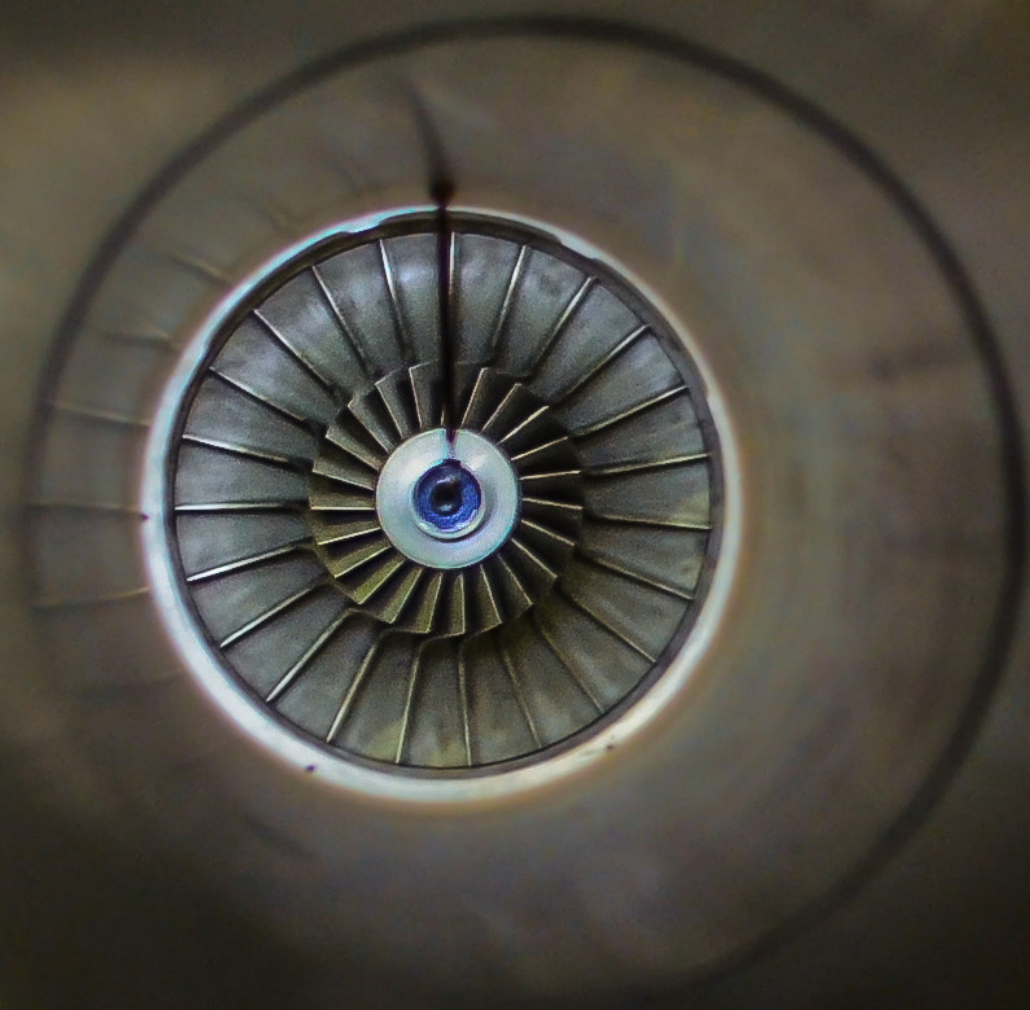


ESREL 2016

26th European Safety and Reliability Conference
University of Strathclyde, Glasgow
25th - 29th September 2016



Tim Bedford

(University of Strathclyde) Chair

Terje Aven

(ESRA) Co-Chair

Richard Denning

(SaRS) Co-Chair

Lesley Walls

(University of Strathclyde) Technical Chair

Matthew Revie

(University of Strathclyde) Technical Co-Chair

Programme Overview

Sunday 25 th September									
16.00 - 20.00		Registration Open		Foyer Area		Level 2			
18.00 - 20.00		ESREL 2016 - Welcome Reception		Foyer Area		Level 2			
Monday 26 th September									
08.00 - 17.00		Registration Open		Foyer Area		Level 2			
09.00 - 09.30		Opening Session		Main Auditorium		Level 2			
09.30 - 10.40		Cyber Risk Analysis: Method & Illustrations <i>M. Elisabeth Pate-Cornell, Professor of Management Science and Engineering - Stanford University</i>		Main Auditorium		Level 2			
10.40 - 11.00		Tea & Coffee		Foyer Area		Level 2 & 3			
Room		Auditorium: Level 1		Main Auditorium: Levels 2/3		CR 1: Level 3		Executive Room B: Level 9	
11.00 - 12.40		Resilience Modelling & Assessment: Cultural Aspects <i>C. Johnson</i>		KEYNOTE TUTORIAL Cyber Security for High-Reliability, Safety Critical Systems <i>C. Johnson</i>		CR4/5: Level 3 Oil & Gas: Risk Based Decision-Making		CR6/7: Level 3 Accident Investigation & Modelling: Maritime Transportation	
12.40 - 13.45		Lunch		Foyer Area		Level 2 & 3			
Room		Auditorium: Level 1		Auditorium A: Level 2		Auditorium B: Level 3		Executive Room A: Level 9	
13.45 - 15.25		Resilience Modelling & Assessment: Technical Systems		Auditorium A: Level 2 Accident & Incident Investigation Analysis		Auditorium B: Level 3 Safety & Organisational Culture		CR4/5: Level 3 Software Systems Safety Analysis & Management	
15.25 - 15.45		Tea & Coffee		Foyer Area		Level 2 & 3		CR6/7: Level 3 Decision-Making under Uncertainty: Modelling Applications	
Room		Auditorium: Level 1		Auditorium A: Level 2		Auditorium B: Level 3		Executive Room A: Level 9	
15.45 - 17.25		Resilience Modelling & Assessment: Measures		Auditorium A: Level 2 Accident & Incident Modelling: Applications		Auditorium B: Level 3 Safety Culture & Socio-Technical Modelling		CR4/5: Level 3 Dynamic Risk Assessment in Oil, Gas & Chemical	
17.30 - 19.15		ESRA General Assembly		Main Auditorium		Level 2		CR6/7: Level 3 Decision making under Uncertainty: Management Issues	
19.15		Conference Close		Auditorium		Level 2		Executive Room B: Level 9	
19.30 - 22.30		Ceilidh Night		The Barony Hall, 1 McLeod Street, Glasgow, G1 1XQ				CR4/5: Level 3 Dynamic Risk Assessment in Oil, Gas & Chemical	
Tuesday 27 th September									
08.00 - 17.00		Registration Open		Foyer Area		Level 2			
09.00 - 10.00		Plenary Presentation: Safety reporting and analysis: A national step change for GB rail <i>George Bearfield, Director of System Safety - Railway Safety and Standards Board</i>		Main Auditorium		Level 2			
10.00 - 10.20		Tea & Coffee		Foyer Area		Level 2 & 3			
Room		Auditorium: Level 1		CR 1: Level 3		CR3: Level 3		Executive Room A: Level 9	
10.20 - 12.00		Resilience Assessment: Vulnerability		Human Reliability Analysis: Methods		Stochastic Degradation Modelling		CR4/5: Level 3 Oil & Gas: Risk and Reliability Modelling	
12.00 - 13.00		Lunch		Foyer Area		Level 2 & 3		CR6/7: Level 3 Special Session: Foundational Issues in Risk	
Room		Auditorium: Level 1		Main Auditorium: Levels 2/3		CR 1: Level 3		CR8: Level 3 Mechanical Systems & Engineering	
13.00 - 14.40		Uncertainty Analysis: Methods & Applications		KEYNOTE TUTORIAL: Demystifying Human Performance Modelling: An Absolute Beginner's Guide to Dynamic Human Reliability Analysis <i>R. Boring</i>		Maintenance: Modelling Methods 1		CR6/7: Level 3 Mechanical Systems: Structural Reliability	
14.40 - 15.10		Tea and Coffee		Foyer Area		Level 2 & 3		CR8: Level 3 UK Safety and Reliability Society Roundtable	
Room		Auditorium: Level 1		Main Auditorium: Levels 2/3		CR 1: Level 3		Executive Room A: Level 9	
15.10 - 16.50		Crisis and Emergency Management 1		Human Reliability Analysis: Performance Shaping Factors & Methods		Maintenance & Risk Modelling: Energy System Applications		CR6/7: Level 3 Special Session: Critical Infrastructures - Operationalisation of Resilience for Crisis Management	
16.50 - 17.00		Break		Main Auditorium		Level 2		Executive Room B: Level 9	
17.00 - 18.00		Plenary Presentation: Building a reliable and resilient water supply <i>Simon Parsons, Director of Strategic Customer Service Planning - Scottish Water</i>		Main Auditorium		Level 2		CR8: Level 3 Mechanical Systems: Reliability Analysis	
18.00		Conference Close		Main Auditorium		Level 2		CR8: Level 3 Mechanical Systems: Reliability Analysis	
18.15 - 19.30		Glasgow City Chambers Reception		Glasgow City Chambers, George Square				Executive Room B: Level 9 Uncertainty Analysis: Fuzzy Methods	

Wednesday 28 th September									
08.00 - 17.00	Registration Open		Foyer Area	Level 2					
09.00 - 10.00	Plenary Presentation: science in occupational safety and health: Front line service or expensive luxury? <i>Professor Andrew Curran, Chief Scientific Adviser - Health & Safety Executive</i>				Main Auditorium	Level 2			
10.00 - 10.30	Tea & Coffee				Foyer Area	Level 2 & 3			
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR 1: Level 3	CR2: Level 3	CR3: Level 3	Oil & Gas: Risk of Releases	CR4/5: Level 3	CR6/7: Level 3	CR8: Level 3
10.30 - 12.10	Crisis and Emergency Management 2	Human Reliability Analysis: Applications 1	Maintenance Modelling: Applications 2	Digitally Enabled Risk Analysis	Rail Transportation: Risk Modelling & Applications	Oil & Gas: Risk of Releases	Oil & Gas: Accident scenarios & safety barriers	Special Session: Visualisation of Risk	Structural Reliability: Civil Engineering
12.10 - 13.20	Lunch				Foyer Area	Level 2 & 3			
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR 1: Level 3	CR 2: Level 3	CR 2: Level 3	Oil & Gas: Accident scenarios & safety barriers	CR4/5: Level 3	CR6/7: Level 3	Executive Room A: Level 9
13.20 - 15.00	Special session: New Strains of Society: hidden, dynamic and emergent vulnerabilities	KEYNOTE TUTORIAL: Uncertainty Quantification and Global Sensitivity Analysis: an introduction	Maintenance Modelling: Applications 3	Maintenance Modelling: Applications 3	Rail Transportation: Safety Modelling & Management	Oil & Gas: Accident scenarios & safety barriers	Oil & Gas: Accident scenarios & safety barriers	Human Reliability Analysis: Applications 2	Product Development & Warranty Modelling
15.00 - 15.30	Tea & Coffee				Foyer Area	Level 2 & 3			
15.30 - 16.30	Plenary Presentation: Managing risk in major projects: A strategic perspective <i>Jeremy Beeton, Director - Scottish & Southern Energy</i>				Main Auditorium	Level 2			
16.30 - 17.00	Images of Risk Awards and Welcome <i>Professor Sir Jim McDonald, Vice-Chancellor and Principal - University of Strathclyde</i>				Main Auditorium	Level 2			
17.10	Conference Close				Auditorium	Level 2			
19.00 - 00.00	ESREL 2016 - Conference Dinner				Kelvingrove Museum, Argyle Street, G3 8AG				
Thursday 29 th September									
08.00 - 16.00	Registration Open		Foyer Area	Level 2					
09.00 - 10.00	Plenary Presentation: Empirical Bayes: It's now, it's wow <i>John Quigley, Professor of Management Science - University of Strathclyde</i>				Main Auditorium	Level 2			
10.00 - 10.20	Tea & Coffee				Foyer Area	Level 2 & 3			
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR 1: Level 3	CR 2: Level 3	CR 2: Level 3	CR4/5: Level 3	CR4/5: Level 3	CR6/7: Level 3	Executive Room B: Level 9
10.20 - 12.00	Societal Security	KEYNOTE TUTORIAL: Reliability Assessment of Complex Systems <i>A Rauzy</i>	Optimisation: Methods & Applications	Accelerated Tests: Methods and	Accelerated Tests: Modelling and Methods	Nuclear: RAMS 1	Nuclear: RAMS 1	Bayesian Network Modelling: Applications	Supply Chain & Networks Risk Analysis
12.00 - 12.50	Lunch				Foyer Area	Level 2 & 3			
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR 1: Level 3	CR 2: Level 3	CR3: Level 3	CR4/5: Level 3	CR4/5: Level 3	CR6/7: Level 3	CR8: Level 3
12.50 - 14.10	Risk Stakeholder Communication & Cooperation	Natural Hazards Analysis	Optimisation: Aerospace & Aeronautical Applications	Critical Infrastructure: Risk Analysis	Production Systems: Reliability Modelling & Management	Nuclear: RAMS 2	Nuclear: RAMS 2	Bayesian Modelling: Methodological Considerations	Accelerated Tests: Design and Applications
14.10 - 14.40	Tea & Coffee				Foyer Area	Level 2 & 3			
14.40 - 15.40	ESRA Plenary Presentation: Question & answer session on methodological and practical issues of broad interest regarding safety and reliability <i>Enrico Zio & Terje Aven</i>				Main Auditorium	Level 2			
15.40 - 16.00	Closing Session				Main Auditorium	Level 2			
16.00	Conference Close				Main Auditorium	Level 2			

Contents

Preface	5
Acknowledgements	6
Sponsors	8
Exhibitors	9
Programme	10
Plenary Speakers	30
Keynote Tutorials	37
Special Sessions	41
Images of Risk	42
ESRA Events	42
Social Events	43
General Information	45
Exhibition Floorplan	48
Technology and Innovation Centre Floorplans	49

Preface

Welcome to Glasgow! Glasgow has a reputation as a friendly city with a rich history as a centre of science and technology. Glasgow was the place where James Watt invented the separate steam condenser that made steam engines efficient and where Lord Kelvin was Professor of Natural Philosophy for over 50 years. The University of Strathclyde, located close to where Watt made his invention in the heart of the city, is an internationally leading technological University with close links to the Glasgow tradition of engineering excellence.

ESREL 2016 is taking place at the University of Strathclyde's Technology and Innovation Centre, which is a major investment aimed at stimulating innovation through bringing together academic researchers and business staff. The Technology and Innovation Centre embodies the long-standing collaborative academic-industry links to be found at the annual European Safety and Reliability Conference, ESREL. The ESREL conference stems from a 1989 European initiative to merge several national conferences into a major yearly conference under the auspices of the European Safety and Reliability Association, ESRA. ESREL has always had a strong tradition of both academic and industrial participation. This tradition underpins our contributed and invited technical programme.

Our contributed programme includes papers which continue the ESREL tradition of sharing new ideas, methods and applications across multiple industry domains. The form of innovation described in these papers varies across topics with relatively incremental change associated with those better understood problems and more radical innovations proposed for emergent problems or modelling challenges facing industry and society. Topics include established areas such as risk management, systems reliability modelling, maintenance optimisation, probabilistic risk assessment, accident investigation, human reliability and human factors, as well as contemporary themes such as cyber-security and resilience assessment. Practitioner authored papers provide insights into the challenges faced in real applications and share insights into the impact of the interventions to manage risk, while scientific papers share theoretical, methodological and empirical research contributions.

Our invited technical programme includes plenary presentations by leading academics, scientists and risk managers, as well as keynote tutorials from international experts. Our plenary speakers shall share their scientific knowledge and experience to provoke our thinking across a variety of analytical methodologies and application domains spanning many ESRA areas of interest. The introduction of keynote tutorials at ESREL 2016 allows us to programme longer lectures and discussion sessions led by experts who will share up-to-date insights into modelling methods and socio-technical challenges.

We have also initiated an Images of Risk competition at ESREL 2016 and have selected some submissions for the covers of this programme booklet. Our back cover image, created by Jennifer Lynette, a PhD student from Lund University in Sweden, is titled "Disaster Response and Aftermath". Our front cover image, created by Grzegorz Liskiewicz, a former PhD student from the University of Strathclyde, is titled "The Price of Safety in the Compressor Industry". Please visit our exhibition of finalists and see a selection of other images on the ESREL 2016 screen savers as well as on the cover of our Book of Abstracts.

Acknowledgements

We would like to thank many people for their support and contributions to ESREL 2016.

We gratefully acknowledge the members of the ESREL 2016 Technical Programme Committee, the ESRA Technical Committee Chairs and Co-Chairs, and the many ESREL 2016 Reviewers for volunteering their time and expertise to provide feedback as part of the contributed paper review process. We would like to thank colleagues who organised special sessions of contributed papers. We thank University of Strathclyde researchers, particularly Emma Comrie, Mahdi Parsa, Mimi Zhang, Euan Barlow and David Purves, for supporting the paper editorial process.

We also thank the ESREL 2016 Plenary Speakers and Keynote Tutorial Speakers for offering their unique perspectives on risk, safety and reliability at this conference. We also thank all the contributed paper authors for their submissions and the participants in the Images of Risk competition.

The support of the ESREL 2016 sponsors and exhibitors is gratefully acknowledged.

Finally we would like to thank the respective organisations for supporting the conference: It has been made possible by the close collaboration of the University of Strathclyde (Department of Management Science), ESRA, and the UK Safety and Reliability Society (SaRS), working together with the support of In Conference Ltd.

