drilling Vessel** Jia Zheng, Shanghai Marine Diesel Engine Research Institute
		040	**Study on energy saving of ship parallel gas-battery hybrid power system** Liyun Fan, Harbin Engineering University
		042	**Power-split strategies for hybrid diesel-electric marine power plant using predictive control and transient load preview** Nikolaos Planakis, National Technical University of Athens
		053	**Battery-hybrid propulsion system for environmental friendly fishing vessels** Steffen Co, MAN Energy Solutions
		136	**Research on Optimal Design and Practical Use of an Electronically Controlled Cylinder Lubrication System for the Large Low-speed Two-stroke Engine** Yuhai HE, School of Energy and Power Engineering, Wuhan University of Technology
		140	**Free piston linear generator based on magnetic force control methods** Yunqi Liu, Beijing Institute of Technology
		148	**Design of Liquefied Natural Gas Supply System for Marine Nature Gas Engine and Integration Platform Development** Hongkai Ben, Harbin Engineering University
		206	**Transient Energetic Analysis of Hybrid Drivetrains** Conrad Gierow, FVTR GmbH
		245	**Experimental Study of Combustion Instability of LPG as Marine Fuel** Junfeng Yang, University of Leeds
		303	**Operating Profile Effect to the Lifetime of Hybrid Powertrain by Using Thermomechanical Fatigue Analysis and Wärtsilä Digital Design Platform** Tero Frondelius, Wärtsilä
		414	**Further opportunities for Integration of Propulsion System with energy storage system.** Aihua Qiu, Shanghai Marine Diesel Engine Research Institute
		476	**A Review of Energy Efficiency Improvement Strategies for All-Electric Ships** Chalermkiat Nuchturee, Shanghai Jiao Tong University
8	Future Challenges and Ideas for Future Developments – Regulations, Environment, Global Trends - Poster Session	059	**Waste heat recovery of marine engine by organic Rankine cycle with zeotropic mixtures** Enhua Wang, Beijing Institute of Technology
		132	**"Marine Engine Emission Regulations in China I Introduction, Comparison and Impact Analysis"** Wei Lei, China Classification Society
		082	**Experimental studies on black carbon emission characteristics of marine engines** Gunfeel Moon, Korean Register

POSTER SESSION

Thursday - June 13, 2019 (09:00 – 17:00)

Exhibition Hall

10	Latest Engine Component Developments – Components & Tribology - Poster Session / Bearings	146	**Fatigue Characteristic Analysis on Connecting Rod Assembly of Low Speed Marine Diesel Engine** Zining Yu, Harbin Engineering University
		044	**A study of axial profile influence on engine main bearing performance and its optimization** Peirong REN, Beijing Institute of Technology
		122	**"Design and research of full-scale bearing fatigue test system for large scale low-speed machine based on hydraulic control"** Chen Guangku, Harbin Engineering University
		212	**High Performance Tin-Based Adaptive Multilayer Overlay for Medium and High-Speed Diesel Engine Journal Bearings** Yi Zhang, Daido Metal Co. Ltd, European Technical Centre UK
		322	**Study on Fretting Wear of crankshaft bearing bush of diesel engine** Congcong Xu, Shanghai Marine Diesel Engine Research Institute
		403	**HJ common rail lubrication system** Nikolaj Kristensen, Hans Jensen Lubricators A/S
		410	**"Hot box sealing systems to improve fire safety in engine rooms - Case summary: Wärtsilä Spray Protection Sealing Assembly"** Ari Kesti, TT Gaskets
		406	**Technical Cleanliness of Fuel and Lubricating Oil Systems before Commissioning** Stefan Schmitz, Boll&Kirch Filterbau GmbH
		372	**"Studies on Mechanism of Lubricating Oil Consumption for Diesel Engines Lubricated with Low Viscosity Oils"** Mitsuhiro Soejima, Kyushu Sangyo University
		334	**Contaminants in Trunk Piston Engine Oil and Their Effect on Tribological Performance** Jicheng Piao, PetroChina Dalian Lubricating Oil R&D Institute
		371	**Profitable monitoring of cylinder liner wear in low-speed engines** Daniel Grunditz, Chris-Marine
		352	**Eliminating the Reprotoxicity of MDCLs Without Compromising Performance** Alexander Coxon, Infineum UK Ltd.
11	Basic Research & Advanced Engineering – Technologies, Materials & Tools for Future Engines - Poster Session	194	**Experimental Study of Plasma-Assisted Combustion for Natural Gas Engine** Hirofumi Hashimoto, DAIHATSU DIESEL MFG.CO.,LTD.
		062	**Study on Acoustic and Vibration Prediction and Structural Optimization Design of an Oil Pan** Zhang Bo, China Shipbuilding Power Engineering Institute Co., Ltd.
		310	**The Opposed-Piston Engine: Reducing Emissions In Marine, Power Generation and Locomotive Engines** Andrew Schreck, Achates Power
		330	**Abnormal Combustion Behavior in Pre-mixed Combustion Two-Stroke Gas Engine** Takayuki Hirose, IHI Corporation
		355	**Experimental And Simulation Analysis of Influence of Combustion System Parameters on Marine Diesel Engine Thermal Load** Li Hongmei, Shanghai Marine Diesel Engine Research Institute
		382	**No Pipeline Design and Manufacture of a Marine Diesel Engine** Liting Li, Shanghai marine diesel engine research institute
		419	**Combustion and Exhaust Emission Characteristics with regard to the Combined Application of EGR and Water-in-Fuel Emulsion in a Medium Speed Diesel Engine** Beat von Rotz, Paul Scherrer Institute (PSI)
		387	**Towards Predictive Dual-Fuel Combustion and Pre-Chamber Modeling for Large Two-Stroke Engines in the Scope of 0D/1D Simulation** Markus Wenig, Winterthur Gas & Diesel
		307	**A novel method for rapid thermal analysis of large engines** Jan Majer, Ricardo

OPTIONAL TOURS JUNE 11 – 13, 2019

TOUR DATES: JUNE 11 – 13, 2019

Explore Vancouver!

