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Fire Safety Science News

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Smoke emissions from smoldering fires can be lethal for humans and harmful to the environment. Here is an example of wood pellets burning. (Photo: Ragni Fjellgaard Mikalsen/EMRIS)

IAFSS was founded in 1988 with the primary objective of encouraging research into the science of preventing and mitigating the adverse effects of fires and of providing a forum for presenting the results of such research

Secretariat Office: Email: secretariat@iafss2017.org

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Our Aims
Fire Safety Science News aims to be a platform for spreading the work of IAFSS members, and to be the place where fire safety scientists can read what is not readily found elsewhere, thus favoring news and trending research. A digital archive of previous issues can be found online.

IF YOU HAVE NEWS TO POST TO THE WEBSITE

The newsletter only comes out twice a year, but the IAFSS website is always available for current association news and information. If you have information that you'd like posted on the website, contact the team of webmasters at webmaster@iafss.org and they'll help you out.

And now would be a good time to thank those webmasters – Michael Gollner, Nils Johansson, Terry Day and Xinyan Huang – for their hard work and help in keeping us informed!

LETTER FROM THE CHAIR

As I write these lines, we are into the last preparations for the 12th symposium in Lund. Already now we can announce that the symposium in Lund will be the largest in IAFSS history. We have 480 participants registered for the conference and all workshops are close to be fully booked. The new initiative with the MaCFP workshop and working group attracted more than 120 participants. It shows that the IAFSS symposium is a major fire safety science event in the world and it is a good indication for the future of our association.

Another success for the symposium is the fact that all our papers will be published in special editions of the *Fire Safety Journal*. As such, our papers have a full web of science status, which has become important for many researchers in their academic careers. We would like to thank especially Elsevier for this opportunity and also for their cooperation in providing the abstracts and the papers to the symposium participants. However it also means that all participants have to be aware that the papers provided to them are only intended for IAFSS 2017 symposium delegates and are not intended for mass distribution or posting online. If you, as an author, would like to share your article you can consult the sharing policy of Elsevier.

All these factors mean also that it puts more pressure on the organisation of our symposium. A symposium can be only a success by having all different committees working smoothly, in time and cooperate together. This is not an easy task and it requires understanding of each other's situation. We certainly can improve on this and it has shown that when the symposium becomes bigger and bigger, it also needs clear guidelines for each of the committees. However I would like to thank all members of all committees for their efforts, all authors for sending papers, posters, images, etc. and for presenting them at the symposium and of course all participants. They are too many to list, but all of them deserve words of appreciation. We often forget that our association is a non-profit organisation and that a lot is done on a voluntary basis.

This brings me in fact to the point that I would like to inform that we also are standing for the challenge of bringing our organisation in a new structure. Bit by bit we are putting into place guidelines and procedures for our working process so that it has a solid democratic basis and the next challenge for us is to find a new secretariat. Due to the retirement of Carole Franks at Interscience Communications, we are looking for a new solution on providing our secretariat. Not an easy task with respect to our non-profit status and extremely low membership fee. At the moment we have an interim situation for the secretariat and we are making our member registration more effective. But the most important thing is to thank Carole Franks and her team for all the effort and work she has put into our Association. There are not enough words to thank her and we wish her all luck now for the future!

Finally I do hope to see all of you in Lund. Enjoy the symposium! And give us constructive feedback on how we can become better.

Signed: Patrick Van Hees, Chair IAFSS, Lund University, Sweden

12TH INTERNATIONAL SYMPOSIUM ON FIRE SAFETY SCIENCE

The International Association for Fire Safety Science (IAFSS)'s 12th International Symposium on Fire Safety Science is fast approaching -- June 12–16, 2017 at Lund University, Sweden (http://www.iafss2017.se/).

Details on the symposium planning and some of the awards were included in the last newsletter. Check the conference website for up-to-date information.

Symposium activities begin on Sunday, June 11, with several workshops during the day and a Welcome Reception in the evening. The Symposium will also have poster sessions, which will provide an excellent opportunity to interact individually with researchers about their most recent work.

The next newsletter will include lots of information from the symposium. Hope to see you there!

Symposium Committees

12th Symposium Planning Committee
Co-Chair E. Galea
Co-Chair K. Boyce

12th Symposium Program Committee
Co-Chair A. Trouvé
Co-Chair B. Merci
Poster Chair: N. Liu

12th Symposium Workshops Committee
Co-Chair T. Hakkarainen
Co-Chair A. Steen-Hansen

12th Symposium Publications Committee
Editor: E. Weckman

12th Symposium Awards Committee (including best thesis)
Chair A. Hamins

12th Symposium Local Arrangements Committee
Chair D. Nilsson

12th Symposium Writing Mentor Program
Chair: C. Wade

Invited Speakers

- **Luke Bisby** (University of Edinburgh, UK) "Structural Response of Cross-Laminated Timber Compression Elements Exposed to Fire"
- **Karen Boyce** (University of Ulster, UK) "Safe Evacuation for All – Fact or Fantasy? Past Experiences, Current Understanding and Future Challenges"
- **Ritsu Dobashi** (University of Tokyo, Japan) "Studies on accidental gas and dust explosions"
- **Longhua Hu** (University of Science and Technology of China) "A review of pool fire behaviors in wind and challenges"
- **Birgit Östman** (SP, Sweden) "Fire safety engineering in timber buildings"

Proceedings to be Published in *Fire Safety Journal*

For the 12th IAFSS Symposium, and this for the first time, the Proceedings will be published as a Special Issue of the *Fire Safety Journal* (http://www.journals.elsevier.com/fire-safety-journal). Details on the transfer of the manuscripts from the EasyChair website used by IAFSS to the Elsevier website used by *Fire Safety Journal* as well as details on the composition of the Guest Editors team responsible for final publication decisions are still being worked out and will be clarified in the coming few weeks.