Tim Bedford, Lesley Walls, Matthew Revie, Terje Aven, Jacqueline Christodoulou, Richard Denning

Organising Team

Professor Tim Bedford (University of Strathclyde)

Professor Lesley Walls (University of Strathclyde)

Dr Matthew Revie (University of Strathclyde)

Professor Terje Aven (ESRA)

Dr Jacqueline Christodoulou (SaRS)

Mr Richard Denning (SaRS)

Louise Watson (In-Conference Ltd)

Sara Armstrong (In-Conference Ltd)

Leona Cairns (In-Conference Ltd)

ESREL 2016 Technical Programme Committee

<i>Ben Ale, the Netherlands</i>	<i>Iain Dinwoodie, UK</i>	<i>Oswaldo Morales-Nápoles, Netherlands</i>
<i>Marcelo Alencar, Brazil</i>	<i>Olga Fink, Switzerland</i>	<i>Nicola Paltrinieri, Norway</i>
<i>John Andrews, UK</i>	<i>Roger Flage, Norway</i>	<i>Luca Podofillini, Switzerland</i>
<i>Terje Aven, Norway</i>	<i>Mitra Fouladirad, France</i>	<i>Darren Prescott, UK</i>
<i>Piero Baraldi, Italy</i>	<i>Antoine Grall, France</i>	<i>Antoine Rauzy, Norway</i>
<i>Christophe Berenguer, France</i>	<i>Seth Guikema, USA</i>	<i>Ullrika Sahlin, Sweden</i>
<i>Peter Berg, Germany</i>	<i>Ivonne Herrera, Norway</i>	<i>Giovanni Sansavini, Italy</i>
<i>Eirik Bjorheim Abrahamsen, Norway</i>	<i>Benoit lung, France</i>	<i>Raphael Steenbergen, Netherlands</i>
<i>Emanuele Borgonovo, Italy</i>	<i>Stig Johnsen, Norway</i>	<i>David Vališ, Czech Republic</i>
<i>Ron Boring, USA</i>	<i>Chris Johnson, UK</i>	<i>Pieter van Gelder, Netherlands</i>
<i>Nicolae Brinzei, France</i>	<i>Myrto Konstantinidou, Greece</i>	<i>Coen Van Gulijk, UK</i>
<i>Marko Čepin, Slovenia</i>	<i>Gregory Levitin, Israel</i>	<i>Jin Wang, UK</i>
<i>Michalis Christou, Italy</i>	<i>Jana Markova, Czech Republic</i>	<i>Xie Min, Hong Kong</i>
<i>Valerio Cozzani, Italy</i>	<i>Sebastián Martorell, Spain</i>	<i>Ye Zhisheng, Singapore</i>
<i>Richard Denning, UK</i>	<i>Marek Młyńczak, Poland</i>	<i>Elena Zaitseva, Slovakia</i>
<i>Ralf Mock, Switzerland</i>		

ESRA Technical Committees and Chairs

Methodologies

Accident and Incident modeling
Economic analysis in risk management
Foundational Issues in Risk Assessment and Management
Human Factors and Human Reliability
Maintenance Modeling and Applications
Mathematical Methods in Reliability and Safety
Prognostics and System Health Management
Resilience engineering
Risk assessment
Risk Management
Simulation for Safety and Reliability
Structural Reliability
System Reliability
Uncertainty analysis

Application Areas and Technological Sectors

Aeronautics and Aerospace
Chemical and Process Industry
Civil Engineering
Critical Infrastructures
Energy
Information Technology and Telecommunications
Land Transportation
Manufacturing
Maritime and Offshore technology
Natural Hazards
Nuclear Industry
Occupational Safety
Security

Chairs

Stig Johnsen, Nicola Paltrinieri
Eirik B. Abrahamsen
Terje Aven, Enrico Zio
Luca Podofillini, Chiara Leva
Christophe Bérenguer, Mitra Fouladirad
John Andrews, Nicolae Brinzei
Piero Baraldi, Enrico Zio
Ivonne Herrera, Eric Rigaud
Marko Cepin, Henrik Hassel
Lesley Walls, David Valis, Marcelo Hazin Alencar
Nicola Pedronim, Edoardo Patelli
Jana Markova, Martin Krejsa
Gregory Levitin, Serkan Eryilmaz
Emanuele Borgonovo, Roger Flage

Chairs

Darren Prescott
Valerio Cozzani, Gabriele Landucci, Nima Khakzad
Raphael Steenbergen
Giovanni Sansavini, Enrico Zio
Michalis Christou
Elena Zaitseva, Ralf Mock
Olga Fink, Bob Huisman
Benoit lung, François Peres
Jin Wang, Ingrid B. Utne, Mario Brito
Pieter van Gelder, Bas Kolen
Sebastian Martorell, Francesco Di Maio
Ben Ale, Reniers Genserik
Sissel H. Jore

Sponsors

European Safety and Reliability Association (ESRA)



The European Safety and Reliability Association is a non-profit international association for the advance and application of safety and reliability technology in all areas of human endeavor. It is an "umbrella" organization with a membership consisting more than 100 national professional societies, industrial organizations and higher education institutions. The common interest is safety and reliability. ESRA established the ESREL conference series, and is a co-organiser of each conference. Visit the new ESRA website at <http://esrahomepage.eu/>.

The Safety and Reliability Society (SaRS)



The UK Safety and Reliability Society was formed in the UK in 1980 and now has members in the UK, mainland Europe, the Middle East, USA and the Asia Pacific region. It also has an Affiliate Organisation membership scheme for academic institutions, industrial companies, and other organisations with interests in safety and reliability and engineering risk management. The Society is a member of the European Safety and Reliability Association (ESRA) and the Hazards Forum. In 1999 the Society became a Professional Affiliate of the Engineering and works jointly with SEE to register Chartered and Incorporated Engineers.

University of Strathclyde



The University of Strathclyde was founded in 1796 as a "place of useful learning" by Prof John Anderson, and is the only Scottish University founded during the Enlightenment. It began as "Anderson's University", later becoming the Royal College of Science and Technology before gaining its Royal Charter in 1964 and the name of The University of Strathclyde. Its famous graduates include the explorer David Livingstone and the inventor of Television, John Logie Baird. Today Strathclyde enjoys a reputation as one of the leading UK universities in terms of industry collaboration and startups, as well as being in the top 20 most research intensive UK universities. It has around 15000 undergraduates, 7000 postgraduates and 3500 staff members.

Glasgow City Marketing Bureau



Our drinks reception on Tuesday evening is supported by Glasgow City Council to welcome all delegates to the city in a traditional Scottish manner. That is, with a wee dram! In recent years, Glasgow has undergone a resurgence with a regeneration of much of the waterfront, the expansion of service industries alongside its high value engineering industry, the growth of its Higher Education sector, and it's hosting of the Commonwealth Games in 2014.

HBM Prenscia



HBM Prenscia leverages ReliaSoft and nCode software, training, and consulting to deliver solutions that empower the engineering community. We are committed to the development of innovative concepts for improving reliability, availability, maintainability, safety, and durability, while reducing risk across a broad range of applications.

Sponsors/Exhibitors

Exhibitors

The Exhibition will be located on Level 2 Foyer and will be open at the following times:

- » Monday 26th September 08.30hrs – 17.00hrs
 - » Tuesday 27th September 08.30hrs – 17.00hrs
 - » Wednesday 28th September 08.30hrs – 17.00hrs
 - » Thursday 29th September 08.30hrs – 14.30hrs
-

Software Demonstration

Room: TC 214. Time: During Refreshment Breaks & Lunch

Participants will have the opportunity to use Prensia software throughout the entire conference, with live one-on-one demonstrations provided.

Prensia is a software package provided by HBM that empowers engineers in solving a broad range of reliability problems.



Atkins



Atkins is one of the world's most respected design, engineering and project management consultancies. We have an enviable track record across a wide range of industries for our independent advanced engineering expertise.

Whatever you want, we have the expertise: from mechanical design and analysis, asset management, safety, design and information assurance.

BMT Group



BMT Group is an international design, engineering and risk management consultancy, working principally in the defence, energy and environment, marine risk and insurance, maritime transport and ports and logistics sectors. BMT invests significantly in research, and customers are served through a network of international subsidiary companies. The group's assets are held in beneficial ownership for its staff.

BQR reliability Engineering Ltd



BQR has over two decades of experience in providing software and consulting services in the areas of Reliability and Maintenance Engineering for complex products/assets comprising electronic and mechanical components. BQR software tools and services are used by leading companies in various industries to support product lifecycle, from inception, through design, manufacturing and operation, to disposal.

Main product is CARE® Computer Aided Reliability Engineering, set of tools for RAMS analyses.

Isograph



Isograph was founded in 1986 and is now one of the world's leading companies in the development and provision of integrated Reliability, Availability, Maintainability and Safety software products. Our products are well proven in use at over 10,000 sites worldwide where they are used on many high profile projects.

Programme

Sunday 25 th September				
16.00 - 20.00	Registration Open		Foyer Area, Level 2	
18.00 - 20.00	ESREL 2016 - Welcome Reception		Foyer Area, Level 2	
Monday 26 th September				
08.00 - 17.00	Registration Open		Foyer Area, Level 2	
09.00 - 09.30	M0: Opening Session		Main Auditorium, Level 2	
09.30 - 10.40	M1: Plenary Presentation Cyber Risk Analysis: Method and Illustrations <i>M. Elisabeth Paté-Cornell, Professor of Management Science and Engineering - Stanford University</i>		Main Auditorium, Level 2	
10.40 - 11.00	Tea & Coffee		Foyer Area, Level 2 & 3	
11.00 - 12.40	Parallel Session M2			
Session No.	M2.1	M2.2	M2.3	M2.4
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3
Session Name	Resilience Modelling & Assessment: Cultural Aspects	KEYNOTE TUTORIAL	Prognostics: Remaining Useful Life	Statistical & Mathematical Modelling Methods
Chair(s)	<i>Ivonne Herrera</i>		<i>Piero Baraldi</i>	<i>Mahmood Shafiee</i>
11.00 - 11.20	Review of methods for measuring societal resilience and how they address critical infrastructures <i>H Hassel, J Johansson</i>	Cyber Security for High-Reliability, Safety Critical Systems <i>C Johnson</i>	Data driven RUL estimation of rolling stock using intelligent functional test <i>S Garmabaki, A M N Seneviratne, M Ahmadi, A Barabadi, U Kumar</i>	Regression models for the effect of environmental conditions on the efficiency of ship machinery systems <i>E Vanem, A Brandsæter, O Gramstad</i>
11.20 - 11.40	Resilience activation in extreme situations, a literature review <i>C Geoffroy, E Rigaud, F Guarnieri</i>		Predicting Remaining Life of Transmission Tower Steelwork Components <i>M Segovia, V Catterson, A Stuart, L Johnston, H Bain, R McPhaden, R Wylie, A Hernandez</i>	Demand forecasting over complex geographical networks: the case of Northern Gas Networks <i>K Wilson, S Heaps, M Farrow</i>
11.40 - 12.00	Capturing Societal Interdependencies from a Flow Perspective – Part I: Method and Model <i>J Johansson, H Hassel, L Svegrup</i>		A Switching Ensemble Approach for Remaining Useful Life Estimation of Electrolytic Capacitors <i>S Al-Dahidi, F Di Maio, P Baraldi, E Zio</i>	Physics-driven Bayesian Model for Current-Voltage Characteristics of Solar Cells <i>Y Kong, Z Ye, Z Li</i>
12.00 - 12.20	Capturing Interdependencies of Societal Function from a Flow perspective – Part II: Case study <i>L Svegrup, J Johansson, H Hassel</i>		A method for storage status assessment of electronic devices by model-based prognostics <i>Y Zhao, G Fu, E Zio</i>	Quantifying error in deterministic predictions based on phase-resolved linear wave models <i>F Fucile, G Bulian, C Lugni,</i>
12.20 - 12.40	Using gaming and resilience engineering principles to energize a situated resilience training of front-end operators and managers <i>T O Grøtan, J van der Vorm, D van der Beek, D Zuiderwijk, I Wærø</i>		Cluster Analysis of Condition Monitoring Data <i>O Fink, J Lukas, H S Nguyen, N Ponnuthurai, S Subbiah, S Turrin</i>	Reliability law fitting with a Differential Evolution algorithm <i>J Lonchamp, E Dautreme, N Bousquet,</i>
12.40 - 13.45	Lunch	Foyer Area	Level 2 & 3	

Sunday 25 th September				
16.00 - 20.00	Registration Open		Foyer Area, Level 2	
18.00 - 20.00	ESREL 2016 - Welcome Reception		Foyer Area, Level 2	
Monday 26 th September				
08.00 - 17.00	Registration Open		Foyer Area, Level 2	
09.00 - 09.30	M0: Opening Session		Main Auditorium, Level 2	
09.30 - 10.40	M1: Plenary Presentation Cyber Risk Analysis: Method and Illustrations <i>M. Elisabeth Paté-Cornell, Professor of Management Science and Engineering - Stanford University</i>		Main Auditorium, Level 2	
10.40 - 11.00	Tea & Coffee		Foyer Area, Level 2 & 3	
11.00 - 12.40	Parallel Session M2			
Session No.	M2.5	M2.6	M2.7	M2.8
Room	CR4/5: Level 3	CR6/7: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Oil & Gas: Risk Based Decision-Making	Accident Investigation & Modelling: Maritime Transportation	Power Systems Reliability Planning	Reliability Modelling: Multi-State Systems
Chair(s)	<i>Eirik Bjorheim Abrahamsen</i>	<i>Jin Wang</i>	<i>Pierre-Etienne Labeau</i>	<i>Ji Hwan Cha</i>
11.00 - 11.20	Risk assessments as input to decision making during design of oil and gas installations <i>V Tuft, O M Wiggen, A O Torgauten, T M van Roosemalen, T Holde, M Sandøy, T Aven</i>	Marine navigation accidents and influencing conditions: An exploratory statistical analysis using AIS data and accident databases <i>A. L. Aalberg, E Kleiven, R J Bye</i>	Assessing risks related to regional power distribution grids and security of electricity supply <i>E Gramme, T Eriksen</i>	Weighted-graph models for reliability assessment; extension to multi-state systems <i>J F Aubry, N Brinzei</i>
11.20 - 11.40	Criteria of Implementation of Risk Analysis recommendations in Oil & Gas Offshore Production Installations <i>C Morais</i>	The use of 'big data' in constructing loss-based performance indicators in the maritime industry <i>T Kongsvik, R Bye, P Almklov, E Kleiven</i>	Analysis Framework for Performance Evaluation of Reliability Management in Power Systems with Increased Uncertainty <i>E Heylen, G Deconinck, D van Hertem</i>	Efficient Availability Assessment of Reconfigurable Complex Multi-State Systems with Interdependencies <i>H George-Williams, E Patelli</i>
11.40 - 12.00	Risk Mapping in Quantitative Risk Analysis for oil & gas facilities <i>G Maggioli, F Ganci, R Gerboni, A Carpignano</i>	TRACer-MAR - Applying TRACer in a maritime context <i>J Schroeder-Hinrichs, A Graziano, G Praetorius, A Kataria</i>	Composite System Reliability Assessment of Different Active Power Reserve Planning Strategies using Probabilistic Methods <i>E Okur, G Sansavini</i>	Reliability Evaluation of Circular Consecutive k-out-of-r-from-n Systems and Circular Multi-state Sliding Window Systems with Bidirectional Connections <i>J Qin</i>
12.00 - 12.20	Models and Tools for the simulation of exhaust dispersion in oil & gas offshore platforms <i>M Impalà, A C Uggenti, F Ganci, R Gerboni</i>	Some reflections on pre- and post- accident analysis for water transport: A case study of the Eastern Star accident <i>Y Wang, E Zio, S Fu, D Zhang, X Yan</i>	Stochastic hybrid fault tree automaton for the production forecast of PV power plant <i>F Famoso, F Chiacchio, D D'Urso, S Brusca</i>	Reliability & Performance Analysis of Multi-State Systems Based on Analytical Load Flow Considerations <i>H George-Williams, E Patelli, M Lee</i>
12.20 - 12.40	Evaluation of F&G Detection coverage based on NORSOK standard <i>J Park, T Y Lee, G Mule, T S Choi, G S Kim, K I Nam</i>	A discussion of risk influencing factors for maritime accidents based on investigation reports <i>M Nilsen, P Almklov, S Haugen, R Bye</i>	Risk and reliability assessment of future power systems <i>W Bukhsh, K Bell, T Bedford,</i>	Liquefaction technology from a reliability perspective <i>L Tran, G Cozon, C Buccisano</i>
12.40 - 13.45	Lunch	Foyer Area	Level 2 & 3	

13.45 - 15.25 Parallel Session M3					
Session No.	M3.1	M3.2	M3.3	M3.4	M3.5
Room	Auditorium: Level 1	Auditorium A: Level 2	Auditorium B: Level 3	Auditorium C: Level 3	CR1: Level 3
Session Name	Resilience Modelling & Assessment: Technical Systems	Accident & Incident Investigation Analysis	Safety & Organisational Culture	Special Session: Dynamic Risk Assessment in Oil, Gas, Chemical	Fault Detection & Diagnostics Modelling 1
Chair(s)	<i>Ralf Mock</i>	<i>Stig Ole Johnsen</i>	<i>Peter Hughes</i>	<i>Nicola Paltrinieri</i>	<i>Piero Baraldi</i>
13.45 - 14.05	Resilience Assessment of Internet of Things: A Case Study on Smart Buildings <i>R Mock, L Lopez de Obeso, C Zipper, M Schönenberger</i>	Accident measures feasibility study based on context evaluation of human performance in design extension conditions <i>G Petkov, I Petkov</i>	Evolution of the inspection of the industrial plants: Towards a "privatization" of the safety? <i>V Sanseverino-Gorfin</i>	Dynamic Risk Analysis for operational decision support <i>S Haugen, NJ Edwin</i>	Bayesian Belief Networks for fault detection and diagnostics of a three-phase separator <i>M Vileiniskis, R Remenyte-Prescott, D Rama, J Andrews</i>
14.05 - 14.25	Agent based model for telephone communication resilience assessment <i>D Chao, Y Watanabe, T Kanno, K Furuta</i>	Accident Progression and Radiological Analyses of the Interfacing System Loss of Coolant Accident for a typical Pressurized Water Reactor <i>S Park, K Ahn</i>	Internationalization of domestic transportation systems and safety <i>R Bye, G Lamvik</i>	A case of dynamic risk management in the subarctic region <i>N Paltrinieri, TO Grøtan, M Bucelli, G Landucci</i>	Combustion Engine Condition Estimation based on Indirect Diagnostics Data <i>D Vališ, K Hasilová, L Žák</i>
14.25 - 14.45	A method for assessing resilience of socio-technical IT-systems <i>F Landegren, SM Sulaman, P Möller, M Höst, J Johansson</i>	Use of Level 2 PSA to Support NPP Operators Training on Severe Accident <i>P Groudev, P Petrova, E Kichev, K Mancheva</i>	The crisis in the Norwegian petroleum industry: How does it affect safety conditions offshore? <i>K Skarholt, G Lamvik, S Antonsen, J Røyrvik, J Jonassen</i>	A dynamic evaluation methodology of risk level for defective high-pressure manifold <i>Q Wang, L Zhang, J Hu, X Zhang, W He</i>	An intelligent fault diagnosis system on ship machinery systems based on support vector machine principles <i>U Ozturk, K Cicek, M Celik</i>
14.45 - 15.05	Analytical resilience quantification for critical infrastructure and technical systems <i>J Finger, S Hasenstein, U Siebold, I Häring</i>	Cascading effects during incidents: CascEff <i>A Lönnemark, D Lange</i>	Analyses of accidents and cultural: a discussion of the geopolitical migration <i>S Ávila Filho, ES Bittencourt, MNE Fonseca</i>	Monitoring of operational and organizational safety barriers <i>SS Kilskar, K Øien, S Hauge, Å Hoem, L Bodsberg</i>	Test and Evaluation of a Fuzzy Diagnostic Model for Polymer Electrolyte Fuel Cells <i>B Davies, L Jackson, S Dunnett</i>
15.05 - 15.25		Explaining the explosion of FPSO Cidade de São Mateus from Regulator Point of View <i>C Morais</i>	Optimizing process safety performance by improving visibility of safety management system barriers <i>E Paton, D Holland</i>	Aggregation and presentation of safety barrier status information <i>Å Hoem, K Øiem, S Hauge, L Bodsberg</i>	Probabilities in Safety of Machinery - Risk Reduction Effects by Combination of Full Enclosure and Fault Detection in the Process <i>H Moedden</i>
15.25 - 15.45	Tea & Coffee	Foyer Area	Level 2,3 & 9		