Vancouver is a vibrant city with lots of things to see and do. Galleries and public exhibits for art enthusiasts, historical sites and districts for history buffs, and scenic hiking trails and botanical gardens for nature lovers are just a small sampling of the city's diverse attractions. From colorful downtown neighborhoods, to culturally diverse suburbs and mountainside districts, there's plenty to explore!

- have a look around Vancouver with a 360 degree view at **Vancouver lookout**
- visit the **Chinese garden** or the **museum of Vancouver**
- make a trip to the **Sea to Sky Gondola** outside of Vancouver to have a magnifivient view of the majestic coastal forest and surrounding mountains. Once at the top, many adventures await.
- try the **Capilano Suspension Bride Park** high above the Capilano River
- experience an extraordinary view from the Peak of Vancouver on top of **Grouse Mountain**. You can either hike up the mountain or use the gondola.

CIMAC Congress will provide a get-together meeting room with information's about the city, sightseeing tours and excursions with daily tips. You will get the chance to connect with others, to explore Vancouver and its sourroundings together.

Pictures: ©Tara O'Grady

MAIN SPONSORS

Platinum Sponsor

We thank our um Sponsor of the 29th CIMAC World Congress for the extraordinary support!

ABB Turbocharging

5401 Baden, Switzerland

ABB Turbocharging is a technology and market leader in the manufacture and maintenance of turbochargers for 500 kW to 80+ MW diesel and gas engines. Having produced the world's first industrial turbocharger, it has continued to push turbocharging technology forward, providing engine builders and application operators with advanced turbocharging solutions for efficient and flexible application operations and compliance with the most stringent environmental requirements. About 200,000 ABB turbochargers are in operation across the globe on ships, power stations, gen-sets, diesel locomotives and large, off-highway vehicles.

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We thank all the Silver Sponsors of the 29th CIMAC World Congress for their extraordinary support!

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8401 Winterthur, Switzerland

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530-0013 Osaka, Japan

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INTERNATIONAL MARITIME JOURNAL

The MARITIME EXECUTIVE
INTELLECTUAL CAPITAL FOR EXECUTIVES

marine propulsion
& auxiliary machinery

MARITIME REPORTER AND ENGINEERING NEWS

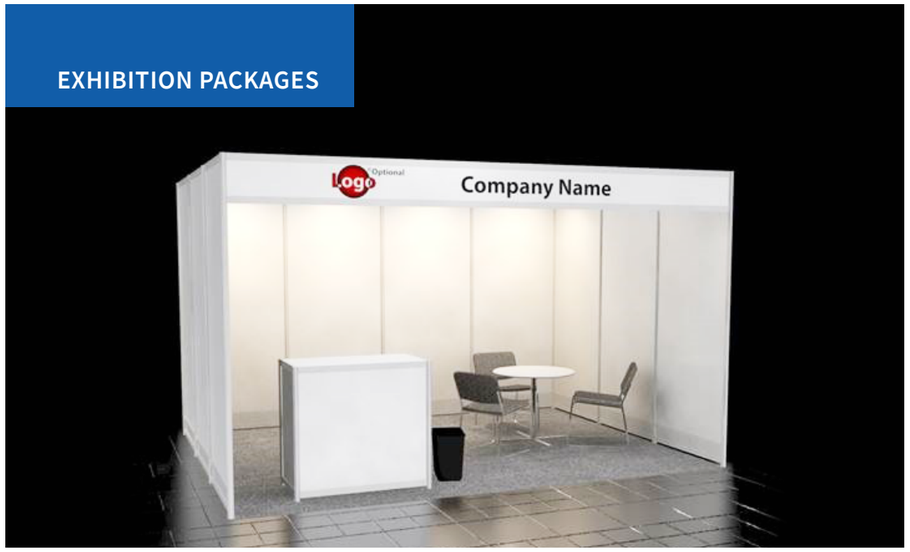
ACCOMPANYING EXHIBITION

Present your Company

We are pleased to inform you about the excellent opportunity to present your company at the accompanying exhibition of the 29th CIMAC World Congress, which will be held in the Vancouver Convention Centre, Vancouver, Canada. The exhibition takes place from **10 until 13 June 2019.**

For the application forms please visit
www.cimaccongress.com

For any questions regarding the exhibition, please contact
Ms. Sybille Lang
CIMAC Project Team



Stand Type 1 – Package (min. 12 sqm)

- Provision of stand space
- Stand construction, uniform design
- Uniform floor covering
- 1 table, 3 chairs, 1 lockable sideboard, 1 waste paper basket
- Fascia board incl. company name and booth-number
- 1 power outlet, approx. 1.5 kw (110V)
- General stand lighting
- Daily basic stand cleaning, excl. exhibits
- Catalogue entry (CIMAC Congress publication)
- Support service by HMC prior to the event and during the show
- 2 exhibitor badges, for each additional 12 sqm you will receive 1 extra badge

EUR 425.00 /sqm (excl. tax)

Exhibitor Badges
The exhibitor badges are for use of the stand staff only and do not entitle to take part in the conference.

Stand Type 2 – Light Stand (6 sqm)