Announcing the Recipients of the Inaugural IAFSS Proulx and Magnusson Early Career Awards

The International Association of Fire Safety Science (IAFSS) is presenting two new awards, the Proulx and Magnusson Early Career Awards, at the 12th Symposium in Lund, Sweden in June 2017. Each of the awards consists of a grant of US$4000, a plaque, and free registration to the Symposium. Each recipient will also deliver at the Symposium a review paper drawn from their body of work.

The Proulx and Magnusson Early Career Awards recognise meritorious achievement by members of the IAFSS who are early in their careers and have contributed a body of work that is of significance to any area

of fire safety science. The two awards are distinguished by the period of time from completion of the candidates' most recent educational degree.

Proulx Award
The recipient of the inaugural 2017 Proulx Award is **Prof. Michael Gollner** from University of Maryland for his major scientific contributions to the understanding of flame spread, wildland and wildland-urban interface fire spread, and fire whirls. Michael is a rising star of the fire science community, an innovative engineer with great vision of the important issues in fire safety.

For the Proulx Award, candidates must be within five years from completion of their most recent degree at the time of nomination. The award commemorates Dr. Guylène Proulx (1960-2009), an expert in human behaviour in fire at National Research Council Canada, and IAFSS Board member at the time she passed away.

Magnusson Award
The recipient of the inaugural 2017 Magnusson Award is **Dr Anna Stec** from University of Central Lancashire for her major and lasting contributions in the field of fire chemistry and fire toxicity which she has applied to many areas of fire safety from material properties and risks to egress from fires. She is an excellent experimentalist with a sound understanding of fire dynamics and fire science.

For the Magnusson Award, candidates must be within five to ten years from completion of their most recent degree at the time of nomination. The award commemorates Prof. Sven Erik Magnusson (1938-2014), pioneer of parametric fires and risk management at Lund University, Sweden, and a driving force in creating the first education curriculum for fire safety engineering.

The awards subcommittee was chaired by Dr Guillermo Rein, and supported by Dr Anne Steen-Hansen, Dr Steven Gwynne and Prof Ritsu Dobashi as co-chairs from each of the IAFSS world regions. The help of 13 independent experts who contributed to evaluate the nominations is greatly acknowledged.

2017 Best Thesis Award

IAFSS Best Thesis Award "Excellence in Research" recognises the best research thesis at the PhD and Masters levels, in all the fields related to fire safety science and engineering. There are three such Awards for the three IAFSS regions – Europe/Africa, Americas, and Asia/Oceania. To be eligible for nomination, the nominee's thesis must have been officially submitted to the university granting the degree for examination between January 1st, 2014 and November 31st, 2016 and nominated for the Award by the nominee's supervisor.

The IAFSS Awards Committee received 13 excellent applications from 10 different countries for the 2017 Best Thesis Award. After a thorough review comprising three independent evaluations of all submissions, it is with great pleasure that we announce the three winners for this year. Despite the excellent quality of the submissions and very close runners-up, the panel chose the winners in unanimity. Each winner will have the opportunity to present his thesis work in Lund.

Asia/Pacific: Zihe Gao – USTC, China in collaboration with Ghent University (Belgium)

Studies on Characteristics of Confined Fire Plumes and Mechanism of Natural Smoke Exhaust by Shaft in Tunnel Fires - This thesis addresses a very relevant problem, tunnel smoke management, and uses a very broad range of tools (model scale experiments, computational fluid dynamics (CFD) simulations and dimensional analysis) in a rigorous and meaningful way. The results provide relevant information of practical use including new criteria for design. The work has been extensively published and the range of methods used have the potential to deliver high fidelity performance engineering tools. The comprehensive nature of this work and the rigour of the use of the different tools set this work apart from other submissions.

Europe/Africa: Cristian Maluk – University of Edinburgh, UK

Development and Application of a Novel Test Method for Studying the Fire Behaviour of CFRP Prestressed Concrete Structural Elements - This thesis includes the invention of a novel fire testing methodology/equipment (H-TRIS), which is important for fire engineering, especially for the research of fire spalling. H-TRIS provided very well controlled heating regime, which significantly reduces the 'randomness' of spalling tests, which is a known issue of conventional testing approach. In addition, the thesis presents timely research on the fire performance of modern, optimized concrete structural elements on both material and structural levels and presents improved understanding of the explosive spalling of concrete in fire. The work reported in the thesis has been published in peer reviewed

journals and the results of the thesis are novel, accurate, useful and add to our present knowledge of the mechanisms and prevention measure of fire spalling, which is an important yet resolved issue of concrete construction. The new test method can potentially benefit all researchers in the fire-spalling research field. H-TRIS has already been adopted widely. The demonstrated to-date impact of this work set it apart from all other submissions.