13.45 - 15.25 Parallel Session M3					
Session No.	M3.6	M3.7	M3.8	M3.9	M3.10
Room	CR2: Level 3	CR4/5: Level 3	CR6/7: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Data Bases & Information Quality	Software Systems Safety Analysis & Management	Decision-Making under Uncertainty: Modelling Applications	Power Systems Networks: Risk & Reliability Modelling	Reliability Modelling: Dependant Systems
Chair(s)	<i>Lesley Walls</i>	<i>Richard Denning</i>	<i>John Quigley</i>	<i>Maria Segovia</i>	<i>Nicolae Brinzei</i>
13.45 - 14.05	Improvements in the UK Offshore Hydrocarbon Release Database B Bain, S Wakefield, R Borresen	Safe Software: A Suitable Case For An Evidence-Based Treatment ? K Wallace	Recovery of Urban Socio-Technical Systems after Disaster: Reactive Decision-Making Based Planning under Uncertainties of Damage Evaluation V Lubashevskiy, T Kanno, K Furuta,	Imprecise Probabilistic Framework for Power Grids Risk Assessment and Sensitivity Analysis R Rocchetta, E Patelli	Modeling dependent competing failure processes based on stochastic hybrid system M Fan, Z Zeng, E Zio, R Kang
14.05 - 14.25	Description of reliability content by using the ReliaLibrary web-database FV Haase, FP Geithner, R Woll	Developing and Assuring Complex Critical Data Centric Systems I Glazebrook	Modelling of uncertainty for continuity quality of power supply M Siergiejczyk, M Stawowy	Evaluation of the impact of intermittent sources on smart grid equipments P Beuseroy, E Gral-Maes, Y Dijoux, E Deloux, G Malarange, DN Nguyen	Boolean approximation for calculating the reliability of a very large repairable system with dependencies among components M Bouissou, O Hernu
14.25 - 14.45	Studies on information subsystem operation in container terminal based on simple example J Świeboda, M Zajac	Integrating model checking and PRA – A novel safety assessment approach for digital I&C system J Lahtinen, K Björkman	Planning cable installation activities for offshore wind farms including risk of supply delays G Leontaris, O Morales-Nápoles, ARM Wolfert	Impact of Degraded Communication on the Reliability of Electric Networks: The Application of Grid Splitting DA Tian, G Sansavini	Reliability model of incomplete Common Cause Failure systems subject to two kinds of common causes R Gu, J Qin
14.45 - 15.05	Modeling information quality and traceability in risk management and decision processes : application to mountain natural hazards L Vidaud-Barral, JM Tacnet, F Pinet	Implementation of a Cloud-based Service-Oriented Architecture for Hardware Control Systems supported by Neural Network O Latka, J Provost	The 'discrete forecast error scenarios' method for grid reliability assessment in short-term planning under renewable generation and cross-border flows G Dogan, PE Labeau, JC Maun, J Sprooten, M Galvez, K Sleurs	Analyzing controllability, efficiency and reliability of network systems by dynamic simulation F Han, E Zio	Hidden risks in electric grids due to dependency on transportation networks M Bíl, R Vodák, Z Křivánková, R Andrášik, J Kubeček
15.05 - 15.25		A safety analysis method with correlation of states for integrated modular avionics systems based on an extended generalized stochastic petri net R Han, S Wang	Application and simulations of uncertainty multilevel models to ensure the ITS services M Stawowy, M Siergiejczyk	Time Series Semi-Markov Decision Process with Variable Costs for Maintenance Planning R Dawid, D McMillan, M Revie	New simulation model for evaluating the production availability of petroleum systems C Folleau, C Vinuesa, S Collas
15.25 - 15.45	Tea & Coffee	Foyer Area	Level 2,3 & 9		

15.45 - 17.25 Parallel Session M4					
Session No.	M4.1	M4.2	M4.3	M4.4	M4.5
Room	Auditorium: Level 1	Auditorium A: Level 2	Auditorium B: Level 3	CR4/5: Level 3	CR1: Level 3
Session Name	Resilience Modelling & Assessment: Measures	Accident & Incident Modelling: Applications	Safety Culture & Socio-Technical Modelling	Dynamic Risk Assessment in Oil, Gas & Chemical	Fault Detection & Diagnostics Modelling 2
Chair(s)	<i>Ji Hwan Cha</i>	<i>Stig Ole Johnsen</i>	<i>Rolf Johan Bye</i>	<i>Nicola Paltrinieri</i>	<i>Marek Sokolski</i>
15.45 - 16.05	Critical Infrastructure Resilience Index C Pursiainen , B Rød, D Honfi, D Lange, G Baker	Preliminary analysis of accident data of one of the BRT lines in Mexico City V Avalos Bravo , D Padilla-Perez, J Santos Reyes	A study on successful practices in a Norwegian company – A systematic approach and key contributing factors A Ekambaram , TM Stene , M Hamre, TO Stupstad	Barrier indicator vs risk - informing operational risk management A Falck , R Flage, T Aven	Condition Monitoring and Diagnostics as Important Factors for Increasing the Reliability of Machinery Components – Case Study P Sokolski , F Przystupa, M Sokolski
16.05 - 16.25	Analysis and comparison of three quantitative approaches for system resilience C Jin , R Li, R Kang, Y Yang	Investigation of crane operation safety by analysing main accident causes MF Milazzo , G Ancione, V Spasojevic Brkic, D Vališ	Organisational safety indicators in aquaculture – a preliminary study IM Holmen , IB Utne, S Haugen	Dynamic risk and reliability assessment for ship machinery decision making K Dikis , I Lazakis, AL Michala, Y Raptodimos, G Theotokatos	Proposal of a new simulated annealing model-based fault identification technique applied to flight control EM actuators MDL Dalla Vedova , A Germanà, P Maggioro
16.25 - 16.45	Logistic system resilience modelling – a dynamic, multiagent, service engineering oriented approach L Bukowski , J Feliks, K Majewska	Variables Influencing the Severity of Motorcycle and Moped Traffic Accidents in Spain S García-Herrero , MÁ Mariscal, R Beltrán, JM Guitérrez	Identification and Implementation of Key Performance Indicators (KPIs) for Achieving Safer and Resilient Passengers Shipping Operations V Arslan , RE Kurt, S Turan, L De Wolff, E Comrie	Real-time guidance system for cranes to manage risks due to releases of hazardous materials G Ancione , I Kavasidis, G Merlino, MF Milazzo	The use of rough set to estimate the quality of objects recognition and localization M Stawowy , T Targosiński
16.45 - 17.05	Resilience modeling of multi-state degradation systems based on aggregated stochastic processes S Du , R Kang, Z Zeng, E Zio	Assessment of an Accident using FMEA to a Tailings Dam, a mining event in Brazil M Fonseca , S Ávila Filho	Analyzing safety strategies at the front-end of projects K Fossum , BE Danielsen, CH Berg	Reliability Study of Subsurface Safety Valve Control System in Oil Wells P Oliveira , A Braga, P Garcia	A Novel Damage Detection Approach using Output-only Responses based on mode shape identification and Improved Gapped Smoothing Method Y Zhou , J He, W Zhang
17.05 - 17.25		Risk based workload and staffing level analysis L Kotek , Z Tuma , P Blecha, L Mukhametzianova		Application of Bayesian network to safety assessment of chemical plants during fire-induced domino effects N Khakzad , G Landucci, G Reniers	Dynamic reliability assessment and prognostics with monitored data for multiple dependent degradation components J Liu , E Zio
17.30 - 19.15	ESRA General Assembly	Main Auditorium	Level 2		
19.15	Conference Close	Auditorium	Level 2		
19.30 - 22.30	Ceilidh Night	The Barony Hall	1 McLeod Street, Glasgow, G1 1XQ		

15.45 - 17.25 Parallel Session M4					
Session No.	M4.6	M4.7	M4.8	M4.9	M4.10
Room	CR2: Level 3	Auditorium C: Level 3	CR6/7: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Failure Data Analysis	Software Systems: Reliability Modelling	Decision Making under Uncertainty: Management Issues	Maritime Transportation: Risk & Safety	Reliability Modelling: Methodological Considerations
Chair(s)	<i>Sarah Dunnett</i>	<i>Ian Glazebrook</i>	<i>Terje Aven</i>	<i>Jin Wang</i>	<i>Michael Beer</i>
15.45 - 16.05	A hazard-based predictive approach for onshore gas transmission pipelines using historical failures K Pesinis , <i>KF Tee</i>	Software Fault Detection in Control Systems S Garmabaki , <i>W Birk, J Lindström</i>	Uncertainty and Conservatism in Safety Cases A Bounds	Risk Assessment of Marine Accidents in the Aegean Sea <i>I Koromila, Z Nivolianitou, T Giannakopoulos</i>	Speed-up reliability assesment for multi-component systems: importance sampling adapted to piecwise deterministic Markovian processes T Galtier , <i>H Chraïbi, A Dutfoy, J Garnier</i>
16.05 - 16.25	Assessment and estimation of energy power sources availability <i>D Vališ, K Hasilová, J Leuchter</i>	Reliability analysis of open source software: A Bayesian approach considering both fault detection and correction processes Y Liu , <i>M Xie, L Wang, Q Hu</i>	How to Manage Uncertainty when Considering New or Changed Regulatory HSE Requirements LIK Sørskår , <i>EB Abrahamsen</i>	Effect of large initial ship stability on ship safety: an example study G Bulian , <i>F Bresciani, A Francescutto, F Fucile</i>	Component Importance Measures for Complex Repairable System G Feng , <i>E Patelli, M Beer, FPA Coolen</i>
16.25 - 16.45	Statistical Analysis of Field Data for a Proven-In-Use Assessment according to ISO 13849 N Nowizki , <i>P Zeiler, B Bertsche, H Moedden</i>	Extended approach for prediction of critical errors in software systems J Krini , <i>J Börsök, A Krini, O Krini</i>	Qualitative versus quantitative risk assessment F Ye	Imminent ships collision risk assessment based on velocity obstacle Y Huang , <i>PHAJM van Gelder, MB Mendel</i>	Reliability analysis of offshore wind turbine support structures using Kriging models A Morató , <i>S Sriramula, N Krishnan</i>
16.45 - 17.05	Reliability analysis of product fleets based on operating data: Separation of risky fleet parts and partial risk prognosis <i>S Bracke, S Sochacki, C Rosebrock</i>	Software Reliability Prediction using Chaos Theory and Heterogeneous Ensemble Learning H Tong, R Ham , <i>B Liu, Y Wu, B Xu</i>	Challenges of Measuring Quality in Emergency Response J Lynette	Sources of structural failure in ship unloaders G Milana , <i>K Banisoleiman, A Gonzalez,</i>	Extended Bow - Tie model for asset risk and reliability modelling. Application to a passenger lift M Vileiniskis , <i>R Remenyte-Prescott</i>
17.05 - 17.25	Failure and repair data analysis of power distribution systems: A case study <i>A Barabadi, M Aliyari, R Barabadi, AHS Garmabaki</i>		Towards a risk management prototype for small and medium enterprises in the construction sector AE Tamparopoulos , <i>C Oduoza</i>	An assessment approach of maritime supply chain of energy vulnerability to piracy risk by simulation of spatial behavior M Tanguy , <i>A Napoli</i>	
17.30 - 19.15	ESRA General Assembly	Main Auditorium	Level 2		
19.15	Conference Close	Auditorium	Level 2		
19.30 - 22.30	Ceilidh Night	The Barony Hall	1 McLeod Street, Glasgow, G1 1XQ		

Tuesday 27 th September					
08.00 - 17.00	Registration Open			Foyer Area, Level 2	
09.00 - 10.00	T1: Plenary Presentation Safety Reporting and Analysis: A National Step Change for GB Rail George Bearfield, Director of System Safety - Rail Safety and Standards Board			Main Auditorium, Level 2	
10.00 - 10.20	Tea & Coffee			Foyer Area, Level 2 & 3	
10.20 - 12.00	Parallel Session T2				
Session No.	T2.1	T2.2	T2.3	T2.4	T2.5
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR3: Level 3
Session Name	Resilience Assessment: Vulnerability	Human Reliability Analysis: Methods	Stochastic Degradation Modelling	Mathematical Methods: Safety & Reliability 1	Hazard Analysis & ICT Applications
Chair(s)	Pieter Van Gelder	Luca Podofillini	Antoine Grall	Marc Bouissou	Maria Francesca Milazzo
10.20 - 10.40	Modeling epistemic uncertainty in resilience assessment for water transportation systems Y Wang, S Fu, E Zio, D Zhang, X Yan	Consolidation of the Human Error Assessment and Reduction Technique J Williams, J Bell	Modelling of a Bounded Stochastic Degradation Process Based on a Transformed Gamma Process Y Deng, M D Pandey	Advanced computing methodology for general highly reliable systems R Bris, P Byczanski	Availability Evaluation of the Virtualized Infrastructure Manager in Network Function Virtualization Environments M Longo, M Di Mauro, F Postiglione, R Restaino, M Tambasco
10.40 - 11.00	Framework for quantitative resilience analysis of maritime transportation systems from risk perspectives: a case study of a ship stuck in ice in Arctic waters S Fu, D Zhang, E Zio, Y Wang, X Yan	Decomposition level of quantification in human reliability analysis M Rasmussen, K Laumann	Reliability Evaluation of Wiener Degradation System Based on Bayesian Network S Miao, J Yao, Y Zhao, X Wang, X Wang, X Li	Algorithm for optimal paths in multi-objective network N Takahashi, H Yamamoto, T Akiba, X Xiao, K Shingyochi	Handoff rate in mobile networks: dependence on the cell perimeter C Tanguy
11.00 - 11.20	Vulnerability assessment of passenger transport system – case study A Tubis, T Nowakowski, S Werbińska-Wojciechowska	GOMS-HRA: A method for treating subtasks in dynamic human reliability analysis R Boring, M Rasmussen	Interval Estimation for Degradation Modeling of Emerging Contaminants Based on Multi-dimensional Wiener Processes L Hong, ZS Ye, R Ling	Reliability analysis of noncoherent systems based on logical differential calculus M Kvassay, E Zaitseva, J Kostolny, V Levashenko	Availability of distributed systems: a new paradigm Y Bot, A Segal
11.20 - 11.40	Probabilistic vulnerability analysis of process facilities to external acts of interference F Argenti, G Landucci, G Reniers, V Cozzani	Quantifying human reliability analysis BBNs from partial information: combining operational event analyses and expert judgment L Podofillini, L Mkrtchyan, V Dang	Model Selection with Application to Gamma Process and Inverse Gaussian Process M Zhang, M Revie	On some limiting theorems for different types of redundant systems H Schaebe, I Subinski	Systemic hazard identification using bow-tie approach M Młyńczak
11.40 - 12.00	Identification of the Electricity Blackout Impacts on the Environmental Security A Oulehlova, J Urbánek	Attack Tree Analysis D Wiseman	Generalized Method of Moments for an Extended Gamma Process Z Al Masry, S Mercier, G Verdier	Control of technical objects operation quality with the use of simulation modeling PE L Muslewski	Hazard and RAMS Studies in a Large Telescope P Fernandez, S Bellver, A Pitigoi
12.00 - 13.00	Lunch	Foyer Area	Level 2 & 3		