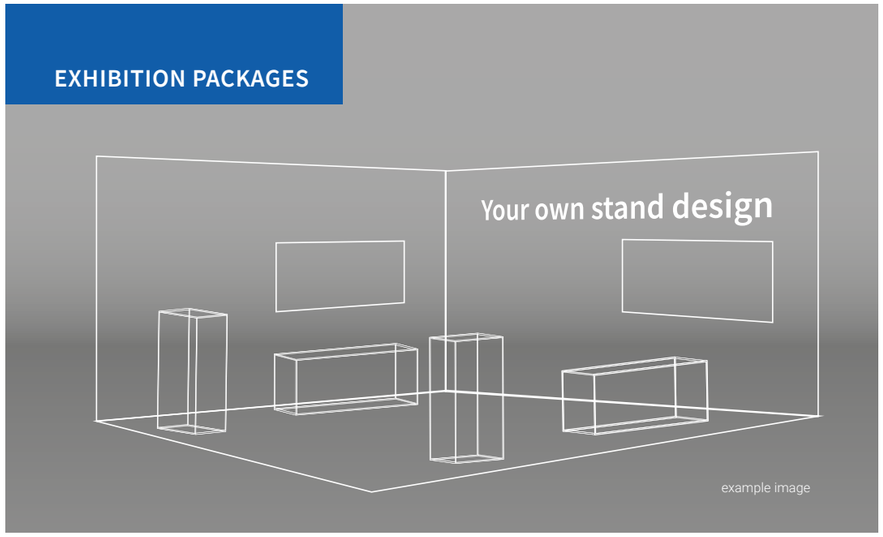
- Provision of stand space
- Stand construction, uniform design
- Uniform floor covering
- 1 lockable counter, 1 high table, 1 bar stool, 1 brochure holder, 1 waste paper basket
- Fascia board incl. company name
- 1 power outlet, approx. 1.5 kw (110V)
- General stand lighting
- Daily basic stand cleaning, excl. exhibits
- Catalogue entry (CIMAC Congress publication)
- Support service by HMC prior to the event and during the show
- 1 exhibitor badge

EUR 2,900.00 lump sum (excl. tax)

Exhibitor Badges

The exhibitor badges are for use of the stand staff only and do not entitle to take part in the conference.

ACCOMPANYING EXHIBITION



Stand Type 3 – Required exhibition raw space excl. stand construction (min. 48 sqm)

- Provision of stand space
- Daily basic stand cleaning, excl. exhibits
- Catalogue entry (CIMAC Congress publication)
- Support service by HMC prior to the event
- 4 exhibitor badges, for each additional 12 sqm you will receive 1 extra badge

EUR 275.00 /sqm (excl. tax)

Exhibitor Badges

The exhibitor badges are for use of the stand staff only and do not entitle to take part in the conference.

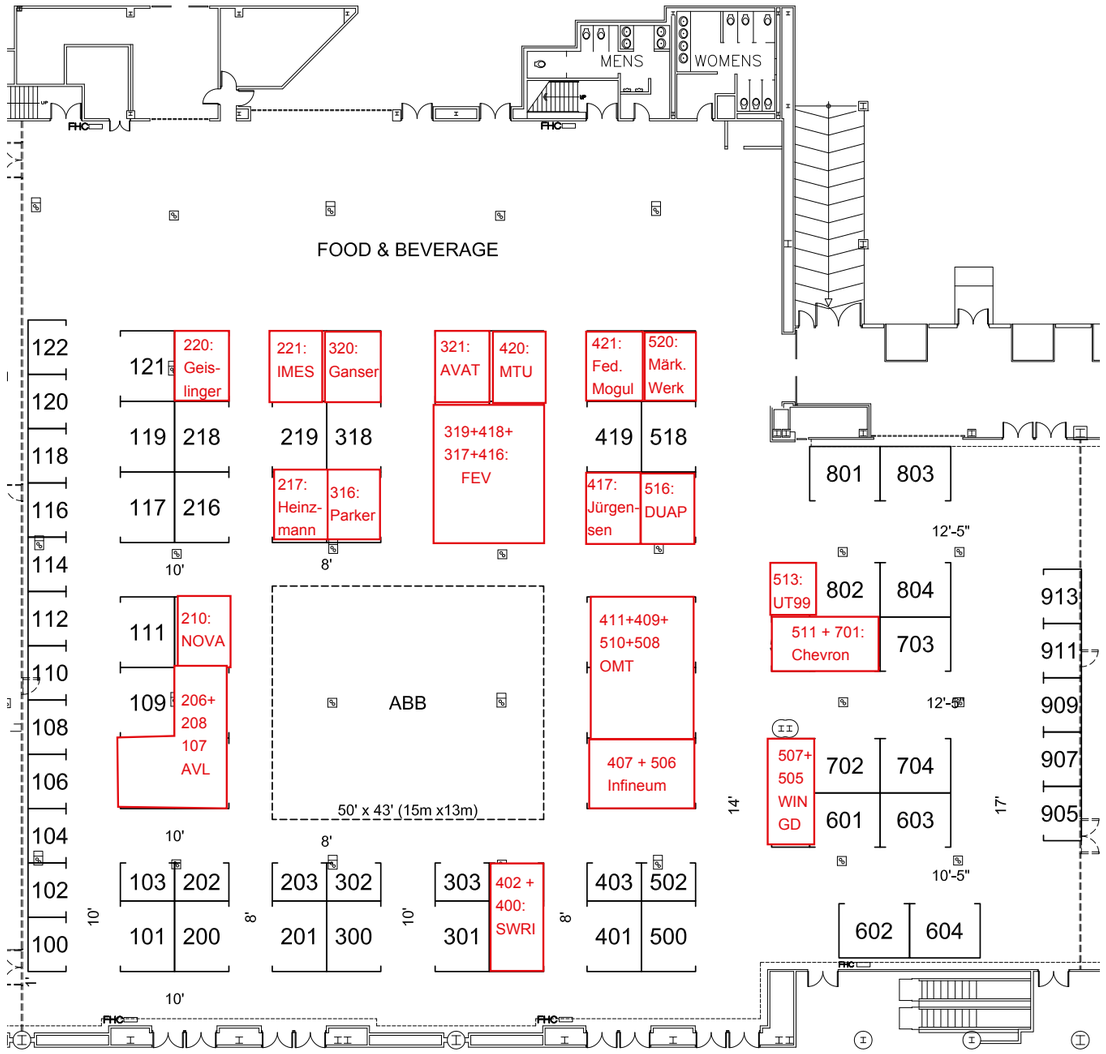
Hamburg Messe und Congress
International GmbH

Hamburg Messe
und Congress
International

Messeplatz 1
20357 Hamburg
Germany
Phone +49 40 3569-2293
Fax +49 40 3569-692293
Email: cimac@hamburg-messe.de
Web: hamburg-messe.de/en/exhibitors/trade-fairs-abroad

HALL LAYOUT

East Building: Hall A & Ballroom C



EXPANSION JOINT
ELECTRICAL / PHONE
ELECTRICAL / PHONE
WATER / DRAIN

29 - 7' x 10' (2m x 3m) BOOTHS
56 – 10' x 13' (3m x 4m) BOOTHS

The layout may have to be altered. Therefore the plan is subject to change.