Americas: Ali Tohidi – Clemson University, USA

Experimental and Numerical Modeling of Wildfire Spread via Fire Spotting - This thesis makes several significant contributions to wildland fire science by improving the current understanding of firebrand transport during wildland fires. It focuses on developing a better understanding of the mechanics of spot fire formation through experimental investigations and computational modelling of ember lofting and transport. The dissertation demonstrates that firebrand transport models should account for atmospheric boundary layer velocity gradients, an important conclusion given that most implementations of firebrands spotting in operational models do not currently do this. The novelty of the approach and the rigour with which the thesis builds its arguments on the basis of exhaustive surveys of the literature sets this work apart from other submissions.

The Award consists of a plaque, a grant of US$2,000 to cover travel and sustenance related to the recipient's attendance at the 12th Symposium in Lund, Sweden, and free registration for the Symposium.

NFPA'S PHILIP J. DINENNO PRIZE AWARDED TO THE VERY EARLY SMOKE DETECTION APPARATUS (VESDA)

The National Fire Protection Association (NFPA) announced that Very Early Smoke Detection Apparatus (VESDA) is the technical achievement to receive this year's Philip J. DiNenno Prize. The award and $50,000 in prize money were presented at NFPA's Conference & Expo in Boston to David Packham, John Petersen, and Martin Cole. VESDA technology and its pre-eminent role in the global introduction of aspirated smoke detection or ASD has led to a major impact on public safety. Ample commendation was also given to deceased co-inventor and passionate advocate Len Gibson.

The prestigious DiNenno Prize recognizes groundbreaking innovations that have had a significant impact in the building, fire and electrical safety fields. The prize is named for the late Philip J. DiNenno, the greatly respected former CEO of Hughes Associates, in recognition of his extraordinary contributions to fire safety.

The VESDA innovation transformed the fire detection and alarm industry and inspired a whole new aspirated smoke detection area of technology. The installation of VESDA in telecommunication facilities, telephone exchanges, data centers, high technology manufacturing, industrial control rooms and other related facilities has had a significant impact on asset protection and business continuity. In addition, the very early smoke detection by VESDA provides life safety protection for employees working in these buildings.

VESDA technology allows for smoke detection over a very large, dynamic range, which means it can be used for both high and standard sensitivity alarm points typically seen in spot smoke detectors. VESDA has proven to be an adaptable technology that is ideal for effective detection in unique applications. For instance, VESDA has been successfully tested and used in road tunnels and zoo enclosures.

The DiNenno Prize was established in 2014 following DiNenno's passing in 2013. A prize committee considers nominations submitted from around the world. More information can be found at www.nfpa.org/dinenno.

BOOK REVIEWS ON THE FIRE SCIENCE REVIEWS WEBSITE

Fire Science Reviews (http://firesciencereviews.springeropen.com/) includes fire science book reviews on its website. The first review on the site was a review of *Temperature Calculation in Fire Safety Engineering* by Ulf Wickström. There is also a review of the 5th edition of the *SFPE Handbook of Fire Protection Engineering*. Additional reviews are planned over the coming months. Ask your publisher to provide a review copy to FSR before formal publication.

FSR continues to feature review papers in fire science. Sign up for alerts on the "About" page of the website. Downloads of the open access reviews continue to be robust with downloads ranging up to nearly 50,000 for the most popular paper. Citation rates are excellent.

2017 INTERNATIONAL FORUM OF FIRE RESEARCH DIRECTOR AWARDS

The International FORUM of Fire Research Directors has selected the recipients for the 2017 Sjölin and mid-career researcher awards.

THE FORUM SJÖLIN AWARD

The FORUM Sjölin Award recognizes an outstanding contribution to the science of fire safety or an advance in the state of the art in fire safety engineering practice of extraordinary significance. It is presented to the individual or group whose efforts are primarily responsible for or traceable to the specified advance. The prize consists of a plaque and an honorarium. Recipients of the award are selected annually and the awards are delivered at the triennial symposia of the International Association for Fire Safety Science, IAFSS.

The FORUM selected *Prof. Arnaud Trouvé*, University of Maryland, as the recipient of the 2017 Sjölin Award in recognition of his outstanding contribution to fire science and engineering through research in combustion science for over 25 years. Prof. Trouvé has produced numerous improvements of combustion models working with fire modelling including Computational Fluid Dynamics (CFD), zone modelling, direct numerical simulation (DNS) and large eddy simulation (LES) of turbulent reacting flows. His work also includes high-performance (parallel) scientific computing, cyber-infrastructure and application of data assimilation to fire and combustion.

Prof. Trouvé's interest in the physical modeling of fire-related phenomena has spanned the following areas: buoyancy-generated turbulence; turbulent combustion; soot formation and oxidation; combustion-generated toxic products; radiation heat transfer; wall surface heat transfer; water-based fire suppression systems; pyrolysis, material flammability and flame spread; flash fires, fireballs, and explosions; and wildfires propagation.

THE FORUM MID-CAREER RESEARCHER AWARD

The FORUM Mid-Career Researcher Award recognizes exceptional achievement and demonstrated leadership in the fields of fire safety science or fire protection engineering made by those in mid-career. It is intended to honor an individual, who is between the ages of 35 and 50 at the time of nomination. The prize consists of a plaque and an honorarium. Recipients of the award are selected annually and the awards are delivered at the triennial symposia of the IAFSS.