Tuesday 27 th September					
08.00 - 17.00	Registration Open			Foyer Area, Level 2	
09.00 - 10.00	T1: Plenary Presentation Safety Reporting and Analysis: A National Step Change for GB Rail George Bearfield, Director of System Safety - Rail Safety and Standards Board			Main Auditorium, Level 2	
10.00 - 10.20	Tea & Coffee			Foyer Area, Level 2 & 3	
10.20 - 12.00	Parallel Session T2				
Session No.	T2.6	T2.7	T2.8	T2.9	T2.10
Room	CR4/5: Level 3	CR6/7: Level 3	CR8: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Oil & Gas: Risk and Reliability Modelling	Special Session: Foundational Issues in Risk	Mechanical Systems & Engineering	Risk Governance & Regulation	Systems Reliability: Importance Measures
Chair(s)	Effie Marcoulaki	Terje Aven	Marek Młynczak	Marcelo Hazin Alencar	Ji Hwan Cha
10.20 - 10.40	Resistance-Based Probabilistic Design by Order Statistics for an Oil and Gas Deep-water Well Casing String Affected by Wear During Kick Load F Di Maio, P Baraldi, L Brivio, E Zio, C Magno	Methodology for security risk assessments – Is there a best practice? M Maal, O Busmundrud, M Enddregard	Reliability assessment methodology for multiproduct and flexible industrial process F Kristjanpoller, A Crespo, M Lopez-Campos, P Viveros, T Grubessich	Performance-based regulation of HSE and the role of regulatory guidance Ø Dahl, R Rosness, U Forseth	New method for evaluation of the qualitative importance measures A Volkanovski, V Matuzas
10.40 - 11.00	Reliability assessment for subsea HIPPS valves with partial stroke testing S Wu, L Zhang, S Liu, Y Liu, A Barros, MA Lundeigen	A combined semantic and quantitative risk analysis approach: VBS / Causality DL S Mohamed, F Innamorati, G Edwadr, D Lourdeaux	Development of two methods for the characterisation of an automotive fleet behaviour based on the simulation of single car rides M Hinz, F Hienzsich, S Bracke	Trapped by compliance? The voices of the regulator in dialogue based regulation of health, safety and environment R Rosness, Ø Dahl, U Forseth	Component importance in infrastructure networks subject to spatially distributed hazards A Scherb, L Garrè, Y Yang, D Straub
11.00 - 11.20	Reliability Analysis and Surrogate Modelling of Biodiesel Filters PO Hristov, FA DiazDelaO, KJ Kubiak, U Farooq	Using an AFD threat identification-based approach to generate risk-reducing measures A Jensen, T Aven	Failures of and Countermeasures for Spares and Standby Equipment - How do you ensure spare parts and standby equipment are in a service ready condition? M Norris	Implications of a New Perspective of Risk in the Norwegian Petroleum Regulation M Roeyksund, OA Engen, T Aven	An Importance Measure based multi-state Reliability and Risk analysis for the Subways N Ali, S Shubin, M An, CC Lv
11.20 - 11.40	Uncertainty analysis incorporated to lifecycle cost analysis in the oil and gas industry V Borges	The methodological framework to analyse coping in the testimony of the Fukushima Dai Ichi manager A Afrouss, A Portelli, G Franck	Deterioration modelling of contact surfaces for a friction drive system DJ Rodriguez Obando, JJ Martinez Molina, C Berenguer	Moving forward or back? Changes in Norwya's risk governanace startegy following the 2011 Oslo attacks M Nilsen, P Almklov, E Albrechtsen, S Antonsen	Quantifying the importance of elements of a gas transmission network from topological, reliability and controllability perspectives, considering capacity constraints F Han, E Zio, V Kopustinskas, P Praks
11.40 - 12.00				Case Studies of Risk Governance – A Literature Review B Arvidsson, A Cedergren	
12.00 - 13.00	Lunch	Foyer Area	Level 2 & 3		

13.00 - 14.40 Parallel Session T3					
Session No.	T3.1	T3.2	T3.3	T3.4	T3.5
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR4/5: Level 3
Session Name	Uncertainty Analysis: Methods & Applications	KEYNOTE TUTORIAL	Maintenance: Modelling Methods 1	Mathematical Methods: Safety & Reliability 2	Oil & Gas: Availability & Life Extension Analysis
Chair(s)	<i>Edoardo Patelli</i>		<i>Christophe Berenguer</i>	<i>Nicolae Brinzei</i>	<i>Eirik Bjorheim Abrahamsen</i>
13.00 - 13.20	An extended BDD method for the assessment of system reliability under aleatory and epistemic uncertainties JA Imakhlaf, M Sallak	Demystifying Human Performance Modelling: An Absolute Beginner's Guide to Dynamic Human Reliability Analysis R Boring	Condition-based maintenance for a system with redundancy and load sharing M Olde Keizer, R Teunter, J Veldman	Basic requirements for proven-in-use arguments H Schaebe, J Braband	Improving BOP reliability and availability through RAM analysis and expanded FMEA scope S Mathew John, K Nouri, J Alexander
13.20 - 13.40	Uncertainty in Process Chains J Keller, O Meyer, C Weihs		As Good As Looking New maintenances A Grall, Y Dijoux, SH Le	Stochastic modelling of cascading failures in k-out-of-n system H Lee, JH Cha	Techno-economic feasibility assessment of life extension decision for safety critical assets I Animah, M Shafiee, N Simms, M Considine
13.40 - 14.00	The choice of failure distribution for modelling the reliability and availability of a multi-component system K Visser		Bayesian Network Models for Making Maintenance Decisions from Data and Expert Judgment H Zhang, W Marsh	Imperfect versus incomplete testing: Implications for safety A Hafver, DV Lindberg, S Eldevik, FB Pedersen, J Domingues, LF Oliveira	Integrating reliability and maintenance methodologies to improve asset availability A Segal, Y Bot
14.00 - 14.20	Reliability Analysis of Cascade Coupling Space Mechanism Considering Reliability Influence Factors and Imperfect Information T Chunlin, L Yuqiang, Z Jianguo, S Jinyi, W Pidong		Repairable Items Inventory Optimization based on Maintenance Data and Risk Criteria J Sobral, C Soares	An attempt to determine the lifetime distribution of a device for random function forms or expected value and variance of the gaussian distribution M Zieja, M Jaształ, S Stępień, M Ważny	
14.20 - 14.40	Two Interpretations of the Risk Increase Factor Definition O Bäckström, P Krcal, W Wang		General Framework about Graphical Analysis for Operation Management P Viveros, A Crespo, L Barberá, F Kristjanpolle, R Stegmaier, T Grubessich, E Johns		
14.40 - 15.10	Tea & Coffee	Foyer Area	Level 2,3 & 9		

13.00 - 14.40 Parallel Session T3				
Session No.	T3.6	T3.7	T3.8	T3.9
Room	CR6/7: Level 3	CR8: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Mechanical Systems: Structural Reliability	UK Safety and Reliability Society Roundtable	Probabilistic Risk & Reliability Analysis	Aerospace: Systems Reliability
Chair(s)	<i>Jana Markova</i>	<i>Richard Denning</i>	<i>Henrik Hassel</i>	<i>Jianguo Zhang</i>
13.00 - 13.20	Method of reliability assessment of pin joints in undercarriages of open-pit mining machinery - a case study P Sokolski	Weaknesses In Safety And Reliability Practices As Perceived By Industry R Denning, G Bearfield, I Stanley	Adaptation with small steps or a big step? A probabilistic approach of flood risk reduction in the Dutch Delta JC Dokter, Ton Botterhuis, M Kok, H Van Waveren	Numerical Simulation on the Fluctuation Mechanism of instantaneous availability Y Yang, Y Chen, Y Du, R Kang
13.20 - 13.40	The Probabilistic Approach and its Practical Applications in Medical and Mechanical Engineering K Frydryšek		Risk Analysis of falsified Automatic Identification System for the improvement of maritime traffic safety C Iphar, A Napoli, C Ray, E Alincourt, D Brosset	Reliability Modeling Method of Space Mechanism Considering Coupling and Cascading Failure Modes with Hybrid Uncertainty P Wang, J Zhang, J Sun, C Tan, Y Liu
13.40 - 14.00	The concept of a comparative assessment of the reliability of industrial gearboxes on the basis of diagnostic tests - a case study M Sokolski, P Sokolski		A Bayesian hierarchical modelling for hydropower risk assessment A Kalinina, M Spada, P Burgherr, S Marelli, B Sudret	Modeling method of performance reliability for radar system based on parallel-in-weight model J Huang, J Zhang, Z Ge, S Zhang
14.00 - 14.20	Reliability of Components Subjected to Interacting Corrosion and Fatigue Processes B Leira		New methods for the availability prediction with confidence level P Zeiler, F Müller, B Bertsche	Risk analysis of equipment system-of-systems architecture based on entropy and brittleness Z Jiang, X Pan, Y Lin
14.20 - 14.40	Prediction of the P-S-N curve of mechanical component based on fatigue test data under random loading Y Wang, H Cheng, L Liu		A comparative study of two failure models in throughput analysis of production lines L Li, YL Qian, K Du	
14.40 - 15.10	Tea & Coffee		Foyer Area	Level 2,3 & 9

15.10 - 16.50 Parallel Session T4					
Session No.	T4.1	T4.2	T4.3	T4.4	T4.5
Room	Auditorium Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR3: Level 3
Session Name	Crisis and Emergency Management 1	Human Reliability Analysis: Performance Shaping Factors & Methods	Maintenance & Risk Modelling: Energy System Applications	Fault Trees: Automated Generation & Algorithms	Aerospace: Mathematical Methods
Chair(s)	<i>Giovanni Sansavini</i>	<i>Jerry Williams</i>	<i>Kevin Wilson</i>	<i>Antoine Rauzy</i>	<i>Rui Kang</i>
15.10 - 15.30	The (European) Union Civil Protection Mechanism: A Reliable Crisis Governance Tool? <i>C Morsut, BI Kruke</i>	Rationalisation and updating of data on selected performance shaping factors <i>L Ainsworth</i>	Forecasting for Day-ahead Offshore Maintenance Scheduling under Uncertainty <i>J Browell, I Dinwoodie, D McMillan</i>	Automatic Generation of Fault Trees: A survey on methods and approaches <i>A Berres, H Schumann</i>	Outline of the method for assessing fatigue life on the basis of crack length density function using the j-integral <i>M Zieja, M Jasztal, S Stępień, M Ważny</i>
15.30 - 15.50	Risk management and social innovation: the example of the outage organization in a high risk industry <i>N Lot, O Guillaume</i>	Experience and training as performance shaping factors in Human Reliability Analysis (HRA) <i>K Laumann, M Rasmussen</i>	Development of a Condition Monitoring System for an Articulated Wave Energy Converter <i>C Kenny, D Findlay, I Lazakis, J Shek, P Thies</i>	AGenTS: Automatic Generation of Component Fault Tree Stubs <i>M Zeller, K Hoefig</i>	Comparison of different methods for calculation of aircraft structure failure probability per single flight <i>M Woch, D Vališ</i>
15.50 - 16.10	Barriers that hamper the efficiency of Public-Private Partnerships (PPPs) in Critical Infrastructure Protection <i>P Marana, L Labaka, JM Sarriegi</i>	Performance Shaping Factors for Human Error Analysis in Construction Projects <i>C Bletsios, M Papanikolaou, Y Xenidis</i>	VME a tool for probabilistic models valuation in Engineering Asset Management <i>J Lonchampt</i>	Automating Compositional Safety Analysis Using a Failure Type Taxonomy for Component Fault Trees <i>F Möhrle, M Zeller, K Höfig, M Rothfelder, P Liggesmeyer</i>	The Markov forecasting model of landing states based on flight data <i>C Hu, S Zho, Y Xie, W Chang</i>
16.10 - 16.30	Emergency Management involving Critical Infrastructure Disruptions: operationalizing the deployment of resilience capabilities <i>P Trucco, B Petrenj, I Kozine, BA Henning</i>	Analysis of cognitive gaps: training program in the sulfuric acid plant <i>S Ávila Filho, MN Fonseca, ALA Santos, CN Santino</i>	Optimizing energy production systems under uncertainty <i>AB Huseby</i>	A fast tree-scanning algorithm finding a compact expression for the structure function of a system with known minimal path(cut)-sets <i>J Malinowski</i>	
16.30 - 16.50		Modification of the HRA-method ESAT for improving human reliability in manual assembly <i>C Kern, R Refflinghaus</i>		A formal definition of Minimal Cut Sequences for dynamic, repairable and reconfigurable systems <i>PY Piriou, JM Faure, JJ Lesage</i>	
16.50 - 17.00	Break				
17.00 - 18.00	T6: Plenary Presentation Building a Reliable and Resilient Water Supply <i>Simon Parsons, Director of Strategic Customer Service Planning- Scottish Water</i>			Auditorium	Level 2
18.00	Conference Close			Auditorium	Level 2
18.15 - 19.30	Glasgow City Chambers Reception			Glasgow City Chambers, George Square	

15.10 -16.50 Parallel Session T4					
Session No.	T4.6	T4.7	T4.8	T4.9	T4.10
Room	CR4/5: Level 3	CR6/7: Level 3	CR8: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Oil & Gas: Pipeline Risk	Special Session: Critical Infrastructures - Operationalisation of Resilience for Crisis Management	Mechanical Systems: Reliability Analysis	Standards & Regulation	Uncertainty Analysis: Fuzzy Methods
Chair(s)	<i>Raphael Steenbergen</i>	<i>Ivonne Herrera</i>	<i>Jana Markova</i>	<i>Marcelo Hazin Alencar</i>	<i>Roger Flage</i>
15.10 - 15.30	Basic approach to the risk assessment of natural gas pipelines <i>P Fuchs, J Kraus, J Novák</i>	Applying resilience concepts in crisis management and critical infrastructures – the DARWIN project <i>I Herrera, TO Grøtan, R Woltjer, B Nevhage, S Nilsson, J Trnka, B Adini, O Cohen, R Forsberg, CO Jonson</i>	Safety and Reliability of Independent Metering Systems in Mobile Machinery <i>B Beck, J Weber</i>	What is the value of a standard? <i>M Revie, L Walls, T Bedford, T Baldwin, J Shimmel</i>	Fuzzy risk matrix as a tool for the analysis of the air traffic safety <i>J Skorupski</i>
15.30 - 15.50	Identification and ranking of important elements in a gas transmission network by using ProGasNet <i>P Praks, V Kopustinskias</i>	Towards resilience operationalization in Urban Transport System: the RESOLUTE project approach <i>E Bellini, P Nesi, L Cocone, E Gaitanidou, P Ferreira, A Simoes, A Candelieri</i>	Error allocation for Motion Mechanism Based on the Kinematic Accuracy Reliability <i>X Chen, X Li, L Liu, R Kang</i>	Design for Reliability and Safety, supported by International Standards <i>V Loll</i>	Fuzzy modeling of cardinal features of a complex technical system <i>M Pająk</i>
15.50 - 16.10	Application of an integrated stochastic optimization and GIS framework to the design of a real scale crude oil pipeline system <i>E Marcoulaki, A Skretas, S Gyftakis</i>	Novel techniques and approaches for risk based application of resilience concepts to critical infrastructure: an introduction to the IMPROVER project <i>D Lange, D Honfi</i>	Approach to Analyse Hydraulic or Pneumatic Control Units <i>K Pickard</i>	Implementation of Improvements to achieve a risk that is As Low As Reasonably Practicable (ALARP), As Soon As Reasonably Practicable (ASARP) <i>A Bounds</i>	Uncertainty quantification in bow-tie analysis: a mixed approach of fuzzy theory with Dempster-Shafer theory of evidence <i>H Abdo, JM Flaus</i>
16.10 - 16.30	CATES (Consequence Assessment Tool for pipeline Emergency Situations) <i>O Baldan, E Funnemark, A Huser, J Ingvarson</i>	The population contribution in crisis management: a case of uncertainty and resilience <i>BI Kruke</i>	Robust identification of low velocity impact events under different impactor stuffness <i>A Beligni, C Sbarufatti, A Gilioli, M Giglio</i>	Passive safety applications in high consequence systems <i>Y Xiong, L Xiao, Y Liu, Y Zhang</i>	The variance-based importance measure analysis of the fuzzy failure criterion and its state dependent parameter solution <i>G Li, Z Lu, C Xie, J Qin</i>
16.30 - 16.50	Accidental Underwater Release of CO ₂ - CFD Modelling of the Underwater Plume and the Subsequent Above Water Gas Dispersion <i>A Huser, K Armstrong, T Berngherbia, G Ferrara, P Vollestad, N Rivedal, MV Essen</i>	Toward Resilient Organization: Strengthening Performance Management in an Era of Turbulent Change <i>R Steen, T Tangesen</i>	Methodological Framework for estimation of failure rates for various high-voltage battery systems <i>J Keller, T Lehmann, O Özgen</i>		Method for evaluation of the influence of LPV-200 procedures usage on the probability of CFIT <i>W Kaleta, J Skorupski</i>
16.50 - 17.00	Break				
17.00 - 18.00	T6: Plenary Presentation Building a Reliable and Resilient Water Supply <i>Simon Parsons, Director of Strategic Customer Service Planning- Scottish Water</i>			Auditorium	Level 2
18.00	Conference Close			Auditorium	Level 2
18.15 - 19.30	Glasgow City Chambers Reception			Glasgow City Chambers, George Square	

Wednesday 28 th September					
08.00 - 17.00	Registration Open			Foyer Area, Level 2	
09.00 - 10.00	W1: Plenary Presentation Science in Occupational Safety and Health: Front Line Service or Expensive Luxury? <i>Andrew Curran, Chief Scientific Adviser - Health & Safety Executive</i>			Main Auditorium, Level 2	
10.00 - 10.30	Tea & Coffee			Foyer Area, Level 2 & 3	
10.30 - 12.10	Parallel Session W2				
Session No.	W2.1	W2.2	W2.3	W2.4	W2.5
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR3: Level 3
Session Name	Crisis and Emergency Management 2	Human Reliability Analysis: Applications 1	Maintenance Modelling: Applications 2	Digitally Enabled Risk Analysis	Rail Transportation: Risk Modelling & Applications
Chair(s)	<i>Ivonne Herrera</i>	<i>Luca Podofilini</i>	<i>Christophe Berenguer</i>	<i>Enrico Zio</i>	<i>Olga Fink</i>
10.30 - 10.50	Development of a new evacuation simulation tool targeting real-time participation G Montecchiari , <i>G Bulian, P Gallina</i>	The implementation of complexity in computation-based human reliability analysis M Rasmussen , <i>RL Boring</i>	Inspection and Maintenance Optimization for OWT's using Bayesian Networks W Courage , <i>P Kempker, M Nicoreac</i>	The potential of ontologies for safety and risk analysis Van Gulikj , <i>M Figueres, P Hughes</i>	Risk management plan for metro station safe operation D Prochazkova , <i>T Kertis</i>
10.50 - 11.10	Safety procedures at university campus: the implementation of evacuation exercises A Santos , <i>M Queirós</i>	Advanced thermal hydraulic simulations for human reliability analysis V Rychkov , <i>B Brocard, K Dawson</i>	A risk-based model for inspection and maintenance of railway rolling stock F Dinmohammadi , <i>B Alkali, M Shafiee</i>	Generic framework for the automated integration of impacts from hazards in PSA models N Berner , <i>J Herb</i>	Decision Making for Railway Operations Using RAM Analysis C Pistolas , <i>G Vernon</i>
11.10 - 11.30	Planning and conducting crisis management exercises - what works and what does not? T Grunnan , <i>H Fridheim</i>	As Low As Reasonable Assessment (ALARA): Applying Discount Usability to Control Room Verification and Validation R Boring	Development of Unmanned Aerial Vehicles Maintenance Strategy under an Asset Management Framework P Gonçalves , <i>J Sobral, L Ferreira</i>	An application for early safety assessment to bridge the gap between design and automated dependability assessment <i>F Chiacchio, C Romano, F Merlo, D D'Urso, L Compagno, Y Papadopoulos, D Parker, M Walker, G Manno</i>	How (not) to work with small probabilities: Evaluating the individual risk of railway transport <i>M Bíl, R Andrášik, R Slovák</i>
11.30 - 11.50	How well do capability assessments reflect actual capability? – An experimental study of capability assessments with multi-actor dependencies M Hanson , <i>S Severinsen, H Lindbom</i>	Human Reliability in the Petroleum Industry: A Case Study of the Petro-HRA Method C Taylor , <i>S Øie, N Paltrinieri</i>	Assessment of a condition-based maintenance policy for Subsea systems: A preliminary study Y Zhang , <i>A Barros, A Rauzy</i>	AMDesigner: an architecture modeling tool for the use in multi-disciplinary design projects M Rajabalinejad , <i>M Bonnema</i>	Reliability and exploitation analysis of power supply of alarm systems used in railway objects M Siegiejczyk , <i>A Rosiński</i>
11.50 - 12.10	Risk-based investment allocation for infrastructure networks S Kunttu , <i>TVälisalo, J Pirttimäki, J Takala</i>	On use of the international standard ISO 14224 on reliability data collection in the oil and gas industry: How to consider failure causes from a human error perspective JT Selvik , <i>LJ Bellamy</i>	A qualitative analysis of the impact of permanent mooring system failures on FPSO production <i>N Ramrattan, A Monferini</i>	Redundancy Handling with Model-Based Systems Engineering N Nguyen , <i>F Mhenni, JY Choley</i>	Safety margins for the reconfigurations of trains' compositions in motion M Pawlik
12.10 - 13.20	Lunch	Foyer Area	Level 2 & 3		