GENERAL INFORMATION

JOURNEY

Vancouver

Cradled amid skyscraping mountains and sparkling ocean, scenic Vancouver is one of the world's premier meeting and convention destinations. World-renowned cuisine, luxury hotels and unique venues – including the two-time winner of "World's Best Convention Centre" – all add up to an unforgettable conference experience. Visitors experience a modern, cosmopolitan city that blends culture and landscape.

With so much to experience in Vancouver, you will be well-entertained during your conference off time. Galleries and public exhibits for art enthusiasts, historical sites and districts for history buffs, and scenic hiking trails and botanical gardens for nature lovers are just a small sampling of the city's diverse attractions.

The late-night scene in Vancouver is a thriving mix of lounges, laid-back pubs and energetic music venues. Some of the trendiest lounges are found in many of the downtown hotels. Live music is never hard to find in Vancouver. Local bands and international touring acts set up regularly in the clubs and venues around town.

Vancouver Basics

- Population: 603,500 City of Vancouver and 2.5 million Metro Vancouver
- Languages Spoken: English and French are Canada's two official languages. English is the predominant language spoken in British Columbia
- Climate: Metro Vancouver has a very mild climate. In winter, it rarely snows in the city; summers are warm with coller evenings
- Time Zone: Vancouver is in the Pacific Time Zone. Daylight time (clocks move one hour ahead) is in effect from the second Sunday in March until the first Sunday in November

For more information about Vancouver please download here: Vancouver Official Visitors' Guide

Traveling to Vancouver

Accessibility

Vancouver makes things easy with its reliable, clean, green and efficient public transportation network; its variety of coach companies providing group travel options; and its world-class network of ferries designed to move people and cars throughout the surrounding region with comfort and ease.

By plane

- 25 minutes south of downtown Vancouver (9.3 miles / 15 km)
- Transfer service to downtown via Canada Line light rapid system ($9.10 CND)
- 43 airlines servicing the destination
- Download Destination Map and Flying Times to Vancouver

More Information please see Vancouver International Airport Website

By car & train

- Three hour drive from Seattle across Canada/U.S. border
- VIA Rail, Amtrak and Rocky Mountaineer all offer rail service to and from Vancouver

By Public Transit & Coach

- TransLink operates over 100 public buses, the Canada Line and the SeaBus
- Fares range from $2.85 to $5.60 CND
- Canada Line station are wheelchair accessible
- Scenic SeaBus connects North Vancouver to Vancouver in 12 minutes
- Vancouver has many affordable and efficient coach companies for various group sizes

CONGRESS VENUE

VANCOUVER CONVENTION CENTRE

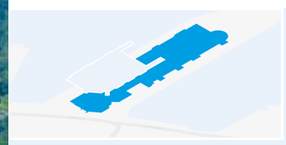
The award-winning Vancouver Convention Centre is located in the heart of downtown Vancouver where everything is accessible – from hotel accommodations to a great variety of restaurants, entertainment, retail and recreational options. Located at Vancouver's downtown waterfront with a dramatic mountain backdrop Vancouver Convention Centre offers one of the most beautiful settings in the world.

Vancouver Convention Centre
East Building
1055 Canada Place
Vancouver
V6C OC3
Canada

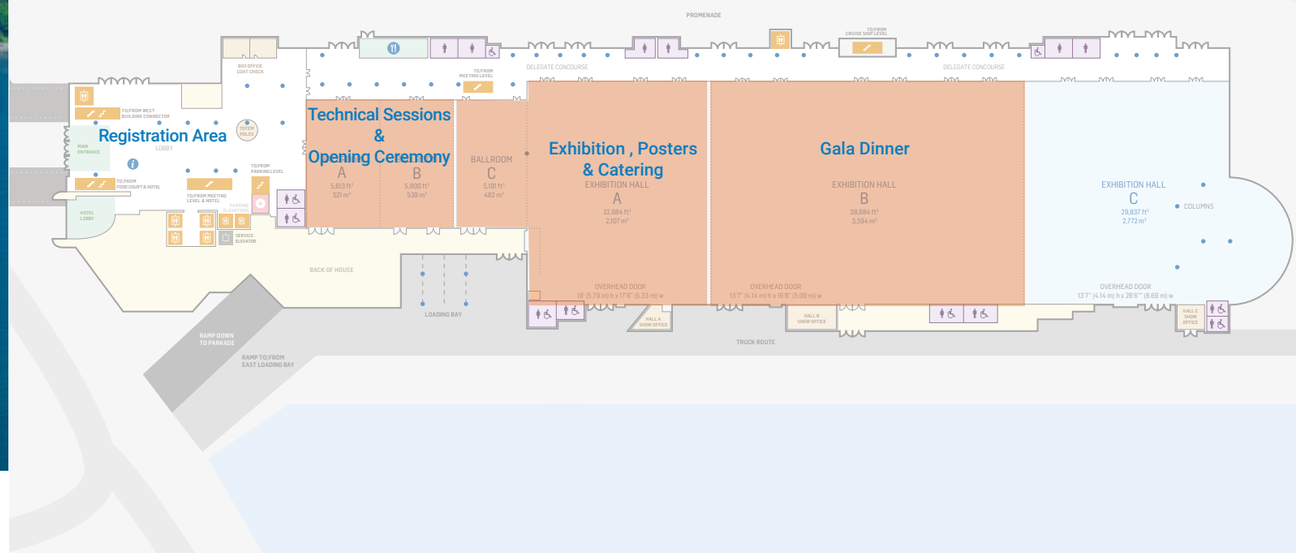
www.vancouverconventioncentre.com

Tourism Vancouver / Vancouver Convention Centre, Photographer: Kristopher Grunert

East Exhibition Level - Ground Floor



NORTH



East Meeting Level - 1st Floor“

ACCOMMODATION

For all Congress participants special room rates have been arranged in the following hotels. Please make your reservation directly in the hotel of your choice by using the appropriate keyword. We recommend an early reservation due to room limitations. For further details about the hotels please access the hotel links.