The FORUM selected *Dr. Randall McDermott,* National Institute of Standards and Technology, NIST, as the recipient of the 2017 Mid-Career Researcher Award. With this award, the FORUM is recognizing McDermott's outstanding contributions over the last decade as a lead technical developer of the Fire Dynamic Simulator (FDS) software and the architect of the latest versions of FDS. He has led technical efforts on the hydrodynamics and combustion solvers as well as the Verification Guide. FDS is most important in terms of use by practicing engineers, education, fire investigations, design of fire protection systems, etc. all over the world.

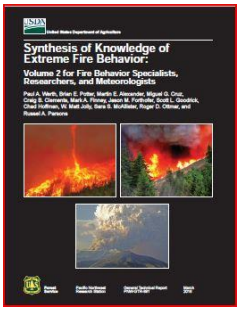
McDermott's specific contributions are numerous and have led to dramatic improvements in FDS's performance. Specific improvements include eliminating spurious vorticity at mesh boundaries and dispersion error in species transport, implementing the Deardorff turbulence model, near-wall stress models, the Turbulent Batch Reactor model, and developing the infrastructure for users to utilize detailed chemical kinetic mechanisms.

In summary, his work has been critical to the technical rigor and sophistication manifest in recent FDS developments, which are having a big impact on international fire safety.

Submitted: Björn Sundström, adj. prof., Ph.D., Chair of the International FORUM for Fire Research Directors

Towards the Understanding of Extreme Wildland Fire Behavior II

by Martin E. Alexander, Wild Rose Fire Behavior, Leduc County, Alberta



Wildfires exhibiting characteristics of extreme behavior continue to occur across wildlands and adjacent interface areas of the globe, often adversely impacting firefighters and the general public. For example, 14 citizens perished when fires unexpectedly swept through the town of Gatlinburg, Tennessee and other communities in the Great Smoky Mountains region of the USA in late November 2016. Nearly 135 people were treated for injuries suffered and more than 2400 structures were damaged or destroyed.

As reported on in the April 2012 issue of this newsletter, the first volume of a synthesis of knowledge of extreme wildland fire behavior intended for fire managers was published in 2011 by the U.S. Forest Service based on funding support from the Joint Fire Science Program. The second and final installment is now available. The second volume is much more technical in content and is primarily intended for fire behaviorists, although generalists will no doubt also find it of value.

Many cases of wildland fire "surprises" can be attributed to instances of extreme fire behavior. Hopefully, this recent publication will limit surprises in the future to just one's birthdays.

Werth, P.A.; Potter, B.E.; Alexander, M.E.; Clements, C.B.; Cruz, M.G.; Finney, M.A.; Forthofer, J.M.; Goodrick, S.L.; Hoffman, C.M.; Jolly, W.M.; McAllister, S.S.; Ottmar, R.D.; Parsons, R.A. 2016. *Synthesis of knowledge of extreme fire*

behavior: Volume 2 for fire behavior specialists, researchers and meteorologists. USDA Forest Service, Pac. Northwest Res. Stn., Portland, OR. Gen. Tech. Rep. PNW-GTR-891.
https://www.treesearch.fs.fed.us/pubs/50530

NEWS FROM MEMBERS

News From Hestia Platform, Prime Institute – University of Poitiers – France

Simon Roblin's PhD Defense: Numerical study of solid fuels auto-ignition using Direct Numerical Simulation: Application to the Polymethyl methacrylate.

Simon defended his thesis on the 12/16 in Pprime Institute. Supervised by Prof. Thomas Rogaume and Dr. Franck Richard, this thesis was supported by Calyxis association and was focused on the solid fuels auto-ignition. By a DNS approach (using FDS), Simon has identified two ignition regimes and brought to the community a better understanding of this brief and local phenomenon. By a modification of a solid density and an analysis of the characteristic times in both phases, he demonstrates that auto-ignition was always piloted by the solid phase. However, for high densities, the ignition takes place locally in the gas phase (1.5 mm above the surface), while, for lower densities, the ignition occurs at the solid surface. The characteristic times imputable to the solid phase is around 60 % for high densities against more than 90% for the lower ones. Few phenomena in the gas phase were identified too like the mixture fraction at ignition. For high densities, the ignition takes place in a rich zone in terms of mixture fracture fraction while this one is equal to the stoichiometry for the lower densities. All of these results confirm the observations and the assumptions formulated by Niioka, Fernandez Pello and Torero about solid fuels auto-ignition.

This work has been lead in collaboration with Prof. Arnaud Trouvé and the University of Maryland with the support of the French Government program "Investissements d'Avenir" (LABEX INTERACTIFS, reference ANR-11-LABX-0017-01).

The defense's jury was presided over by Prof. Bart Merci (Ghent University) and composed of Prof. Jose L. Torero (University of Maryland), Prof. Bernard Porterie (Marseille University), Prof. Arnaud Trouvé (University of Maryland), Dr. Franck Richard (Poitiers University), Prof. Thomas Rogaume (Poitiers University) and Dr. Catherine Sztal Kutas (Calyxis). We would like to thank all the members of the jury and wish Simon good luck in his future projects!