Wednesday 28 th September					
08.00 - 17.00	Registration Open			Foyer Area, Level 2	
09.00 - 10.00	W1: Plenary Presentation Science in Occupational Safety and Health: Front Line Service or Expensive Luxury? Andrew Curran, Chief Scientific Adviser - Health & Safety Executive			Main Auditorium, Level 2	
10.00 - 10.30	Tea & Coffee			Foyer Area, Level 2 & 3	
10.30 - 12.10	Parallel Session W2				
Session No.	W2.6	W2.7	W2.8	W2.9	W2.10
Room	CR4/5: Level 3	CR6/7: Level 3	CR8: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Oil & Gas: Risk of Releases	Special Session: Visualisation of Risk	Structural Reliability: Civil Engineering	Occupational Health & Safety	Sensitivity Analysis
Chair(s)	Henrik Hassel	Lesley Walls	Raphael Steenbergen	Genserik Reniers	E Patelli
10.30 - 10.50	Accident risk assessment of refineries depending on configuration and geographic location P Burgherr, M Spada, A Kalinina, P Eckle, Y Pannatier	A method for visualisation of uncertainty and robustness in complex long-term decisions J Hanski, T Rosqvist, S Kunttu	Safety requirements for buildings under induced earthquakes due to gas extraction R Steenbergen, T Vrouwenvelder	Will atypical working patterns become typical in the UK: What are the implications for occupational health and safety? H Beers	Gini out of the bottle: Global sensitivity analysis with distance correlation and energy statistics E Plischke, E Borgonovo
10.50 - 11.10	CFD dispersion simulations of liquid argon releases in a deep underground large scale cryogenic installation E Marcoulaki, A Venetsanos, I Papazoglou	Multidimensional risk evaluation: Information visualization to support a decision-making process in the context of natural gas pipeline. C Medeiros, MH Alencar, AT de Almeida	Uncertainties in Crack Width Verification of Reinforced Concrete Structures J Marková, M Sykora	Synergies and trade-offs between OHS and productivity: an assessment method to support the design of new interventions P Trucco, A Rosti, D Masi	Dimensionality reduction of the resilience model of a critical infrastructure network by means of elementary effects sensitivity analysis P Turati, N Pedroni, E Zio
11.10 - 11.30	CFD simulation of a time varying release of LPG in geometrical complex environment M Pontiggia, M Gerbec, J Sužnik, M Sbaouni, R Lelong	Managing Major Hazard Industry Risks I Travers, A Aitken	Analyses of imposed load models in current standards J Markova	Design of organization and safety measures for the reclamation from friable asbestos of an industrial area in Italy L Fedele	A Sensitivity Analysis for the Adequacy Assessment of a Multi-State Physics Modeling Approach for Reliability Analysis W Wang, F Di Maio, E Zio
11.30 - 11.50	Accounting for wind direction and speed fluctuations on the prediction of flammable cloud dispersion AM Schleder, MR Martins	Advanced risk visualization for the offshore industry V Borges, V Mittal, K Shaba	Assessment of structural reliability for punching K Jung, J Markova	Bringing order to chaos: Working in partnership to address the risks of transporting goods by road N Day	Sensitivity Analysis for Bayesian Networks with Interval Probabilities S Tolo, E Patelli, M Beer
11.50 - 12.10	Assessing the consequences of accidental releases from sour oil and gas facilities C Robinson, A Halford	Visualizing and Gauging Collision Risk M Mendel, P van Gelder	Experimental model of non-cohesive layers ground with reinforcement J Ryczyński, A Surowiecki	Health Risk Assessment of Heavy Metals from Transport M Naplavova, F Bozek, J Huzlik, I Hoza, T Kurek, M Pondelicek	
12.10 - 13.20	Lunch	Foyer Area	Level 2 & 3		

13.20 - 15.00 Parallel Session W3					
Session No.	W3.1	W3.2	W3.3	W3.4	W3.5
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR4/5: Level 3
Session Name	Special session: New Strains of Society: hidden, dynamic and emergent vulnerabilities	KEYNOTE TUTORIAL	Maintenance Modelling: Applications 3	Rail Transportation: Safety Modelling & Management	Oil & Gas: Accident Scenarios & Safety Barriers
Chair(s)	Tor Grøtan		Antoine Grall	Olga Fink	Coen van Gulijk
13.20 - 13.40	Take it to the limits! An empirical strategy for exploring the new strains of society in terms of hidden, dynamic and emergent vulnerabilities <i>TO Grøtan, S Antonsen</i>	Uncertainty Quantification and Global Sensitivity Analysis: an introduction <i>E Borgonovo</i>	Selective maintenance for multi mission oriented systems <i>L Ribeiro, C Cavalcante, T Rodriguez</i>	European Rail Transport Management System mobile transmission safety analyse <i>M Pawlik, M Siergiejczyk, S Gago</i>	Analysis of Dynamic Positioning System Accidents and Incidents with Emphasis on Root Causes and Barrier Failures <i>Y Dong, B Rokseth, JE Vinnem, IB Utne</i>
13.40 - 14.00	Pandemic Landscape of New Strains of Society <i>Ø Dahl, A Øren</i>		A cost-benefit approach for the evaluation of prognostics-updated maintenance strategies in complex dynamic systems <i>Jl Aizpurua, VM Catterson, F Chiacchio, D D’Urso</i>	The use of design targets in harmonisation of safety management in the European rail industry <i>D Griffin, G Bearfield</i>	Dynamic barrier management <i>S Greenfield, M Fisher, H Flotaker, A Stokke, R Pitblado</i>
14.00 - 14.20	Scenario approaches as a means of handling emerging risks in society <i>EH Okstad</i>		Perspective renewal model for water distributions systems <i>K Pietrucha-Urbanik, D Valis, Z Vintr</i>	Ontology network analysis for safety learning in the railway domain <i>M Figueres-Esteban, P Hughes, C van Gulijk</i>	Improving accident investigation by evaluating the pre-accident risk assessment and management from a fundamental risk perspective <i>K Bjørnsen, T Aven</i>
14.20 - 14.40	Calibrated resilience landscapes of composite protection; theoretical grounding of an empirical approach <i>TO Grøtan, J Bergstrøm</i>		A review on information assurance (IA) framework for condition-based maintenance of railway track <i>Y Al-Douri, P Tretten</i>	Interfaces, functions and components based failure analysis for railway RAMS assessment <i>Q Mahboob, B Altmann, S Zenglein</i>	Perspective and criticalities of CFD modelling for the analysis of oil&gas offshore accident scenarios <i>AC Uggenti, Andrea Carpignano, F Ganci, L Savoldi, R Zanino</i>
14.40 - 15.00	New Strains – The emergence of cyber physical vulnerabilities <i>S Johnsen</i>		The Maintainability Analysis and Conceptual Design of On-orbit Service (OOS) System for Space Station <i>Z Guo, D Zhou, X Zhou</i>	Correlating train performance data with safety incidents: A preliminary case study for improving the understanding of the effects from train delay on safety risk across the GB rail network <i>C Harrison, R Weltz</i>	
15.00 - 15.30	Tea & Coffee			Foyer Area	Level 2 & 3
15.30 - 16.30	W4: Plenary Presentation Managing Risk in Major Projects: A Strategic Perspective <i>Jeremy Beeton, Director - Scottish & Southern Energy</i>			Main Auditorium	Level 2
16.30 - 17.00	Images of Risk Awards and Welcome <i>Professor Sir Jim McDonald, Vice-Chancellor and Principal - University of Strathclyde</i>			Main Auditorium	Level 2
17.10	Conference Close			Main Auditorium	Level 2
19.00 - 00.00	ESREL 2016 - Conference Dinner			Kelvingrove Museum, Argyle Street, G3 8AG	

13.30 - 15.00 Parallel Session W3			
Session No.	W3.6	W3.7	W3.8
Room	CR6/7: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Human Reliability Analysis: Applications 2	Product Development & Warranty Modelling	Socio-Technical Analysis of Accidents
Chair(s)	Ron Boring	Mahmood Shafiee	Sebastian Martorell
13.20 - 13.40	Preparing for human spaceflight to the Moon 2020 - 2030 <i>TM Stene, BE Danielsen, D Trevisani</i>	Reliability engineering in face of shorten product life cycles: Challenges, technique trends and method approaches to ensure product reliability <i>S Bracke, M Hinz, M Inoue, E Patelli, S Kutz, B Ulutas, C Hartl, P Mörs, P Bonnaud, H Gottschalk</i>	Analysis of economic and structural factors on occupational accidents using a Generalized Additive Model. Example of application to Spain <i>S Martorell, V Gallego, AI Sánchez</i>
13.40 - 14.00	Human reliability analysis of seafarers using CREAM method - The case of tanker shipping <i>Q Zhou, YD Wong, H Xu, VV Thai</i>	Design-to-test: an approach to enhance testability of programmable controllers for critical systems – two case studies <i>C Ma, J Provost</i>	Bayesian network analysis of the influence of labour market variables on accident rates of workers in Spain. <i>JR Lopez-Garcia, MA Mariscal Saldaña, S Garcia-Herrero, JM Gutierrez Llorente</i>
14.00 - 14.20	Theoretical learning outcome of night driving. A comparison study of traditional real life training and simulator training <i>R Robertsen, G Sætren, P Haukeberg, H Sivertsen</i>	Determination of Reliability Distributions and Warranty Costs based on Qualitative Quality Assurance Method <i>K Pickard</i>	Different accident levels between offshore and onshore helicopter operations – A comparison of socio-technical systems <i>RJ Bye, SO Johnsen, G Lillehammer</i>
14.20 - 14.40	Human error probability estimation of maintenance activities in cold operating environment based on Bayesian Network <i>YZ Ayele, A Barabadi</i>	Warranty analysis of a two-component system with failure interaction <i>M Fouladirad, N Zhang, A Barros</i>	Traffic accident hotspots: Identifying the boundary between the signal and the noise <i>M Bil, R Andrášik,</i>
14.40 - 15.00	Learning from accidents: investigating the genesis of human errors in multi-attribute settings to improve the organisation of design <i>R Moura, M Beer, E Patelli, J Lewis, F Knoll</i>	A new reliability improvement program for repairable products sold with two-dimensional warranty <i>Y Wang, Q Yu</i>	
15.00 - 15.30	Tea & Coffee		Foyer Area Level 2 & 3
15.30 - 16.30	W4: Plenary Presentation Managing Risk in Major Projects: A Strategic Perspective <i>Jeremy Beeton, Director - Scottish & Southern Energy</i>		Main Auditorium Level 2
16.30 - 17.00	Images of Risk Awards and Welcome <i>Professor Sir Jim McDonald, Vice-Chancellor and Principal - University of Strathclyde</i>		Main Auditorium Level 2
17.10	Conference Close		Main Auditorium Level 2
19.00 - 00.00	ESREL 2016 - Conference Dinner		Kelvingrove Museum, Argyle Street, G3 8AG

Thursday 29 th September					
08.00 - 16.00	Registration Open			Foyer Area, Level 2	
09.00 - 10.00	TH1: Plenary Presentation Empirical Bayes: It's Now, It's Wow <i>John Quigley, Professor of Management Science - University of Strathclyde</i>			Main Auditorium, Level 2	
10.00 - 10.20	Tea & Coffee			Foyer Area, Level 2 & 3	
10.20 - 12.00	Parallel Session TH2				
Session No.	TH2.1	TH2.2	TH2.3	TH2.4	TH2.5
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR4/5: Level 3
Session Name	Societal Security	KEYNOTE TUTORIAL	Optimisation: Methods & Applications	Accelerated Tests: Modelling & Methods	Nuclear: RAMS 1
Chair(s)	<i>Sissel H. Jore</i>		<i>Mitra Fouladirad</i>	<i>Zdenek Vintr</i>	<i>Marko Cepin</i>
10.20 - 10.40	Toward an empirical clarification of societal safety and societal security – preliminary findings from interviews with leaders and key stakeholders in Norway <i>S Høyland, KA Pettersen</i>	Reliability Assessment of Complex Systems <i>A Rauzy</i>	Dependability Optimization of Process-level Protection in an IEC-61850-Based Substation <i>A Altaher, S Mocanu, JM Thiriet</i>	Combining nonparametric predictive inference and power-Weibull model for accelerated life testing <i>YC Yin, FPA Coolen, T. Coolen-Maturi</i>	Reliability Requirements and Use of Risk Applications for the Reliability Program in Canadian Nuclear Power Plants <i>U Menon, C Morin, Y Akl</i>
10.40 - 11.00	Possibilities of critical infrastructure protection against terrorism <i>M Vašková, J Barta, J Johanidesová</i>		Robust Portfolio Modelling Methodological Approach to GB Gas Grid Risk Analysis via a Simplified Network Version <i>T Sacco, M Compare, G Sansavini, E Zio</i>	The method of analyzing accelerated degradation data based on acceleration factor constant principle <i>HW Wang, KN Teng, BL Gai</i>	Influence of trust in institutions on public acceptance of nuclear power from a historical context across nuclear countries <i>P Mlejnkova, E Patelli, C Grundy, Z Hodgson</i>
11.00 - 11.20	Safety Culture -A Sufficient Explanation for a Terrorist Attack? <i>SH Jore</i>		Bayesian approach for safety barrier portfolio optimization <i>A Mancuso, M Compare, A Salo, E Zio</i>	Development of process for adaptive lifetime estimation of mechanical assemblies using accelerated testing methods <i>JP Hietala, P Ojala, P Multanen, J Miettinen, P Saarenrinne</i>	A comparison between traditional BEPU and Extended-BEPU approaches for Deterministic Safety Analysis on Nuclear Power Plants <i>S Martorell, F Sánchez-Sáez, I Martón, P Martorell, JF Villanueva</i>
11.20 - 11.40	A Method for Analysing Security Threats in Operational Risk Analysis and Management <i>S Malerud, H Fridheim</i>		A Preventive Replacement Scheduling Model for Multi-component System with Lifetime Limited Components <i>J Hou, Y Qian, L Li, X Wen</i>	Optimal design for accelerated degradation tests with stochastic model uncertainty <i>L Liu, XY Li, TM Jiang, JG Zhang</i>	State-of-the-Art Reactor Consequence Analyses Project: Uncertainty Analysis of a Potential Unmitigated Short-Term Station Blackout of the Surry Nuclear Power Station <i>ST Ghosh, K Ross, N Bixler, S Weber, C Sallaberry, J Jones</i>
11.40 - 12.00	Safety and Security – Is there a need for an integrated approach? <i>SH Jore</i>				Development of advanced surveillance requirements of Nuclear Power Plants using a risk-informed approach in the horizon 2020 <i>I Marton, S Martorell, P Martorell, JF Villanueva, S Carlos, A Sánchez, R Mullor</i>
12.00 - 12.50	Lunch	Foyer Area	Level 2 & 3		

Thursday 29 th September			
08.00 - 16.00	Registration Open		Foyer Area, Level 2
09.00 - 10.00	TH1: Plenary Presentation Empirical Bayes: It's Now, It's Wow <i>John Quigley, Professor of Management Science - University of Strathclyde</i>		Main Auditorium, Level 2
10.00 - 10.20	Tea & Coffee		Foyer Area, Level 2 & 3
10.20 - 12.00	Parallel Session TH2		
Session No.	TH2.6	TH2.7	TH2.8
Room	CR6/7: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Session Name	Bayesian Network Modelling: Applications	Supply Chain & Networks Risk Analysis	Organisational Factors & Safety Culture 1
Chair(s)	Ullrika Sahlin	Stefan Bracke	Genserik Reniers
10.20 - 10.40	A Bayesian network for diagnosis of networked mobile robots <i>I Sassi, A Gouin, JM Thiriet</i>	Reliability capability assessment of cooperative networks using the example of developing demonstrators of structured materials <i>FV Haase, M Reinhold, R Woll, M Wolf, H Seidlitz</i>	The failure of knowledge-based task performance - a study of the police emergency response during the 22/7 terror attacks in Norway <i>RJ Bye, PG Almklov, OM Nyheim, A Gilberg, SO Johnsen</i>
10.40 - 11.00	Application of Bayesian Network in safety analysis on civil aircraft systems <i>H Wang, D Zhong T, Zhao</i>	Integrated reliability analysis in task of emission production orders in ERP system: a case study on a company's sports segment <i>M Fonseca, P Carvalho, R Kalid, S Ávila Filho</i>	Safety leadership influence on patient safety and the mediating role of unit safety climate <i>E Olsen, MT Jensen</i>
11.00 - 11.20	Using Bayesian Networks to quantify the reliability of a subsea system in the early design <i>J Zhang, YL Liu, MA Lundteigen, L Bouillaut</i>	Risk analysis of supply: comparative performance and short-term prediction <i>L Walls, J Quigley, M Parsa, E Comrie</i>	Which types of leadership behaviors can promote safety in an interorganizational context? <i>V Milch, K Laumann</i>
11.20 - 11.40	Asset integrity case development for normally unattended offshore installations: Bayesian network modelling <i>S Loughney, J Wang, D Lau, D Minty</i>	Supply reliability and dynamic safety analysis of an alternative energy supply chain <i>ZN Hansen, F Markert, P Jacobsen, A Schmidt, E Touray</i>	Sociotechnical aspects in safety regulation in the high-risk industries <i>M YlöNen, OA Engen</i>
11.40 - 12.00	Reliability analysis of gas turbine systems based on Fault Tree and Bayesian Networks <i>J Zhang</i>	Risk and reliability assessment of the district heating network methodology with case study <i>I Žutautaitė, R Krikštolaitis, J Augutis, G Dundulis, M Valinčius, S Rimkevičius</i>	Impact of experiential learning on safety climate: a case study <i>P Cocca, F Marciano, M Alberti, M Lambri, D Lorenzi</i>
12.00 - 12.50	Lunch	Foyer Area	Level 2 & 3