Only few places left

1

Hotel Pan Pacific

Suite 300-999, Canada Place Vancouver, British Columbia V6C 3B5, Canada

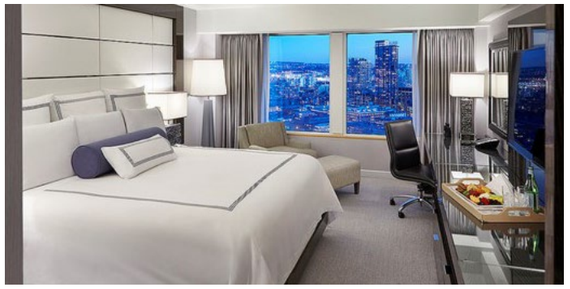
Telephone +1 604 662 8111
Toll-Free 1 800 663 1515 (Within Canada)
Toll-Free 1 800 937 1515 (Within USA)
Toll-Free 1 800 514 9086 (Within Mexico)

Email info@panpacificvancouver.com
https://www.panpacific.com/en/hotels-and-resorts/pp-vancouver.html

Room rates:
Deluxe Harbour Double / Deluxe Harbour King: **$349.00 CAD** per night
Premier Double / Premier King: **$399.00 CAD** per night

The above rates are quoted in Canadian funds and are net; room rates are subject to taxes

Reservations ID: CIMAC619 (Please quote to the Reservations Agent)
Reservations Due Date: May 10, 2019



2

Hotel Coast Coal Harbour

1180 West Hastings Street
Vancouver, BC V6E 4R5, Canada

Telephone +1 604-697-0202

https://www.coasthotels.com/hotels/bc/vancouver/coast-coal-harbour-hotel/

Room rates:
Comfort Room One King Bed or Two Double Beds: **$269.00 CAD** per night

The above rates are quoted in Canadian funds and are net; room rates are subject to taxes

Reservations ID: CCC-GFC6224 or Meeting Name „2019 International Council on Combustion Engines Technology"
Booking Website: https://aws.passkey.com/e/49468132
Reservations Due Date: May 10, 2019

3

Hotel Pinnacle Vancouver Harbourfront

1133 West Hastings Street
Vancouver, BC V6E 3T3, Canada

Telephone +1 604-689-9211

Email Vancouver.info@pinnaclehotels.ca
https://www.pinnacleharbourfronthotel.com

Room rates:
City Side Single/Double: **$239.00 CAD** per night

The above rates are quoted in Canadian funds and are net; room rates are subject to taxes

Reservations Direct Phone: +1-844-337-3118 or +1-604-689-9211
Booking Website: https://aws.passkey.com/event/49590929/owner/2075/home
Reservations Due Date: May 9, 2019

MAP OF VANCOUVER

1 Hotel Pan Pacific
Suite 300-999, Canada Place Vancouver, British Columbia V6C 3B5, Canada

2 Hotel Coast Coal Harbour
1180 West Hastings Street
Vancouver, BC V6E 4R5, Canada

3 Hotel Pinnacle Vancouver Harbourfront
1133 West Hastings Street
Vancouver, BC V6E 3T3, Canada

A Vancouver Convention Centre

B Vancouver Aquarium – Welcome Reception

REGISTRATION

Ticketshop

You can register for the 29th CIMAC World Congress online by using the ticketshop. Please follow the link: **Ticketshop**

Opening Hours Information Desk

Sunday	June 09	14:00 – 18:00
Monday	June 10	08:00 – 18:00
Tuesday	June 11	08:00 – 18:00
Wednesday	June 12	08:00 – 18:00
Thursday	June 13	08:00 – 18:00

Registration Fees*

	Euro / €	CND / $	USD / $
CIMAC Members	€ 1,790	$ 2,680	$ 2,200
Non-members	€ 1,980	$ 2,990	$ 2,450
Speakers	€ 1,490	$ 2,250	$ 1,840
Students		on invitation only	
Accompanying persons	€ 350	$ 530	$ 430
One-Day Ticket	€ 750	$ 1,130	$ 920
Exhibition Ticket per day	€ 50	$ 80	$ 60
Gala Dinner only	€ 250	$ 380	$ 300
Poster Session	€ 250	$ 380	$ 300

*No subject to Canadian GST (VAT) under FCTIP.

The prices in Euro are binding. Dollar prices may vary and are for orientation only.

The Congress fee for **CIMAC members, non-members** and **speakers** includes: participation in the scientific program, admission to the exhibition, the Opening Ceremony, the Welcome Reception, ABB Evening and the Gala Dinner. Additional Congress components, such as the accompanying program (optional tours, technical tours) must be booked and paid for separately. The Congress documents (program, Congress bag, participant badge) as well as catering during breaks are included in the Congress fee.

Students have the above mentioned services included - except the participation in the Gala Dinner.

The participation fee for **accompanying persons** includes: admission to the exhibition, coffee breaks and lunch, Opening Ceremony, Welcome Reception, ABB Evening and Gala Dinner, this ticket does NOT include the scientific program.