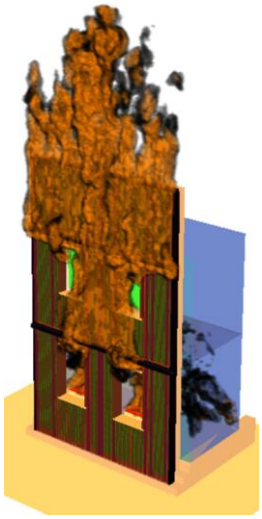
STUDY OF LEPIR 2 TEST APPLY TO WOOD FACADE

In April 2016, Pprime Institute in collaboration with FCBA institute (Bordeaux) began a research project to help the wooden construction industry. With the strong development of that material especially in building facade, that sector needs to strengthen fire safety and to develop dedicated digital fire simulation tools in order to study and propose new constructive solutions, for the increase of the security aspects.

This study is jointly led:

- By Huy Quang Dong (post-doctoral) for modeling of the structure and the pyre of LEPIR 2 test to simulate fires with FDS code in its standard version in order to identify the actual locking points of this code in this specific application.
- And Julien Sauvagère (PhD. Student) for the improvement of the model by a numerical and experimental multi-scale approach. This approach will focus on a study of the pyre and the thermal decomposition, inflammation and propagation of the flame on the facade.

  LEPIR 2 test and its FDS simulation:



Xiaowen QIN, a new PhD on the numerical simulation of the burning behavior of composite materials

Xiaowen QIN began his PhD study on September 2016, working with Prof. Thomas ROGAUME, Dr. Franck RICHARD and Dr. Benjamin Batiot. He got a CSC scholarship and he will focus on numerical simulation of the burning behavior of carbon composites materials: Application on fire safety of new generation of aircraft. His work is specifically concentrated on the simulation of the thermal degradation process of this specific material, using the Firefoam code.

Oin Xiaowen

Le Van Minh PhD on the Modeling of finite rate chemistry effects in the combustion of solid fuels relevant to fire safety problems

The thesis of Le Van Minh began 01/10/2016 in the framework of cooperation between research departments: University of Maryland (UM), USA; University of Poitiers (UP), France under the supervision of Prof. Thomas Rogaume, Dr. Franck Richard, Dr. Jocelyn Luche at UP and Prof. Arnaud Trouvé at UM. In detail, the present project is aimed at bringing more detailed information on solid decomposition chemistry and gas-phase combustion chemistry into CFD-based fire models. Detailed information on chemistry is required for a description of ignition and extinction phenomena as well as a description of soot formation and the emission of toxic products. The objective of the thesis is then to implement and resolve a detailed chemical kinetic model into the CFD fire model FireFOAM. This work is financially supported by the French Government program "Investissements d'Avenir" (LABEX INTERACTIFS, reference ANR-11-LABX-0017-01).

Le Van Minh

Signed: Thomas Rogaume, University of Poitiers

News from Aalto University, Finland

The Fire Safety Engineering group was founded at Aalto University in 2014. The group, led by Associate professor Simo Hostikka, has its home in the department of Civil Engineering. We are currently five full-time doctoral students, one visiting doctoral student and university lecturer Djebar Baroudi. Djebar mostly works with structural mechanics but has years of experience in fire research from VTT. Last year, we also had the pleasure of having Dr. Kaiyuan Li as a research fellow in the group.

The Aalto FSE researchers are shown in the photo. Top row: doctoral students Dawei Zhang (visiting student, evacuation modelling), Shakil Saani (high-strength steel, supervised by prof. Puttonen), Deepak Paudel (fire barrier reliability analyses), Rahul Kallada Janardhan (fire modelling for large steel structures), and Evan Cummings (wood pyrolysis

modelling using Material Point Method, co-supervised by prof. Solowski). Bottom row: Simo, university lecturer Djebar Baroudi, and doctoral student Teemu Isojärvi (thermal radiation modelling).

Three years have gone by quickly, setting up fire-related courses within the Building Technology master's program and starting the research activities. The first research project to be completed at Aalto was about pressure management in apartment fires. The experimental part demonstrated the failure of light-weight structures due to the pressure increase in a closed apartment and the danger of inwards-opening exit doors. The modelling part first validated the simulation tools using experimental data and then investigated the influence of air-tight construction practices on the risk of pressure-related failures.

More information from https://blogs.aalto.fi/fire/pahahupa/.

The findings have already found their way to the draft of the new fire part of the Finnish building code.

News from the University of Edinburgh

New appointments

Prof Grunde Jomaas has been appointed as the new BRE Chair of Fire Safety Engineering. Grunde adds new strengths to our combustion and fire dynamics expertise in addition to new topics such as in-situ burning of oil, PV panel fire safety and microgravity flame spread. **Dr Angus Law** has joined us in the newly created position of BRE Lecturer in Fire Safety Engineering. Angus brings experience of fire engineering design, consulting and structural fire engineering. These new appointments will allow us to continue to shape fire safety engineering education and research with BRE and the BRE Trust.

Having recently successfully defended their PhD theses, **Eric Mueller** and **Jan Christian Thomas** have joined us as Postdoctoral Research Associates in the growing area of wildfire research. They will work with Dr Hadden on projects to understand the multi-scale combustion processes in wildland fires and coupling fire behavior to firebrand flux generation, respectively. They will be joined by **Dr Bhisham Dhurandher** who will work on a NIST-funded project to develop an integrated system for firebrand flux and condition measurements from wildfires.

Ruben Van Coile recently joined the Challenging Risk project, a cooperation between the University of Edinburgh and UCL, focusing on the performance-based assessment and design for fire and earthquake hazards. Specifically, Ruben is investigating target safety levels for probabilistic structural fire design and aims to derive from these target safety levels a simplified safety format for deterministic design calculations. Previously, Ruben has worked as a structural and fire safety engineer after obtaining his PhD on structural fire safety engineering from Ghent University.