12.50 - 14.10 Parallel Session TH3

Session No.	TH3.1	TH3.2	TH3.3	TH3.4	TH3.5
Room	Auditorium: Level 1	Main Auditorium: Levels 2/3	CR1: Level 3	CR2: Level 3	CR3: Level 3
Chair(s)	Peter Hughes	Tim Bedford	Rui Kang	Maria Francesca Milazzo	Marek Młyńczak
Session Name	Risk Stakeholder Communication & Cooperation	Natural Hazards Analysis	Optimisation: Aerospace & Aeronautical Applications	Critical Infrastructure: Risk Analysis	Production Systems: Reliability Modelling & Management
12.50 - 13.10	Cooperation across Government Services: The relation between the Norwegian Police and the Norwegian Armed Forces in the aftermath of the terror attacks of July 22 nd 2011 <i>K Wasilkiewicz, A Øren, SO Johnsen</i>	How risk perception on natural hazards influenced the content of risk and vulnerability analysis and the implementation of risk-reduction measures <i>M Leonhardsen, KH Olsen, OE Olsen</i>	Reliability-based structural design optimizaiton of a double-stage swirler <i>X Liu, M Huang, J Yi, J Xue</i>	Operational Improvement of Systems & Processes at Critical Infrastructure Detection Check Sites <i>JF Urbánek, J Johanidisová, JJ Urbánek, J Barta</i>	Application of FRAM to risk assessment in manufacturing process <i>Z Zheng, J Tian</i>
13.10 - 13.30	Whose Risk is it –Tools for deciding how many trees make a wood <i>A Bain</i>	Seismic risk analysis of the Italian built environment at territorial scale <i>A Rasulo, MA Fortuna, G Modoni, B Borzi</i>	Arc-tracking and non-electrical fire considerations in helicopter environment <i>N Verite, S Bailly</i>	Optimum post-disruption restoration for enhanced infrastructure network resilience: a fuzzy programming approach <i>Y Fang, G Sansavini</i>	Evaluation method of the waste processing system operation <i>R Giel, M Plewa, M Młyńczak</i>
13.30 - 13.50	Risk Assessment – Experts vs. Lay People <i>T Stålhane, T Malm</i>	Earthquake preparation and risk perception: the case of high school students in Mexico City <i>T Gouzeva, G Santos Reyes, J Santos Ryes</i>	An Industrial Implementation of an Optimization Based Method for Balancing Safety, Reliability and Weight of Aircraft Systems <i>C Johansson, J Ölvander, M Derelöv, J Bergström, H Nilsson-Sundén</i>	An integrated framework for business continuity management of critical infrastructures <i>J Xing, E Zio</i>	A new Idea to remanufacture safety related components with respect of the reliability <i>A Krini, J Krini, O Krini, J Borcsok</i>
13.50 - 14.10	From negative statements to positive safety: identifying text-based descriptions of control breakdowns <i>P Hughes, M Figueres-Esteban, C van Gulijk</i>	Quantification of evolving regional vulnerability to hurricanes <i>S Guikema, A Reilly, J Garzon Hervas, C Ferreira</i>	Reliability modeling and optimization of the spray process for seal coatings on the aero-engine compressor casing <i>J Xue, M Huang, J Yi, X Liu</i>	Improved method to Calculate Additional Ramps Explicitly (CARE2) in Quantitative Risk Analysis for road tunnels <i>M Nelisse</i>	Reliability modelling of automated guided vehicles using Petri nets <i>R Yan, S Dunnett, L Jackson</i>
14.10 - 14.30		Propagating spatial and thematic uncertainties in mountain natural hazard assessment process <i>G Dupouy, JM Tacnet, F Bourrier, F Berger, N Crimier, K Mekhnacha, M Memier, E Moulet-Vargas</i>		Problems Connected with Determination of Size of Maximum Expected Disaster in Selected Site <i>D Prochazkova, J Prochazka</i>	
14.10 - 14.40	Tea & Coffee			Foyer Area	Level 2 & 3
14.40 - 15.40	TH4: ESRA Plenary Presentation Question & Answer Session on Methodological and Practical Issues of Broad Interest regarding Safety and Reliability <i>Enrico Zio & Terje Aven</i>			Main Auditorium	Level 2
15.40 - 16.00	Closing Session			Main Auditorium	Level 2
16.00	Conference Close			Main Auditorium	Level 2

12.50 - 14.10 Parallel Session TH3					
Session No.	TH3.6	TH3.7	TH3.8	TH3.9	TH3.10
Room	CR4/5: Level 3	CR6/7: Level 3	CR8: Level 3	Executive Room A: Level 9	Executive Room B: Level 9
Chair(s)	<i>Sebastian Martorell</i>	<i>Kevin Wilson</i>	<i>Xiaoyang Li</i>	<i>Antoine Grall</i>	<i>Sissel Jore</i>
Session Name	Nuclear: RAMS 2	Bayesian Modelling: Methodological Considerations	Accelerated Tests: Design and Applications	Dynamic Reliability & Systems Modelling	Organisational Factors & Safety Culture 2
12.50 - 13.10	Application of PRA for the assessment of defence-in-depth of a nuclear power plant JE Holmberg, O Bäckström, M Porthin, T Tyrväinen	Small data and conflicting information U Sahlin	Optimization of the dental implant testing based on FEM simulation of fatigue and accelerated life A Müller, M Hinz, S Bracke	MCDET analysis: From input specification of uncertainties to the probabilistic evaluation of critical variables of dynamic systems N Berner, J Scheuer	Corn Flakes and Safety Culture Improvement E Jacob, A German, M Shermon
13.10 - 13.30	Dynamic Features in Large PSA Studies Y Butkova, H Hermanns, P Krcal, O Bäckström, W Wang	Approaches to Bayesian network structure elicitation K Zwirgmaier, D Straub	Methodology of the accelerated life test of a temperature sensor Z Vintr, D Valis	Reliability Analysis for the Process of DIMA Dynamic Reconfiguration H Ju, S Wang, T Zhao	Safety Systems in Product Safety Culture L Suhanyiova, R Flin, A Irwin
13.30 - 13.50	Shutdown Probabilistic Safety Assessment – Method and Results M Cepin, M Antoncic	The Use of Structured Expert Judgment Methods to aid in Parameter Estimations for Data Sparse Problems A El-Shanawany, F Brandford-Adams	Multivariable accelerated testing of seep through of humidity due to vibration in electric connector P Ojala, J Pippola, JP Hietala, J Miettinen, L Frisk, P Julkunen, EL Varpe	Evaluation of PFD of Safety Systems with Time-dependent and Test-Step Varying Failure Rates L Oliveira, J Domingues, A Hafver, S Lindberg, FB Pedersen	General framework methodology to increase organizational learning in the field of asset management T Grubessich
13.50 - 14.10	Availability modelling of ageing equipment addressing multiple items and failure causes P Martorell, S Martorell, I Marton, A Sánchez, S Carlos	Bayesian Model Calibration Using Subset Simulation Z Gong, FA DiazDelaO, M Beer	Research on accelerated degradation test for GaAs solar cells in LEO environment Y Zhang, X Ma, H Wang, H Jiang		Impact of cultural factor for reliability of the food supply chain - research introduction A Tubis, A Górecka, M Nowakowska
14.10 - 14.30					Vulnerability and prevention of fatal fires G Gjesund, P Almklov, K Halvorsen, K Storesund
14.10 - 14.40	Tea & Coffee			Foyer Area	Level 2 & 3
14.40 - 15.40	TH4: ESRA Plenary Presentation Question & Answer Session on Methodological and Practical Issues of Broad Interest regarding Safety and Reliability Enrico Zio & Terje Aven			Main Auditorium	Level 2
15.40 - 16.00	Closing Session			Main Auditorium	Level 2
16.00	Conference Close			Main Auditorium	Level 2

Plenary Speakers

Monday 26th September: 09.30 – 10.40

Cyber Risk Analysis: Method and Illustrations

Professor Elisabeth Pate-Cornell

Professor of Management Science and Engineering, Stanford University



The risks of cyber attacks have become a growing problem for individuals, businesses, government entities and others. Recent attacks that were widely publicized, include the U.S. Office of Personnel Management, the U.S. Department of Energy, Sony Pictures and Target stores to name a few. These attacks attempt to steal personal information and intellectual property, compromise operations, damage equipment, obtain money through extortion, or damage the institution's image. "Securing everything" is as unrealistic as ensuring "zero risk", and attempts at doing so are probably counter-productive if resources are misallocated. Therefore, decision makers need to quantify cyber risks to set priorities among cyber security investments and best allocate limited resources to minimize the risk, or by solving the dual problem, to determine what budget is needed to reach a tolerable risk level.

In this talk, I will present a general probabilistic model of cyber risk analysis and three examples of forward-looking analyses. In a constantly changing world, the goal is to capture not only the set of attacks that have already occurred but also scenarios that have not yet materialized to provide risk management decision support. The approach of the Stanford Engineering Risk Research Group is thus statistical when data are available, and system-based --including expert opinions--, otherwise. This model includes the nature of the defender and of the possible attackers, the structure of the defender's network, its vulnerabilities, the location of critical information, the possible attack scenarios (including insiders' threats), the probabilities and consequences of a successful attack, and the expected benefits of possible defense strategies based on the risk model.

Three illustrations are motivated by recent cyber-attacks. The first one is a statistical analysis of over 60,000 cyber security incidents in a large government organization. This analysis shows, among other results, that the rate of attacks in that case has been fairly constant so far. The second is a systems analysis of cyber risk for a smart, connected electric grid. This model addresses the current concern that beyond a certain point, "smartness" that involves a large number of connections may also create more vulnerabilities than the benefits justify. The problem is to find an optimum that balances the benefits of connectivity and the risk of cyber attacks. The third example models decisions to upgrade an existing cyber security system or adopt a new one, with the objective to stay ahead of an adversary trying to find its way in the organization's system. The illustration through a town's water system's management shows that there is an optimum strategy that balances the costs of software upgrades and the benefits of reducing the risks of a cyber attack. In all cases, probabilities are used from different sources of information, to represent the uncertainties involved. The results are probability distributions of losses to attacks in support of risk management decisions, based on previous and anticipated events.

Biography

Elisabeth Paté-Cornell is the Burt and Deedee McMurtry Professor and Founding Chair of Management Science and Engineering at Stanford. Her field is engineering risk analysis for complex systems (space, medical, etc.). Her research includes game analysis (e.g., counter-terrorism) and cyber-security. She is a member of the NAE and of several boards. She holds degrees in mathematics and physics, Applied Math/CS, Operations Research, and Engineering-Economic Systems (Stanford PhD).

Tuesday 27th September: 09.00 – 10.00

Safety Reporting and Analysis: A National Step Change for GB Rail

Dr George Bearfield

Director of System Safety

Rail Safety and Standards Board



Modern information systems will support effective dynamic and timely safety management activity across a rail network: The future rail safety manager will review and analyze real time safety information data in a 'safety control centre' acting on alarms with urgent response in the field. Systems will also support rapid tactical analysis of similar combinations of weaknesses in safety defenses by rapidly and intelligently filtering aggregated risk, asset and safety control data to quickly target a broader response. Such systems will also support the robust analysis of investment options to strengthen the safety control framework where necessary rapidly developing robust investment cases based on clear analysis of the balance between cost, performance and safety, to support timely management decisions.

This future for railway safety is rapidly approaching through the Safety Management Intelligence System being developed by RSSB on behalf of the GB rail industry. This project, to develop a safety incident and close call reporting system, and associated data warehouse containing key asset and performance data, is the first step in a cross industry programme of work to automate core risk-based safety management activity in a user friendly modern IT platform.

But this is not just about technology. The implementation of this system is the culmination of a 20 year journey for rail in Great Britain, to develop the necessary safety culture, and maturity around data sharing that is necessary for the technology to function effectively within the safety management systems of rail companies. There have been stages of evolution that the industry has had to evolve through bottom up, and this has required a mature, risk based approach to regulation and monitoring. It's also required a degree of centralized, strategic planning from within the industry itself, something that RSSB, as a cross industry body owned by industry has been able to support.

Biography

George Bearfield joined RSSB in 2006 and was appointed System Safety Director in 2014. He is responsible for the analysis and reporting of GB rail's safety performance and risk. George has a PhD in Computer Science. He is a Chartered Engineer, a Member of the Institution of Engineering and Technology, and a Fellow of the Safety and Reliability Society.

.....
Tuesday 27th September: 17.00 – 18.00

Building a Reliable and Resilient Water Supply

Professor Simon Parsons

Director of Strategic Customer Service Planning
Scottish Water



Scottish Water provides vital services to the people of Scotland, providing high quality drinking water and waste water services for around 2.4 million domestic households and over 150,000 business premises.

The vast majority of customers experience 100% service reliability, and trust that they will continue to receive this. Our most recent customer research identified that high quality drinking water that was always available was their highest priority. To achieve this we need to make our service more reliable and more resilient.

Resilience can be defined as the ability to maintain essential services under extreme circumstances. In many ways for water supply this can be considered as the ability to supply customers from an alternative supply. Our current estimates suggest that we have the capability to continue normal supplies in extreme events for around only 15% of our customers, levels significantly lower than many of the other UK water companies. If we look at water supply there are many examples of events that have disrupted water supplies in UK in the past few years. These include:

- » herbicide spills, oil spills, cryptosporidium,
- » flood events impacting the water quality of raw
- » abstractions, inundation of water treatment works and other infrastructure;
- » storms causing loss of power supplies and communications;
- » extreme winter weather causing failure of water mains and leakage;
- » extreme summer temperatures increasing the demand for water and leakage;
- » droughts that have caused a reduction in water available for abstraction;
- » dam, sluice, aqueduct and canal failures; and
- » other infrastructure failures.

The impact of a disruption could have far-reaching consequences such as major disruption to businesses, public health and social cohesion. It could mean standpipes or water cuts and AECOM recently estimated the economic and social costs of an extreme 3 year drought in the 2050s would be up to £80 billion. Flooding of a large water treatment works, which caused loss of supply to 350,000 people, was between £25-35 million and a recent cryptosporidium incident is reported to have cost in excess of £20 million.

To better understand how to build a reliable and resilient water service we are testing a comprehensive of potential hazards to better understand the resilience of our water supplies and associated infrastructure. This paper will look at how we approach understanding and managing these risks.

.....
Biography

Having joined Scottish Water in 2012 as Chief Scientist, I am now Director of Strategic Customer Service Planning, leading teams in regulation, water and waste water services, strategic review, science and innovation. It's my responsibility to ensure customer needs and expectations are built into our strategies and plans for the future.

Wednesday 28th September: 09.00 – 10.00

**Science in Occupational Safety and Health:
Front Line Service or Expensive Luxury?**

Professor Andrew Curran

Chief Scientific Adviser and Director of Research
Health and Safety Executive



Great Britain's record on work-related safety and health is one of the best in the world. High-quality science, evidence and analysis underpin Great Britain's risk-based, goal-setting regulatory regime and are vital for ensuring effective and proportionate risk management that protects workers and safeguards the public while enabling productivity, innovation and growth. In addition, the UK regulator uses its science, medical and engineering capability to investigate the cause of failure in plant, processes, products and people from the individual component to the whole system level. The knowledge and insight gained through this process is invaluable in the prevention of future issues and the intelligence collected by the UK's Health and Safety Executive in the course of such investigations over the last 40 plus years is a unique global resource that is helping to design out such failures in the future. In addition, the use of foresight and horizon scanning techniques enables HSE to be prepared for macro-level changes and to identify gaps in knowledge which may need to be addressed to enable healthy and safe introduction of novel technologies which is resilient and sustainable. Examples include the hydrogen economy, the use of additive manufacturing and the impact of demographic change in the attitudes and behaviours of the future workforce. Over the last twelve months we have been developing a new science and evidence strategy which is predicated on the use and development of practical, solution-oriented science, maximising the synergies from our regulatory work and our investment in science, and the science we undertake with direct funding from industry and other stakeholders. In our strategy we set out our 'science and evidence cycle': anticipating challenges to health and safety; providing robust evidence for effective risk control; underpinning regulatory policy and operational decisions; protecting workers and safeguarding the public by developing interventions; and catalysing engagement within the health and safety system and improving performance. The supporting plan has identified where our priority areas for investment in research should be made in the context of a changing world of work. These "Priority Research Hubs" cover the following areas:

- » Ensuring regulatory frameworks are fit for the future;
- » Developing an appropriate evidence strategy for the future;
- » Managing the impact of demographic change on the health and safety of the future workforce;
- » Developing the right intervention strategy for the British industrial asset base;
- » Taking responsibility for health at work; and
- » Technical support for investigations, inspections and enforcement.

Our Science Plan will facilitate continuity and support for longer term strategic research programmes, including foresight. Science and evidence is at the heart of HSE's work. Our science and evidence strategy aims to maximise its contribution to delivering the wider strategy for the health and safety system, Helping Great Britain Work Well. This presentation will review the approach HSE uses to invest in science and engineering and consider its value as a "front-line service".