SCHEDULE

Day	Time	Acitivties
Sunday June 9, 2019	**14:00 – 18:00**	**Congress Information Desk**
	14:00 – 18:00	**Speakers' Preparation**
Monday June 10, 2019	08:00 – 18:00	Congress Information Desk
	10:00 – 18:00	**Speakers' Preparation**
	10:00 – 17:00	Exhibition
	10:00 – 11:30	**Opening Ceremony**
	13:30 – 17:00	Technical Sessions
	18:30	**Welcome Reception**
Tuesday June 11, 2019	08:00 – 18:00	Congress Information Desk
	08:00 – 18:00	**Speakers' Preparation**
	08:30 – 17:00	Exhibition
	09:00 – 17:00	**Poster Sessions**
	09:00 – 17:00	Technical Sessions
	18:30	**ABB Evening**
Wednesday June 12, 2019	08:30 – 18:00	Congress Information Desk
	08:00 – 18:00	**Speakers' Preparation**
	09:00 – 17:00	Exhibition
	09:00 – 17:00	**Poster Sessions**
	09:00 – 17:00	Technical Sessions
	15:30 – 16:30	**Collin Trust sponsored Key Note Speech**
Thursday June 13, 2019	08:00 – 18:00	Congress Information Desk
	08:00 – 15:00	**Speakers' Preparation**
	08:30 – 17:00	Exhibition
	09:00 – 17:00	**Poster Sessions**
	09:00 – 17:00	Technical Sessions
	15:30 – 17:00	**Final Panel Discussion**
	18:30	**Gala Dinner**
Friday June 14, 2019	09:00 – 14:00	Half-day Technical Tours
	09:00 – 17:00	Full-day Technical Tours

ANNOUNCEMENT 30TH CIMAC CONGRESS

On behalf of CIMAC, the South Korean National Members Associations, we are happy to announce **Busan** as the host city for the 2022 Congress.

Busan is Korea's representative tourist city with over 3 million foreign visitors a year. From the Haeundae Beach to the beautiful natural environment, visitors can enjoy all four seasons.

It provides a variety of marine tour programs, shopping experiences and other cultural activities.

These have all combined to make Busan a world class tourist city for lodging and relaxation.

Busan looks forward to welcoming CIMAC delegates in 2022!

2022
BUSAN

QUICK FACTS

Accommodation

Informations about selected Hotels in Vancouver please see page 39.

Cancellation of Congress Participation

Cancellations of participation are only possible up to **30 April 2019** at the latest. On cancellation of participation, the participation fee will be refunded minus the administrative charge amounting to € 180. Cancellations or refunds at a later date are not possible. There shall be no refunds of participation fees for non-attendance without a cancellation within the stipulated period.

CIMAC

CIMAC is the non-commercial sponsor of the 29th CIMAC World Congress in Vancouver. For further informations on CIMAC please visit the website at http://www.cimac.com/

CIMAC Membership

If you are uncertain about your membership status or want to apply for a membership, please contact the CIMAC Central Secretariat – info@cimac.com

Congress Catering

Catering stations will be integrated in the exhibition area. During the coffee breaks and lunch break participants will be provided with food and drinks. Enjoy regional and international cuisine!

Congress Documents

Please bring your mobile ticket ready on your mobile phone or tablet with you or print out your e-ticket legibly on a sheet on paper. Your personal badge is your entrance ticket to all sessions, the exhibition and the social events. Please, remember to wear your badge at the congress and the social events at every time. Congress bags will be provided in the registration area in the Convention Centre.

Contact for Questions

For questions regarding the technical Program, please contact CIMAC Central Secretariat. For questions regarding the congress, sponsoring and exhibition, please contact the Main and the Co-Organizer of the congress. Contact details see page 53.

Cloakroom

Participants may leave their belongings in the designated area.

Language

The official language of the Congress is English. No translation will be provided.

Newsletter

For the subscription of the CIMAC Newsletter please fill out the form on CIMAC website: http://www.cimac.com/publication-press/newsletter-subscription/index.html

Mobile App

A mobile app will be available for downloading in Goolge Play and Apple App Store for all congress participants in early spring time. The app contains the actual technical Program, general informations, floor plans and furthermore.

Optional Tours

For participating in the optional tours, please visit our hospitality room at the congress. Please see pages 29.

Social Media

Fans and followers will find the CIMAC Congress on LinkedIn and Twitter.

Speakers' Preparation Room

All presentations can be checked and delivered to the speaker's preparation room at least 2 hours prior to speaker's session. Presentations being held during a morning session should be checked at the end of the day before. Speakers are kindly requested to follow the instructions of the chairperson and strictly keep to the time of their presentation.

Technical Program

Admission to all sessions of the technical Program is only possible with a valid congress ticket. The congress ticket for **CIMAC members, non members, speakers and students** includes: congress badge, congress bag, admission to all sessions and the exhibition, coffee breaks and lunch, Opening Ceremony, Welcome Reception, ABB Evening, Gala Dinner (except students).

The registration for **accompanying persons** includes: admission to the exhibition, coffee breaks and lunch, Opening Ceremony, Welcome Reception, ABB Evening, Gala Dinner.

Technical Tours

Separate registration is required for participation in the technical tours. Registration will be available in the beginning of 2019 on the congress website.

Ticketshop

NEW

Tickets are only sold online via our Ticketshop and only payable via credit card. Print your ticket or bring it along on your mobile device.

WIFI

Free WIFI is available at Vancouver Convention Centre. Login and password will be announced on-site.

CONGRESS ORGANIZER

Main Organizer Congress:

Gesellschaft zur Förderung des Maschinenbaues mbH (GzF)

a VDMA group company

Lyoner Straße 18
60528 Frankfurt am Main
Germany

Contact: Nicole Potz
Phone: +49 69 6603-1143
Fax: +49 69 6603-2843
Email: congress@cimac.com
Web: www.cimaccongress.com
www.gzf-expo.de

Co-Organizer Congress:

CIMAC National Member Association

12001 Network Blvd, Ste 110,
San Antonio, TX 78249

Contact: Timothy Callahan
Email: timothy.callahan@swri.org

Co-Organizer Exhibition:

Hamburg Messe und Congress International GmbH

Messeplatz 1
20357 Hamburg
Germany

Contact: Sybille Lang

Phone: +49 40 3569-2293
Fax: +49 40 3569-692293
Email: cimac@hamburg-messe.de
Web: www.hamburg-messe.de/en/visitors/trade-fairs-abroad

Non-Commercial Sponsor:

CIMAC

Lyoner Strasse 18
60528 Frankfurt am Main
Germany

Contact: anirudh.purayil@vdma.org

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Fax: +49 69 6603-2149
Email: info@cimac.com
Web: www.cimac.com