Dr Zafiris Triantafyllidis has also joined the Challenging RISK project and is building on his PhD work to assessing the structural performance of fibre reinforced intumescent coatings. His work is aimed at better understanding and optimizing the mechanical contributions of these components to the structural and fire performance of structural elements, in collaboration with industry.

Ulises Rojas Alva is a new PhD student supervised by Grunde Jomaas and Rory Hadden. His PhD project focuses on burning of solid materials in microgravity environments. Along with Grunde Jomaas, he took part in two parabolic flight campaigns in Merignac during October and November 2016, organized by CNES and ESA, respectively. Currently, he is developing a new Upward/Downwards Flammability Apparatus following the ISO 14624-1:2003 standard. In addition, he is the new member of the International topical team for the Spacecraft Fire Experiment (SAFFIRE) project, which is managed by NASA in collaboration with ESA, ZARM, CNES and JAXA. **Martina Manes** has started a PhD project to investigate the resilient design of steel structures for fire. She is supervised by Dr David Rush and is currently investigating the use of fire statistics to approximate the cost of fires with respect to different building types.

Good news

We are delighted that BRE Centre alumnus **Dr Cristian Maluk** has been awarded the IAFSS Best Thesis Award (Europe and Africa) for his PhD thesis entitled *Development and Application of a Novel Test Method for Studying the Fire Behaviour of CFRP Prestressed Concrete Structural Elements* (available here). This work was supervised by Prof Luke Bisby at Edinburgh, in collaboration with Dr Giovanni Terrasi from the Swiss Federal Laboratories for Materials Testing, who is also a Research and Visiting Professor at Edinburgh.

BRE Centre PhD Student **Felix Wiesner** won the SFPE UK Chapter's "Best Fire Research Project" for 2016 for his undergraduate thesis project entitled "Alternative Assessment Methods for Localised Fire Exposure". The work investigated the asymmetrical increase in temperature in the flanges and web of an I-section steel column when exposed to a bin fire. This contributes knowledge for structural fire design in large open spaces with isolated

fuel sources, where a flashover is unlikely to occur and traditional fire protection requirements might therefore not apply.

Ben Ralph recently completed his 6 months as a Guest Researcher at NIST. He worked with the Engineered Fire Safety Group on the development of FDS; implementing transient transport of species, energy and mass in the HVAC 1D solver. The visit enabled an upcoming collaboration with NIST to introduce a much needed tunnel validation section into the FDS Validation Guide.

Dr Hadden was awarded funding from NIST to develop an integrated system for the detection and risk evaluation of firebrands generated from wildfires. This one year project will deliver a new approach to quantify fire brand fluxes automatically to better understand the risks posed.

Drs Welch & Rush were awarded funding from the Research Fund for Coal and Steel (RFCS http://ec.europa.eu/research/industrial_technologies/rfcs_en.html) for "TRAFIR", a structural fire engineering project focusing on non-uniform transient fire exposures, or "travelling fires". The project extends to testing (isolated elements and simplified fire progression, as well as a full-scale large compartment) and modelling (both simplified analytical/phenomenological models and CFD). The industrial lead is ArcelorMittal and the other project partners are University of Liège, University of Ulster and SP. The Edinburgh contribution to the proposal was developed with input from final year PhD student **Xu Dai** who is due to present a review paper on the topic at the Lund IAFSS symposium.

Xu Dai was also short-listed for the International Research Award sponsored by the BRE Trust and the Worshipful Company of Constructors, on the theme of the digital built environment; Xu's project proposal was titled "An Open Source Computational Tool for Simulating the Response of Structures in Fire for the Build Environment".

Research updates

Last autumn, the experimental work for the *Compartment Fires or Tall Timber Construction* project, led by **Dr Hadden** and supported by Arup, was successfully completed. This series of experiments systematically investigated the effects of exposed engineered timber on the fire dynamics in large-scale compartments. The initial outputs from this work will be published at the next Symposium.

Dr Hadden has also recently returned from a set of large scale wildfires in New Jersey. These fires were undertaken as part of the Joint Fire Science Program-funded project *Measurement of firebrands generated during fires in pine-dominated ecosystems in relation to fire behavior and intensity.* Novel measurements of wildfire behavior were made to link the firebrands collected to the fire behavior. The project is also assisting in linking wildfire behavior to fire severity.

Concluding in 2016 was the 3.5 year FireComp project on the "thermo-mechanical response of composite pressure vessels in fire" (http://www.firecomp.info/). Air Liquide were the industrial lead and the final dissemination workshop was held at their headquarters in Paris on 11 May, with contributions from the Edinburgh team (work done by post-doctoral researchers **Paolo Pironi** and **Juan Hidalgo Medina**, and led by **Drs Welch & Hadden**) and the other research partners CNRS Pprime/Lemta, LMS Samtech, Ineris, Hexagon Composites and HSL. The key outputs of the project were presented, and the same event was aired as a webinar, facilitating interactions with a range of interested parties around the world. The project summary ("publishable") report, along with links to a large number of research papers, is available online (http://www.firecomp.info/fileadmin/user/PDF/FireComp_FinalReport_PublishableSummary.pdf) with further publications in preparation.