Biography

Professor Andrew Curran is Chief Scientific Adviser and Director of Research at the Health and Safety Executive. He has responsibility for the professional leadership of 850 scientists, engineers and physicians, and for development and delivery of HSE's science strategy. He has oversight of HSE's Scientific Advisory Committee on Workplace Health (WHEC), is the Chair of the Sheffield Group (global network of national health and safety research organisations), Chair of the Scientific Steering Group of PEROSH (Partnership for European Research in Occupational Safety and Health) and a Board Member of ICOH (International Commission for Occupational Health). He is an Honorary Professor at Sheffield University, and an Honorary Fellow of the Faculty of Occupational Medicine (UK).

.....
Wednesday 28th September: 15.30 – 16.30

Managing Risk in Major Projects: A Strategic Perspective

Jeremy Beeton

Director Scottish and Southern Energy



Jeremy will explore how risk is managed in major projects. He will draw upon examples from his career within a major engineering and construction company, whose portfolio includes designing and building projects including power plants, refineries, rail systems, and communication networks and supporting national defence. Jeremy is also uniquely placed to share insights into managing risk at high-profile events given his former role as the Director General of the UK Government Olympic Executive where his responsibilities included ensuring on-time, on-budget delivery. The Olympics not only had a total cost of multiple-billion pounds, but they were also uniquely complex compared with an engineering project because of the multiple stakeholders involved both nationally and internationally. Through a conversational style interview, Jeremy will share his experiences of communicating and managing risk at different levels of an organisation, from the engineering function through to the Board and he will examine the key factors that he believes influence the success of risk management for major and complex projects.

.....
Biography

Jeremy was the Director General of the UK Government Olympic Executive, the lead government body for coordinating the 2012 London Olympics, and the body responsible for carrying out strategic level risk management. Previously, he was Principal Vice-President of Bechtel Ltd, where he had responsibility for the management and delivery of civil engineering projects in infrastructure and aviation business lines. Currently he sits on the Advisory Board of PwC, is Chairman of Merseylink Ltd, and a Non-Executive Director of SSE plc and John Laing Group plc.

Thursday 29th September: 09.00 – 10.00

Empirical Bayes: It's Now, It's Wow

Professor John Quigley

Professor of Management Science



A traditional and contemporary goal of Statistical Science is to use data effectively to provide evidence to inform decision-making and policy formulation. As the nature of data continues to change, new statistical modelling challenges emerge. Within a risk context, we can often find ourselves with the problem of estimating rare events for safe, reliable systems with few observed events but with increasingly large amounts of data on factors related to the system. This provides us with an exciting opportunity to create elaborate taxonomies for each event type however sparse the empirical observations might be. Empirical Bayes offers a methodology which aims to make use of the available data, not only that observed but also engineering expert judgement, to provide good estimates. By good, we mean estimates that are themselves reliable insofar as the uncertainty bounds are accurate and meaningful. This talk discusses motivating industry applications concerned with the analysis of risk and innovation for which Empirical Bayes provides a credible methodological solution. The general process for Empirical Bayes will be explained and compared with the approaches of traditional Frequentist and Bayesian statistical methods. The strengths as well as weaknesses of Empirical Bayes will be explored, largely through real examples concerned with estimating the occurrence of events. The examples will be based upon the Binomial and Poisson families of probability models, both univariate and multivariate, and will show how expert judgement can be represented naturally in combination with observed data.

Biography

John has just begun his tenure as Head of the Management Science Department at the University of Strathclyde and is a passionate Industrial Statistician. He has published widely in journals such as Risk Analysis, Statistical Science, European Journal of Operational Research, Reliability Engineering and System Safety, on his methodological research. He has considerable experience in engaging with industry to develop useful, novel statistical modelling solutions for risk and reliability challenges facing organisations such as Rolls Royce, Aero-Engine Controls, RSSB.

Thursday 29th September: 14.20 – 15.15

ESRA Plenary Panel Discussion

**Chairs: Professor Terje Aven and
Professor Enrico Zio**



This will be an informal Question & Answer session on methodological and practical issues of broad interest regarding Safety and Reliability. During the conference participants will be able to submit questions which will be distributed to experts from the ESRA Technical Committees (ESRA TCs) who will participate in the panel. Questions and answers will be read and discussed interactively during the session. This session provides an opportunity to engage in cross-cutting discussions about issues emerging during ESREL 2016 and surfacing topics and issues for future consideration.

Biographies

Professor Terje Aven is the current Chairman of the European Safety and Reliability Association (ESRA). He is Professor of Risk Assessment and Risk Management at the University of Stavanger (UiS), Centre for Risk Management and Societal Safety (SEROS), Norway. He is the Editor-in-Chief of the Journal of Risk and Reliability. Terje has a broad background from industry, consulting companies and academic institutions. His research covers a variety of topics in the risk and reliability fields. Recently his main research interest has been foundational issues in risk analysis and risk management.

Enrico Zio is former Chairman of the European Safety and Reliability Association (ESRA). He is currently the Director of the Chair on Systems Science and the Energetic Challenge of the Foundation Electricite' de France (EDF) at CentraleSupélec, Paris, France, full Professor and President of the Alumni Association at Politecnico di Milano, adjunct professor at University of Stavanger, Norway, City University of Hong Kong, Beihang University and Wuhan University, China and Co-Director of the Center for REliability and Safety of Critical Infrastructures (CRESCI), China. His research focuses on the modelling of the failure-repair-maintenance behaviour of components and complex systems, for the analysis of their reliability, maintainability, prognostics, safety, vulnerability, resilience and security characteristics, and on the development and use of Monte Carlo simulation methods, artificial intelligence techniques and optimization heuristics.

Keynote Tutorials

The keynote tutorials are 90 minute long expert-led sessions on specific topics. Information about the tutor, the content and style of the tutorial, as well as any pre-requisites and intended learning outcomes for participants are given below.

Monday 26th September: 11.00 – 12.40

Cyber Security for High-Reliability, Safety Critical Systems
Professor Chris Johnson, University of Glasgow, Scotland



Summary Description

There has been a growing number of cyber-attacks on critical infrastructures around the globe. At the same time, the increasing use of Commercial Off-The-Shelf (COTS) software and the integration of high-reliability systems increase our vulnerabilities. This tutorial will describe a number of different attack vectors; we will then enumerate some of the problems of implementing security controls in safety-critical software systems. The closing sections will present a range of solutions that reduce the risks across a range of industries including transport, healthcare and SCADA/Industrial Control applications.

The tutorial style will be a mix of lectures to introduce topics and open discussion. Case studies of cyber-attacks will be drawn from air traffic management, nuclear, healthcare and military domains. There are no prerequisites.

Learning Outcomes

- » An understanding of recent attack methods.
- » Knowledge of state sponsored, advanced persistent threats as well as commercially motivated attacks.
- » An overview of the problems in improving cyber security in safety critical systems (including conflicts between safety and security standards).
- » An understanding of countermeasures (technical, organisational, human factors).

Biography

Chris is Professor and Head of Computing at the University of Glasgow. He was founding co-chair of the Scientific Advisory Board for the €3 Billion EC SESAR programme on the modernisation of Air traffic management. He has advised the European Commission (DG Move), the European Aviation Safety Agency and the UK CAA on cyber security. He has also assisted a number of UK airports as well as Aeroports de Paris and Schiphol airport on aspects of cyber resilience. Johnson also advises EDF and the UK nuclear industry on digital forensics within the civil reactor new-build programme. Prior to that he supported the United Nations on the cyber security of Chemical, Biological, Radiological and Nuclear facilities. He has held fellowships from NASA and the US Air Force.

Tuesday 27th September: 13.00 – 14.40

***Demystifying Human Performance Modelling:
An Absolute Beginner's Guide to Dynamic Human Reliability
Analysis***

Dr Ron Boring, Idaho National Laboratory, USA

Summary Description

This tutorial aims to introduce participants to the emerging field of dynamic human reliability analysis. While this topic may at first blush seem steeped in mystery and complicated statistics, this presentation will aim to clarify the topic by demonstrating how the basic concepts of dynamic modelling and simulation build on the fundamentals attendees already know from psychology or classic human reliability.



The tutorial is based on an interactive case study and will explore how we define basic tasks, quantify them, and link them together dynamically. These building blocks will provide a simple foundation that attendees can use to begin exploring dynamic risk modelling on their own. Examples will be provided to demonstrate how the key concepts can be applied to nuclear, aerospace, military, and petrochemical domains.

Learning Outcomes

Attendees can expect come away from the tutorial with an understanding of the key concepts of dynamic human reliability analysis and the ability to begin applying these concepts.

Biography

Ronald Laurids Boring, Ph.D., is a Principal Human Factors Scientist at Idaho National Laboratory, where he has worked as a researcher and principal investigator on projects for the U.S. Nuclear Regulatory Commission, NASA, the U.S. Department of Energy, the Canadian Nuclear Safety Commission, the Joint Warfare Analysis Center, and the Norwegian Research Council. He previously worked as a human reliability researcher at Sandia National Laboratories, a usability engineer for Microsoft Corporation and Expedia Corporation, a guest researcher in human-computer interaction at the National Research Council of Canada, and a visiting human factors scientist at OECD Halden Reactor Project. Dr. Boring has a Ph.D. in Cognitive Science from Carleton University. He was a Fulbright Academic Scholar to the University of Heidelberg, Germany. He has published over 170 research articles in a wide variety of human reliability, human factors, and human-computer interaction forums. He has served on the organizing committees for international conferences held by the Human Factors and Ergonomics Society, IEEE, the Association for Computing Machinery, and the American Nuclear Society

.....
Wednesday 28th September: 13.30 – 15.10

***Uncertainty Quantification and Global Sensitivity Analysis:
An Introduction***

Professor Emanuele Borgonovo, Bocconi University, Milan, Italy

.....



.....
Summary Description

In this tutorial, we shall provide the audience with a non-technical introduction to global sensitivity analysis and uncertainty quantification. We will address first the notion of sensitivity analysis settings, to show the variety of questions that can be answered through global sensitivity methods. We will then enter into the details of some of the main global sensitivity analysis methods, including variance-based methods and moment-independent methods. We will also address numerical aspects, underlying the notion of given data estimation.

.....

Learning Outcomes

- » How to conduct a global sensitivity analysis
 - » How to interrogate a computer code
 - » Knowledge of the main global sensitivity analysis methods
-

Biography

Emanuele Borgonovo is full Professor at the department of Decision Sciences. He is Co-Editor in chief of the European Journal of Operational Research and co-Chair of the Technical Committee on Uncertainty Analysis of ESRA. He has received several national and international awards. He is also a member of the Council of the Decision Analysis Society of INFORMS, and a member of the editorial board of several international journals. His research has been published in journals such as European Journal of Operational Research, Journal of the Royal Statistical Society Series B, Management Science, Operations Research, Reliability Engineering & System Safety, Risk Analysis, etc.

Thursday 29th September: 10.20 – 12.00

Reliability Assessment of Complex Systems

Professor Antoine Rauzy, Norwegian University of Science and Technology, Norway



Summary Description

This tutorial aims to present some important results and current challenges of reliability assessment of complex systems. The presentation will focus on issues related to models, modelling formalisms and assessment algorithms. The central question discussed in this tutorial will be “where the complexity (of reliability assessment) comes from?” We shall show that, aside the epistemic and aleatory uncertainties, the reliability/safety analyst faces a computational uncertainty that comes from the models, or more exactly from the combination of models and assessment algorithms. We shall introduce the concept of limited calculability, which can be seen as declension to reliability engineering of Simon’s concept of limited rationality of economical agents. Using this concept, we shall attempt to characterize features of systems that make reliability assessments complex. The tutorial will thus draw a panorama of current issues in reliability assessment of complex systems and will sketch a research and development program for the reliability engineering community.

The tutorial style will be a lecture followed by an open discussion with the audience. There is no pre-requisite for this tutorial, although some knowledge about modelling formalisms used in reliability engineering (e.g. fault trees, Markov chain, Petri nets) would be useful.

Learning Outcomes

- » Introduction to main computational complexity results related to reliability engineering.
- » Introduction to challenges raised by the reliability assessment of complex systems from a modelling point of view.
- » Panorama of current research and trends in this field.

Biography

Antoine Rauzy is currently Professor at the Norwegian University of Science and Technology (NTNU, Trondheim, Norway) and Head of the Chair Blériot-Fabre (CentraleSupélec, Paris, France). During his career, he has moved forth and back from academia (University of Bordeaux, CNRS, Ecole Polytechnique) to industry (Dassault Systèmes) and created start-ups (ARBoost Technologies). Antoine works on mathematical and algorithmic foundations of reliability engineering. He has developed several state-of-the-art algorithms and software (e.g. for fault trees and Markov chains assessment) and is the main designer of the AltaRica modelling language. He has published over 150 articles in international journals and conferences.

Special Sessions

Monday 26th September

13.45 – 15.25 Auditorium C: Level 3

Special session: Dynamic Risk Assessment in Oil, Gas, Chemical

Nicola Paltrinieri, ESRA Technical Committee on Accident and Incident Investigation

Tuesday 27th September

10.20 – 12.00 Room CR6/7 Level 3

Special Session: Foundational Issues in Risk

Terje Aven, ESRA Technical Committee on Foundational Issues in Risk Assessment and Management

Tuesday 27th September

13.00 – 14.40 Room CR8 Level 3

Special Session: Roundtable on Weaknesses in Safety and Reliability Practices

Roundtable on Weaknesses in Safety and Reliability Practices As Perceived By Industry

Sponsored by the UK Safety and Reliability Society

Tuesday 27th September

15.10 – 16.50 CR6/7 level 3

Special Session: Critical Infrastructures - Operationalisation of Resilience for Crisis Management

Ivonne Herrera, ESRA Technical Committee on Resilience Engineering

This will be an interactive session that will centre upon the use of innovation games in R&D projects. The session will be an integrated presentation across the named papers, rather than a sequence of 20 minute paper presentations as is the norm for other contributed sessions.

Wednesday 28th September

10.30 – 12.10 Room CR6/7 Level 3

Special Session: Visualisation of Risk

Lesley Walls, David Valis, Marcelo Alencar, ESRA Technical Committee on Risk Management

Wednesday 28th September

13.20 – 15.00 Auditorium Level 1

Special Session: New Strains of Society: Hidden, Dynamic and Emergent Vulnerabilities

Tor Grotan

Images of Risk

Exhibition of Finalists in Level 2 Foyer 25-29 September

Award of Prizes 16.30hrs Wednesday 28 September in Main Auditorium

Entries to the Images of Risk competition are being shown in various locations around the ESREL 2016 conference: on the screen savers, in the exhibition space and on the covers of our programme booklet.

All images are original and have been selected by ESREL 2016 participants to communicate an interesting aspect of their work. Although we have called the competition Images of "Risk", in this context we include safety, reliability, risk, resilience, maintenance and all related terms that fall within the scope of ESREL 2016.

An exhibition of the finalists are shown in the exhibition spaces. The finalists have been shortlisted because their entry communicated a striking image associated with their particular speciality which ranged from risk communication to statistical modelling.

A panel of judges led by Professor Andrew Curran, one of our plenary speakers, will assess the finalist images to determine the best in the student and non-student categories. All ESREL 2016 participants will be able to vote for their favourite electronically. Details of how to vote will be shared via the conference app.

Prizes will be awarded by the Principal of the University of Strathclyde, Professor Sir Jim McDonald.

ESRA Events

ESRA General Assembly

Monday 17.30 – 19.15

Main Auditorium, Level 2

The annual meeting of the ESRA General Assembly will be held this evening. Papers will be circulated by the ESRA Secretary to members. A buffet reception for members will follow the main meeting.

ESRA Plenary Panel Discussion

Thursday 29th September: 14.40 – 15.40

Main Auditorium, Level 2

Professor Terje Aven and Professor Enrico Zio will chair a panel comprising experts from the ESRA Technical Committees who will participate in an informal Question & Answer session on methodological and practical issues of broad interest regarding Safety and Reliability. The Questions will be collected during the conference from participants and will form the core of this interactive session.

ESRA Technical Committee meetings

ESRA Technical Committee on Land Transportation

Wednesday 15.30 - 17.00

Room CR2

ESRA Technical Committee on Risk Management

Wednesday 12.15 - 13.15

Room CR8

Social Events

Welcome Reception:

The Technology and Innovation Centre, University of Strathclyde

Sunday 25th September 2016: 18.00 – 20.00

Delegates are invited to join the welcome reception at the Technology and Innovation Centre for drinks.

Ceilidh Night: The Barony, University of Strathclyde, 1 McLeod Street, Glasgow, G4 0RA

Monday 26th September 2016: 19.30 – 22.30

Join us for an evening of fun and networking with a twist at The Barony where delegates will be able to take part in a Scottish Ceilidh. This is an event which involves teamwork and collaboration in dancing led by a Scottish folk band. It is where tradition meets innovation. Snacks will be served at this event, so we encourage you to eat before you arrive. There will be a cash bar available



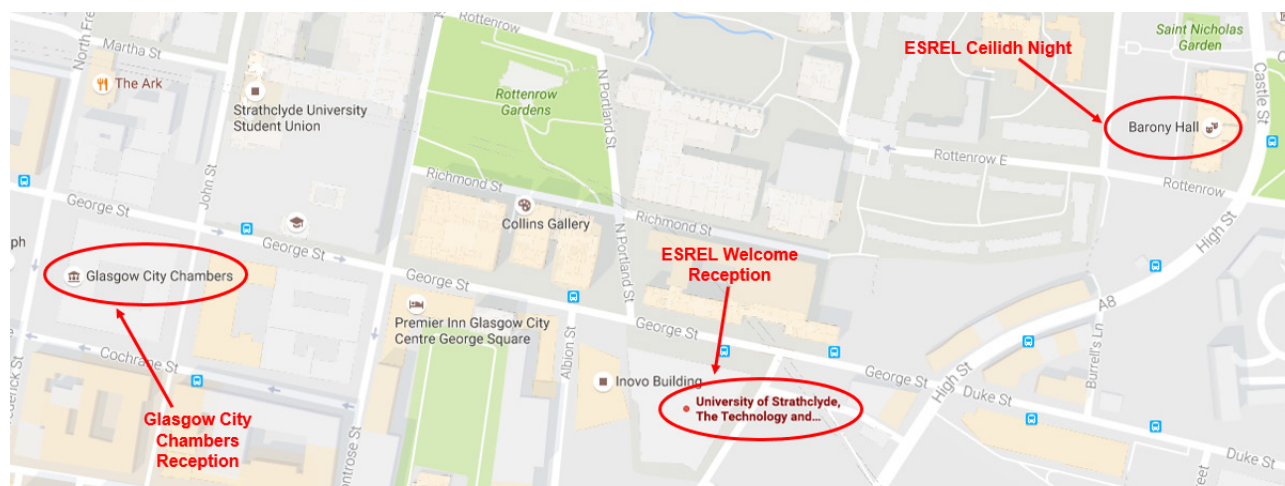
Glasgow City Chambers

Reception:

City Chambers, Glasgow, G2 1DU

Tuesday 27th September 2016: 18.15 – 19.30

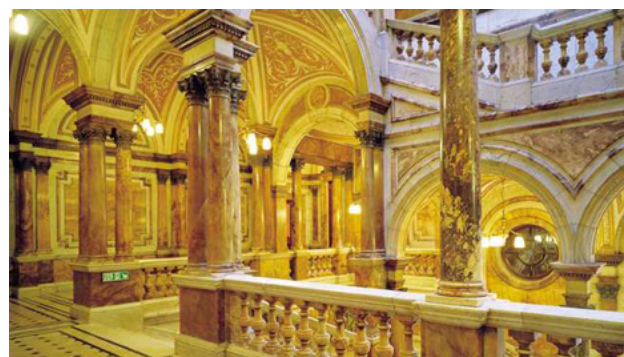
Join us at the Glasgow City Chambers for an evening of drinks in the surroundings of this historic building.