ABOUT CIMAC

CIMAC: the Global Forum for Large Engines and their Applications

Originally founded in Paris in 1951, CIMAC has become **the leading global association of the internal combustion machinery industry.** It is a non-profit association bringing together and re pre-senting the large engine industry to regulators and standardising bodies. In addition to promoting the work of National Member Associations, it supports information exchange and understanding across the large combustion engine industry including:

- Builders of large diesel, gas and dual-fuel engines
- Users of large engines such as owners and operators of ships, power plants, locomotives etc.
- Systems and component suppliers
- Fuel and lubricant suppliers, including oil companies
- Classification societies and other regulatory bodies
- Academic institutions, consultant engineers, scientists
- Other service providers

CIMAC's Mission is to:

- promote exchange of scientific and technical information via its Congresses, CIMAC Circles and CIMAC CASCADES events
- improve understanding between engine manufacturers and engine users
- improve understanding between engine manufacturers and their suppliers
- focus upon and promote the work and activities of National Member Associations
- promote exchange on technological developments in a pre-competition state, e.g. in its Working Group meetings
- contribute to internationally applied technological standards and publications
- collaborate with other international associations

CIMAC Membership

CIMAC members currently come from **26 countries** across North and South America, Asia and Europe. Membership can take three forms:

- Membership of the official CIMAC National Member Association in your country
- Membership of National Member Groups
- Corporate Membership for individual companies

Please see page 53 for CIMAC contact details.

CIMAC Working Groups: the Consensus Seekers

CIMAC Working Groups are the heart of CIMAC. Led by **international specialists** from CIMAC member organisations, they seek solutions to industry-wide technical issues.

They interface with legislators, standards organisations, and regulators such as the classification societies to develop a united CIMAC recommendation or a position paper, representing the industry as a whole, on a pre-competitive, pre-legislative basis. They have a distinguished record of issuing guidance and published media articles on a wide range of crucial subjects relating to the operation of large diesel, gas and dual-fuel engines.

Consequently, CIMAC Working Group activities encompass the environmental compatibility, efficiency and safety of large engines and their applications.

CIMAC Working Groups currently cover these vital areas of engine technology and operation:

- Classification
- Crankshaft Rules
- Electronics & Software Systems
- Exhaust Emissions Control
- Fuels
- Gas Engines
- Inland Waterway Vessels
- Marine Lubricants
- System Integration
- Users

CIMAC Events

The CIMAC Congress represents the culmination of all CIMAC activities, being held every three years, each time in a different member country. Spanning the globe as well as all technology aspects, the Congress is **a unique gathering of key industry decision makers,** including engine owners and operators, researchers and developers, and representatives from the engine, component and consumables industries.

The Congress progamme centres on the **presentation of technical papers** on engine research, development, application engineering on the original equipment side, and engine operation and maintenance on the end-user side. This is complemented by a social program which promotes friendship and networking among engine builders and engine users.

CIMAC Circles are panel discussions involving CIMAC members debating topical issues. They are hosted at key industry events around the world at least once a year.

CIMAC CASCADES promote the advancement of young engineers and their careers. The events enable them to meet with leading industry experts to exchange information, network and present their projects.

REVIEWERS TECHNICAL PROGRAM

Person	Company	Place
Aabo, Kjeld	MAN Energy Solutions	Copenhagen, Denmark
Abidin, Zainal	SWRI	Texas, USA
Åkerman, Jonas	Wärtsilä	Vaasa, Finland
Aufischer, Rainer	Miba Gleitlager Austria GmbH	Laakirchen, Austria
Bartholomä, Klaus	MAN Energy Solutions	Augsburg, Germany
Beran, Robert	AVL List GmbH	Graz, Austria
Boletis, Elias	Wärtsilä	Vaasa, Finland
Boom, Rick	Woodward	Amsterdam, Netherlands
Buchholz, Bert	University of Rostock	Rostock, Germany
Chatterjee, Daniel	Rolls-Royce Power Systems	Friedrichshafen, Germany
Dillen, Eric	GE	Illinois, United States
Flynn, Paul	HorsePower Consulting	Pennsylvania, USA
Frigge, Patrick	Innio	Jenbach, Austria
Gust, Edgar	Zollern BHW Gleitlager GmbH Co.KG	Braunschweig, Germany
Heuser, Peter	FEV Group GmbH	Aachen, Germany
Hiltner, Joel	Hiltner Combustion	Washington, USA
Itoh, Yasuhiro	Niigata Power Systems Co.,Ltd	Tokyo, Japan
Jacobs, Tim	Texas A&M University	Texas, USA
Jakobsen, Ole Graa	Maersk Line A/S	Copenhagen, Denmark
Knafl, Alexander	MAN Energy Solutions	Augsburg, Germany
Koch, Franz	hofer powertrain	Nürtingen, Germany
Mohr, Hinrich	AVL List GmbH	Graz, Austria
Montgomery, David	CATERPILLAR	Illinois, United States
Müller, Stefan	MTU Friedrichshafen	Friedrichshafen, Germany
Müller-Baum, Peter	CIMAC	Frankfurt, Germany
Nordrik, Rune	Rolls-Royce Power Systems	Hylkje, Norway
Osborne, Dustin	SWRI	Texas, USA
Östman, Fredrik	Wärtsilä	Vaasa, Finland
Rabe, Rom	Uni Flensburg	Flensburg, Germany
Ralf Marquard	N.N	N.N
Ritscher, Bert	Caterpillar Marine	Kiel, Germany
Rofka, Christoph	ABB Turbo Systems	Baden, Switzerland
Rojgaard, Charlotte	Bureau Veritas VeriFuel	Copenhagen, Denmark
Schlemmer-Kelling, Udo	FEV GmbH	Aachen, Germany
Schneiter, Dominik	WINGD	Winterthur, Switzerland
Steigert, Tim	Innio	Jenbach, Austria
Steve Fritz	SWRI	Texas, USA
Takahata, Yasuyuki	Yanmar	Osaka, Japan
Takasaki, Koji	Kyushu Univ.	Fukuoka, Japan
Tanaka, Ichiro	Mitsui	Tokyo, Japan
Tonon, Paolo	ABB Turbo Systems	Baden, Switzerland
Vlaskos, Ioannis	WINGD	Winterthur, Switzerland
Wachtmeister, Georg	TU Munich	Munich, Germany
Weisser, German	WINGD	Winterthur, Switzerland
Wik, Christer	Wärtsilä	Vaasa, Finland
Wimmer, Andreas	LEC GmbH (Large Engines Competence Center)	Graz, Austria