Open positions

We are seeking applications for PhD studentships in the following areas:

- External Fire and Smoke from Fuel Rich Compartments
- Facade Failure Mechanisms and Risks in Fire
- Quantifying the Thermomechanical Resilience of Cross-platform Advanced Composite Materials Exposed to Fire Conditions
- Understanding the heat transfer, pyrolysis, and ignition of wildland fuels
- Pushing the boundaries of fire modelling

IMFSE update

The group was delighted to host **Dr Wolfram Jahn** as an IMFSE visiting scholar for two weeks in March. Wolfram contributed to teaching on CFD and gave a fascinating update on fire research at Pontificia Universidad Católica de Chile. He also interacted with the IMFSE thesis students, of which the group is currently hosting four working on topics the following topics; cable heating in fires, appraisal of fuel and mechanical loads in buildings,

predictions of structural collapse due to fire and the effects of insulated boundaries on compartment fire dynamics (latter co-supervised with Juan Hidalgo Medina at UQ).

IAFSS Symposium

The group has several presentations at the upcoming Symposium, covering topics such as wildfires, engineered timber compartments, flammability, tunnel fires, thin-layer spill fires, travelling fires and structural fire engineering. We look forward to seeing you there!

You can keep up to date with the latest news from Edinburgh by following @edinburghfire, facebook.com/EdinburghFire or visiting www.fire.eng.ed.ac.uk.

Signed: Rory Hadden, University of Edinburgh

News from Ghent University

Book on Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures

Prof. Bart Merci and Dr. Tarek Beji wrote the book 'Fluid Mechanics Aspects of Fire and Smoke Dynamics in Enclosures'. It is available online at https://www.crcpress.com/Fluid-Mechanics-Aspects-of-Fire-and-Smoke-Dynamics-in-Enclosures/Merci-Beji/p/book/9781138029606 The book can serve as handbook at undergraduate and starting researcher level on fire and smoke dynamics in enclosures, giving fluid mechanics aspects a central role.

The scope ranges from the discussion of the basic equations for turbulent flows with combustion, through a discussion on the structure of flames, to fire and smoke plumes and their interaction with enclosure boundaries. Using this knowledge, the fire dynamics and smoke and heat control in enclosures are discussed. Subsequently, a chapter is devoted to the effect of water and the related fluid mechanics aspects. The book concludes with a chapter on CFD (Computational Fluid Dynamics).

The authors have attempted to write a book where the theory is illustrated by worked-out examples and the reader is challenged to complete additional clarifying exercises. The book is useful for teaching purposes, but at the same time should prove a useful tool for starting researchers in the field of fire safety science, providing in-depth insight into fluid mechanics in relation to fire phenomena.

PhD Setareh Ebrahimzadeh

On 21 December 2016, Setareh Ebrahimzadeh defended her PhD entitled 'Extensive Study of the Interaction of a Hot Air Plume with a Water Spray by means of CFD Simulations'. Prof Bart Merci is the academic supervisor. In the PhD thesis, a comprehensive study is performed on the influence of several parameters on the simulations of thermal plumes and water sprays in the context of spray-plume interaction. The simulation results are divided into three sections, including Large Eddy Simulations of 1) thermal plumes in the absence of water sprays, 2) water sprays in the absence of thermal plumes, and 3) the interaction between waters sprays and thermal plumes. The extensive sensitivity study performed for hot air jet plumes impinging onto a horizontal ceiling reveals the importance of parameters such as the level of turbulence intensity imposed at the inlet and the turbulence model constant on the plume evolution and the induced ceiling flow. The number of parcels per second injected into the computational domain and the type of droplet distribution modeling are shown to have a significant influence on the prediction of spray characteristics. It is also confirmed that the interaction boundary of the spray with the jet moves up from the base of the plume by increasing the convective heat release rate of the hot jet.

Submitted: Prof Bart Merci, Ghent University

News from Danish Institute of Fire Technology (DBI)

FIRETOOLS

The EU sponsored FIRETOOLS project is now in its closing stages. The project been running for four years and most of the work is now focused on analysing the collected data and dissemination of the research. The five PhD students that were a part of the FIRETOOLS project are also busily finalising their dissertation documents. It has been a fruitful four years for FIRETOOLS, with many publications and research reports. The latest publication that has been accepted is in the Fire and Materials journal is entitled "*Uncertainties in modelling heat transfer in fire resistance tests: A case study of stone wool sandwich panels*" and was written by K Livkiss, B Andres, N Johansson and P van Hees. At the Fire and Materials conference in San Francisco this year, Blanca Andres presented work performed during her

secondment at the University of Edinburgh whilst Konrad Wilkens presented work on the fire behaviour of foam/fabric composites.

Final tests of the FIRETOOLS project

In addition, PhD students Konrad Wilkens and Karlis Livkiss won the coveted "Golden pine cone" for the best team average result in the 2016 Christmas Tree Heat Release Rate Prediction Competition, organised by the fire research division at NIST.

Façade activities

DBI has recently initiated a number of projects focused on the study of façade fires in modern constructions. This has started with the commencement of an experimental postdoc aimed at developing a reduced-scale experimental methodology by Martyn McLaggan, who recently received his PhD from the University of Edinburgh. The project is sponsored by Innovation Fund Denmark and will be partnered by a modelling postdoc, both of which are in collaboration with Lund University. In addition, DBI will be running two highly instrumented full-scale experiments in collaboration with KICT, a Korean research institute, using their state-of-the-art facilities.