Conference Dinner: Kelvingrove Art Gallery and Museum, Argyle Street, Glasgow, G3 8AG

Wednesday 28th September 2016: 19.00 - midnight

The Conference Dinner will be taking place at the Kelvingrove Art Gallery and Museum, offering a spectacular setting to enjoy a combination of culture with a 3 course meal. You will have the opportunity to view the museum's collections during the welcome drinks reception.



By Foot

Kelvingrove is situated in Kelvingrove Park on Argyle Street and is easily accessible on foot. It is around 20 minutes' walk from the city centre along Sauchiehall Street. You can also access the museum via Kelvin Way.

By Subway

Glasgow Subway system is a easy to use and convenient way to access Kelvingrove Art Gallery. Buchanan Street station is about 5 minutes walk from TIC. From here, participants can access Kelvinhall or Kelvinbridge subway stations. The closest subway station to the Kelvingrove is Kelvinhall.

By Bus

First Bus services 2, 3 and 77 all stop outside the museum. Details timetables can be found on the first bus website <https://www.firstgroup.com/greater-glasgow/>

By Car

Kelvingrove Museum is situated on Argyle Street, around 6 minutes from the M8.

There is a pay and display carpark at the rear of the Museum. The current charge is £1 for a 4 hour stay. The car park also has 10 spaces reserved for blue badge holders. These spaces are free of charge and there is no time restriction.

A taxi from the City Centre to Kelvingrove Art Gallery and Museum should cost no more than £8.



General Information

CHANGES TO TECHNICAL AND SOCIAL PROGRAMME

ESREL 2016 organisers reserve the right to adjust or change the Technical and/or the Social Programmes as, if and when necessary.

CONFERENCE APP

The conference app is an easy way to plan your event schedule, access Extended Abstracts, get tips for eating out and about things to do in Glasgow. You can download the Guidebook App free for IOS and Android devices from the Apple App Store or Google Play Store. Once installed, you simply search for and download our very own ESREL2016 Guidebook. Note that the first download may take a little time as it downloads the Extended Abstracts, but later updates will be fast.

The conference app will be used to notify participants of any changes in the technical programme, and we recommend that you use this. A web version is also available and can be accessed via the guidebook site guidebook.com.

CONFERENCE VENUE

The Technology and Innovation Centre
University of Strathclyde
99 George Street, Glasgow, G1 1RD

CONFERENCE GUIDES

As well as the conference administrators who can be found at the Registration Desk throughout the conference, Strathclyde PhD students and post-doctoral researchers will act as Conference Guides. A Guide will be available in each room for contributed presentations and also generally available to help. Guides will be identifiable by their ESREL2016 t-shirts.

CATERING

Catering points will be located on levels 2 and 3. If you have a special dietary requirement and requested a special meal at the time of registering, please advise the catering staff who will attend to your needs.

EXHIBITION

We would like to thank all the ESREL 2016 sponsors and exhibitors, please visit them during the conference in the level 2 Foyer.

GUIDELINES FOR PRESENTERS AND SESSION CHAIRS

Each presentation has been allocated 15 minutes, with an additional 5 minutes for discussion. Please keep to the scheduled times so that the conference can run smoothly and participants can attend the talks they wish to see. Session chairs have been asked to keep exactly to the timetable.

Presenters should upload their presentation onto the presentation computers before their session using a USB memory device. The presentation computers have an ESREL 2016 directory structure that corresponds to the session location, day and time.

These computers are running the Windows operating system, and are preloaded with Windows 7, Powerpoint 2013 and Adobe Acrobat DC Reader software to display PowerPoint and PDF files. No other file formats are supported.

Presenters are strongly discouraged from using their own computers and should do so only in exceptional cases. Changing computers takes time away from other presenters and valuable discussions. In these special cases, presenters should verify that their presentation works by connecting their device to the projector in the room where they will present and trying their presentation out before their session. Conference staff will be there during the breaks to help.

Presenters should meet the Session Chair during the break before the session. They are encouraged to provide very short written biographical statements to the Session Chair in advance.

Discussion and Time keeping

Session Chairs have the responsibility to introduce the speakers, to lead the discussions, and to ensure that the session schedule is observed. Every effort should be made to keep to the 20-minute total time allocation for each presenter, in order that the next talk starts on time. In case a session presenter does not show up, the Session Chair should compensate, as much as possible, by allowing for appropriately extended discussion of the presented papers while maintaining the presentation sequence, and ensuring that the next speaker starts at the publicised time.

INTERNET ACCESS

Two free WiFi networks are available in TIC: Eduroam (for those with a pre-existing credentials) and The Cloud (for anyone). The Cloud requires you to create an account which you do with the following steps:

- » Select 'WiFi Guest' from the list of your available networks
- » Launch your preferred browser and click 'Get Online'
- » Select 'Free Wi-Fi Cloud'
- » If you have used _The Cloud elsewhere before, you can use the same credentials. If not, select 'Create Account' and enter all mandatory information requested.
- » Select 'Continue'

REGISTRATION DESK

All delegates will receive their badge holder with lanyard, pre-booked tickets and all relevant conference information upon arrival at registration on Level 2. The registration and information desk will be open at the following times:

- » Sunday 25th September 16.00hrs – 20.00hrs
- » Monday 26th September 08.00hrs – 17.00hrs
- » Tuesday 27th September 08.00hrs – 17.00hrs
- » Wednesday 28th September 08.00hrs – 17.00hrs
- » Thursday 29th September 08.00hrs – 16.00hrs

SECURITY

Your name badge must be worn at all times otherwise you will not be allowed entry to the main conference sessions.

SOCIAL EVENTS

Places at the social events are limited and could be selected during registration. Please ask at the registration desk for later ticket availability.

FIRST AID

Should you require any assistance please contact a University of Strathclyde staff member or a member of the In Conference Team located at the registration desk on Level 2.

All Conference Rooms are fitted with a phone which can make internal calls – dial 7000 for Reception, and 7010 for a Conference Host.

FEEDBACK

A survey will be sent out to you electronically on the last day of the conference which we would encourage you to complete. This will help to continually improve and develop the ESREL conference.

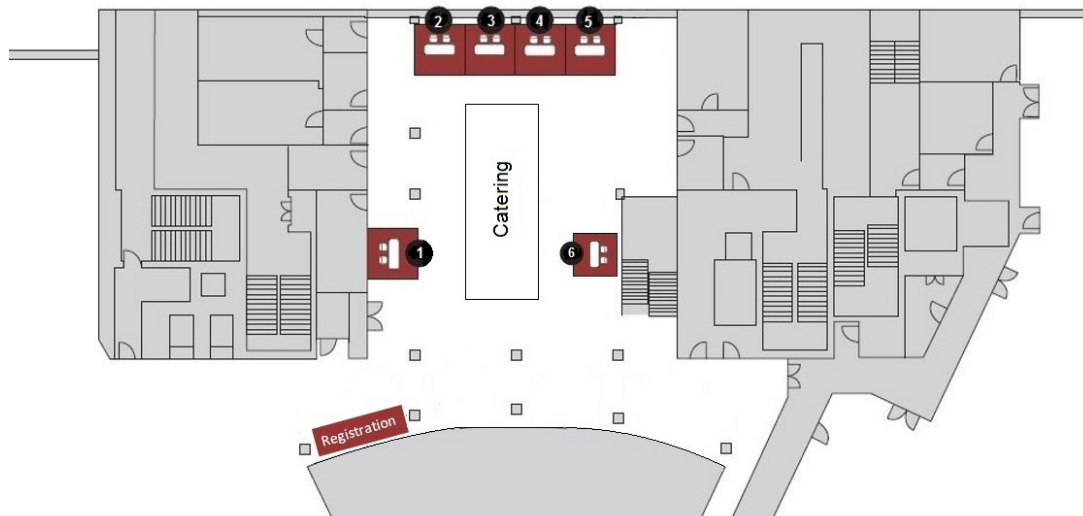
LANGUAGE

The official Language of ESREL is English

Exhibition Floorplan

The Exhibition will be located on Level 2 Foyer.

TIC - Level 2

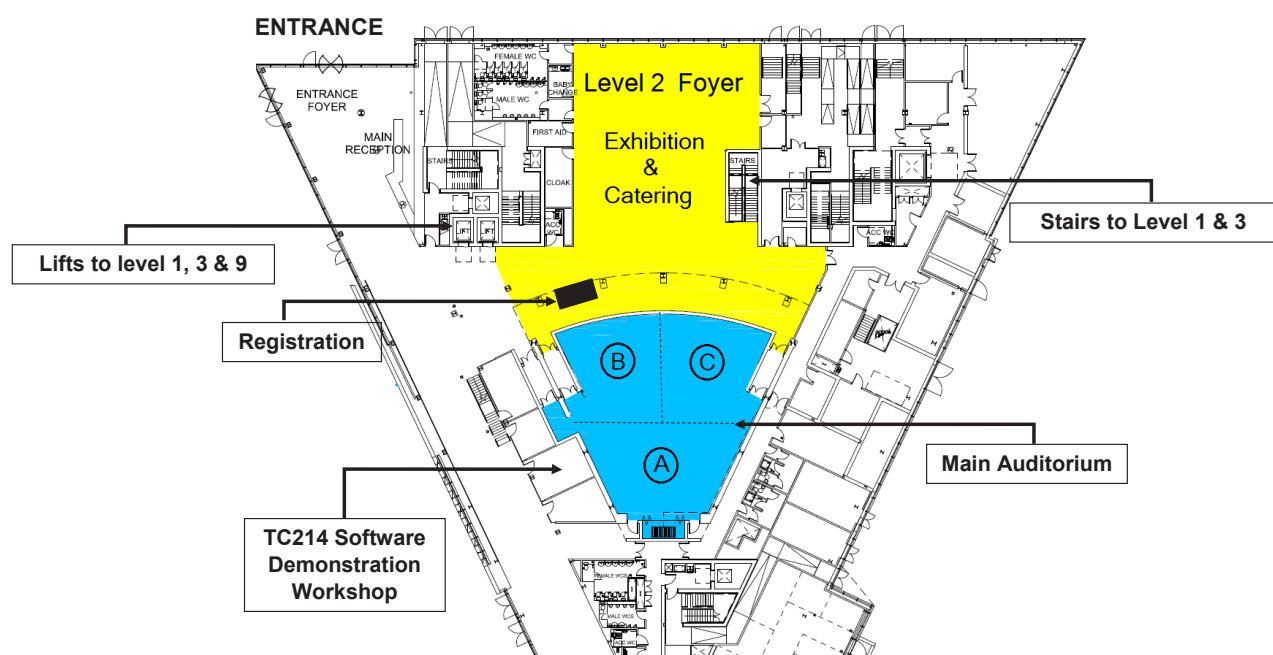


Exhibitor	Stand No
HBM United Kingdom (with Software Demonstration Workshop in room TC214)	1
Isograph Ltd	2
BQR Reliability Engineering Ltd	3
Atkins	4
BMT Group	5
SaRS (Safety & Reliability Society)	6

Technology and Innovation Building

Level 2

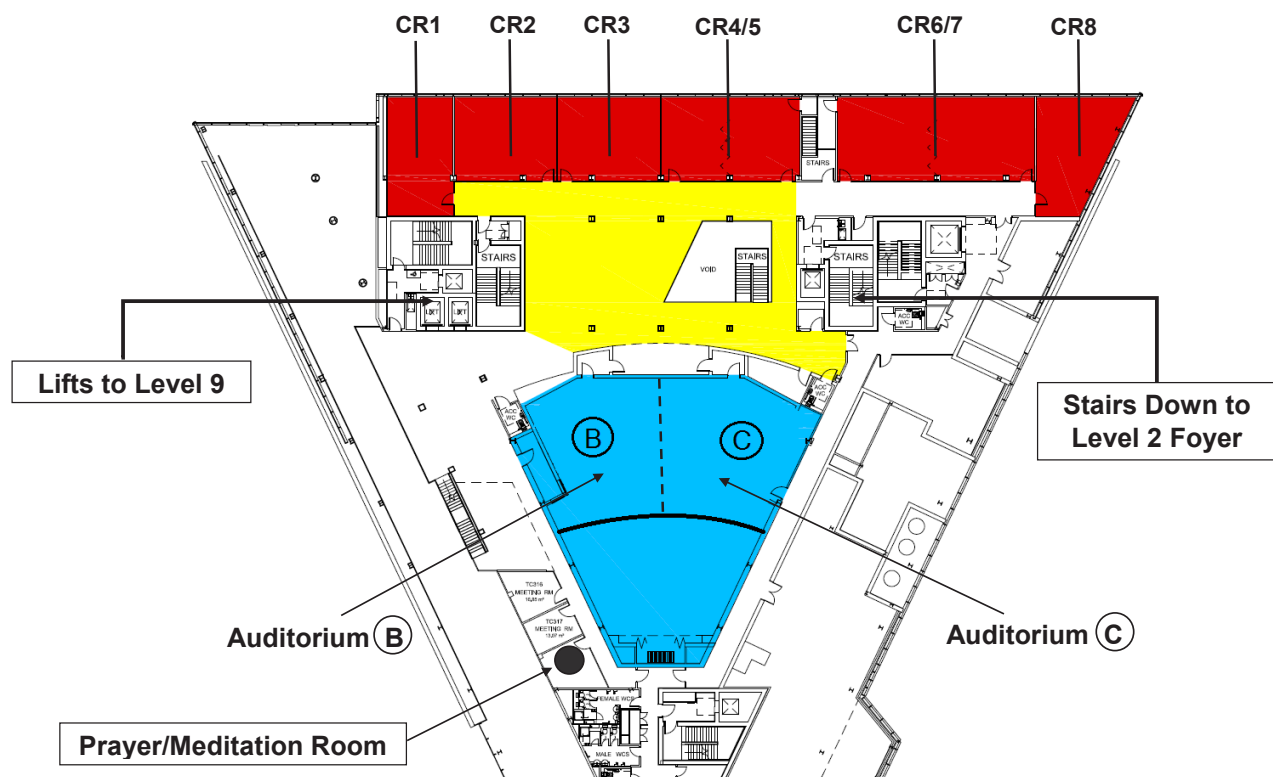
Level 2



Technology and Innovation Building

Level 3

Level 3



Technology and Innovation Building

Level 1

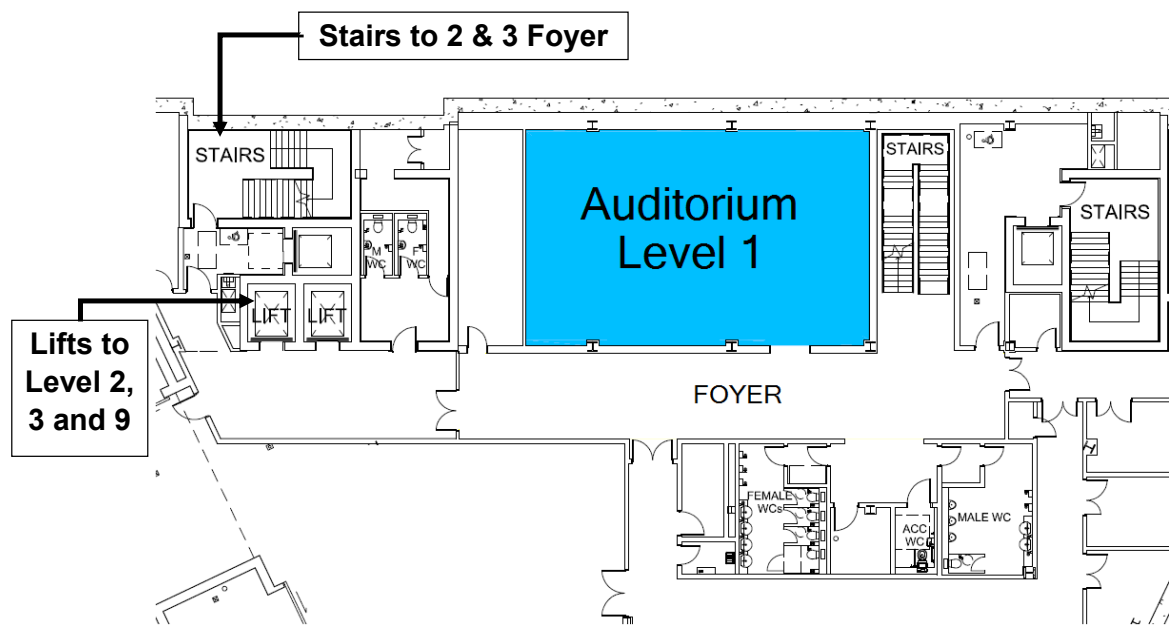




Image by Jennifer Lynette