CONGRESS ORGANISING COMMITTEE

Klaus M. Heim
CIMAC President

Winterthur Gas & Diesel
Switzerland

Marko Dekena
Vice-President „Technical Program"

AVL List
Austria

Donghan Jin
CIMAC Council Representative

Shanghai University
China

Rick Boom
CIMAC Council Representative

Woodward
Netherlands

Hanny Mäntymaa
Vice-President „Technical Program"

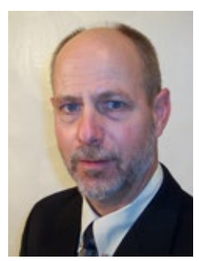
Wärtsilä
Finland

Tim Callahan
Congress 2019 President

Southwest Research Institute
USA

Olivier Baiwir
CIMAC Council Representative

Aderco Europe
Belgium



Neil Blythe
Representative of Congress Hosting Organization

GE Transportation
USA

Axel Kettmann
Vice-President „Communication"

ABB Turbo Systems
Switzerland

Yasuyuki Takahata
Congress VP Global Integration

Yanmar
Japan

David Mumford
Representative of Congress Hosting Organization

Westport
Canada

Fred Richardson
Representative of Congress Hosting Organization

Teekay
Canada

Tobias Ehrhard
Representative of CIMAC Host Associate Secretariat

VDMA
Germany

Peter Müller-Baum
CIMAC Secretary General

CIMAC Central Secretariat
Germany

MEMBERS OF CIMAC

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President

Christoph Teetz
Past President

Marko Dekena
Vice President Technical Program

Hannu Mäntymaa
Vice President Technical Program

Christian Poensgen
Vice President Working Groups

Donghan Jin
Vice President Working Groups

Yasuyuki Takahata
Vice-President Global Integration

Ole Gra Jakobsen
Vice President Users

Axel Kettmann
Vice President Communication

Tim Callahan
Congress President

Peter Müller-Baum
Secretary General

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Dekena, Dr. M. (Board Member)
Aufischer, Dr. R.
Krafft, Dr. B.-T.

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Baiwir, O.
Vermeire, M.
Vervaeke, L.

Brazil
Kremer, F. G.
Santos R.

Canada
Richardson F.

China
Jin Donghan (Board Member)
Shusheng Li
Shaojun Sun

Czech Republic
Klima, J.

Croatia/Hrvatska
Naranca N.

Denmark
Jakobsen O. (Board Member)
Preem M.
Jensen S. H.
Ibsen B.

Finland
Mäntymaa H. (Board Member)
Wideskog M.
Frostell P.

France
Abiven F.
Riom E.
Vigreux M.

Germany
Teetz Dr. C. (Board Member)
Poensgen Dr.-Ing. C. (Board Member)
Ehrhard Dr. T.
Wachtmeister Prof. G.

Greece
Ioannidis P.
Katsikas S.

India
Ramakumar Dr. S. S. V.
Singh S.
Mathai Dr. R.

Italy
Coppo Dr. M.

Japan
Takahata Y. (Board Member)
Takahashi S.
Yamada T.

Korea
Prof. Lee D.
Cha J.-H.

Monaco
Smrcek M.

Netherlands
Blankenstein L.
Boom R. (Auditor)
Kloppenburg P.
Mestemaker B.

Norway
Johannessen E.
Ask T. O.
Koch P.

Poland
Koziel, G.

Russian Federation
Kalmantaev R.
Ryzhov V. A.

Singapore
Gwee A. H.
Lecloux P.

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Iruretagoiena I.
Cordón Velaz Dr. J.

Switzerland
Heim K. (Board Member)
Riemenschneider O.
Kettmann A. (Board Member)
Schneiter D.
Waernier-Gut B.

United Kingdom
Smythe J.H.
Calder G.
Fooks M.

United Sates
Callahan T. (Board Member)
Blythe N.

MEMBERS OF CIMAC

National Member Associations

Country	NMA
Austria	FMMI
China	CSICE
Denmark	CIMAC DANMARKS NATIONALE KOMITÉ
Finland	The Federation of Finnish Technology Industries
France	Profluid
Germany	Deutsches Nationales CIMAC Kommitee
India	CIMAC India
Japan	JICEF
Republic of Korea	KOFCE
Netherlands	CIMAC NMA NL p.a. Techno Fysica
Norway	CIMAC NMA Norway, c/o Peter Koch
Sweden	Kurt V. Olsson
Switzerland	Swissmem
United Kingdom	Mark Fooks, c/o Daido Metal Co. Ltd.
United States	Tim Callahan, c/o Southwest Research Institute

Corporate Members

Country	NMA
Belgium	Aderco Europe S.A.
	Anglo Belgian Corporation N.V.
	Chevron Belgium NV
Brazil	Norskan Offshore Ltda
	Petróleo Brasileiro S.A. (PETROBRAS)
Canada	Teekay Shipping (Canada) Ltd.
Croatia	AVL – AST d.o.o.
Czech Republic	PBS Turbo s.r.o.
Greece	Aegean Marine Petroleum SA
	Metis Cyberspace Technology SA
Italy	O.M.T. Officine Meccaniche Torino S.p.A.
Monaco	Transocean Maritime Agencies
Poland	Celsa ‚Huta Ostrowiec‘
Russian Federation	LLK INTERNATIONAL
	OAO Kolomensky Zavod
Singapore	Aderco Pte Ltd.
	Maritec Pte Ltd.
Spain	Dresser-Rand GUASCOR
	Sidenor Forgings & Castings S.L.U.