Fire Forecaster

In October 2016, Niklas Kasenburg started as an industrial PostDoc on the Fire Forecaster project at DBI. The goal of the project is to look at data from fire tests performed at DBI to build a model that is able to predict the outcome of such tests. The model will automatically learn patterns in the data that are related to the test outcome with the help of machine learning.

Signed: Martyn McLaggan, Karlis Livkiss & Niklas Kasenberg, DBI, Denmark

IMFSE SFPE Student Chapter

A group of IMFSE postgraduates, who are currently PhD researchers at the partner institutes of IMFSE, have recently initiated the IMFSE student chapter of SFPE which was successfully approved in Oct 2016. The chapter board is upheld by John Barton and Silvia Arias at Lund University, Carmen Gorska Putynska at the University of Queensland, Simon Santamaria at the University of Edinburgh, and Davood Zeinali at Ghent University.

The IMFSE student chapter is meant to provide a platform for promotion of fire safety education, practice and awareness. This objective is to be advocated by the IMFSE cohorts, as a multinational group of capable engineers with a special interest in fire safety. With the help of the IMFSE students, relevant talks are planned in the chapter, given by fire safety experts, such as active fire researchers, professors in the field, experienced consultants, and IMFSE students themselves when they have attractive findings, an inspiring thesis, or a puzzling topic or question to reflect on. Other activities in the chapter could involve free-discussions or any other social event or relevant activity that members may think of. Occasionally, SFPE offers attractive technical webinars too which are free for the members.

The chapter has had three events so far. The first event was a fire industry presentation at Ghent University in Nov 2016 which aimed to stimulate discussion concerning the career prospects and challenges of fire engineering in Belgium and abroad, conveyed by former IMFSE students Ir. Bart Van Weyenberge and Ir. Arne Inghelbrecht, who are currently working with Fire Engineered Solutions Gent (FESG). The second event was integrated with the *3rd IMFSE Fire Safety Engineering Day* in Lund in Feb 2017, providing a briefing on the activities that the chapter hopes to arrange together with the students during 2017 and how the students could get more involved with the chapter. The final event also concerns a lecture given by Dr. Michael Spearpoint, Associate Professor at the University of Canterbury in New Zealand, titled '*Why don't we just put sprinklers everywhere and forget about fire engineering design?*' on March 27, 2017, in Gent.

If you have any suggestions or questions, do not hesitate to keep in touch with the chapter board.

Signed: John Barton

News from the International Master of Science in Fire Safety Engineering (IMFSE)

At the moment of writing, the applications for the new student intake have just been finalized, resulting in a list of very strong candidates. The IMFSE board is pleased to see that many good students from around the globe find their way to the programme. The next intake will start the programme in September 2017.

The applications for self-sponsored students are still open until 30 April 2017, so candidates who missed the scholarship call, can still join self-sponsored!

With more and more IMFSE alumni on the labour market, more and more success stories can be shared. For this newsletter, we want to put 2 alumni in the picture:

- **Nick Bartlett** (cohort 2010-2012) was recently accepted as a program evaluator for ABET. In this role he will evaluate undergraduate fire safety engineering programs to ensure the standards of the profession are upheld. Nick also recently assisted in the fire investigation at Ghost Ship Fire in Oakland, California.

- **Oriol Rios** (cohort 2011-2013) joined the Prevention & Safety Engineering Expertise section in the Safety Engineering and Environmental Protection Group in CERN. His role is to give general advice on fire safety issues in CERN facilities and to participate in the future circular collider (FCC) conceptual design study regarding fire safety. The FCC is foreseen to have an about 100km long tunnel dug hundreds of meter below ground level. It should allow to multiply by 10 the current LHC (27km) energy (reaching 100 TeV). The infrastructure poses unique problems in terms of fire safety, evacuation and performance base design which are considered a great opportunity to challenge the FSE field.

Do check out our Facebook Page for pictures and more info about past events (including the graduation ceremony on June 26), and get a glimpse of the IMFSE student life via our student blog!

Signed: Elise Meerburg, IMFSE, Ghent University

News from Luleå University of Technology

A selection of interesting bachelor and master theses

Full reports can be found on the LTU website http://pure.ltu.se/portal/en/studentthesis/search.html.

Temperature distribution and charring penetrations in timber assemblies exposed to parametric fire curves - Comparisons between tests and TASEF predictions

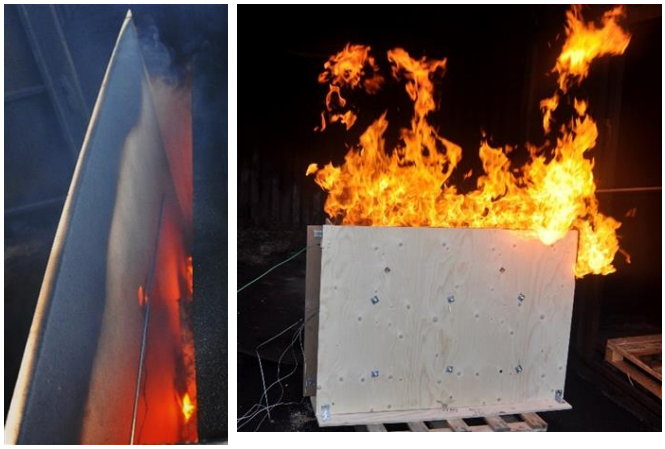
Authors: Isac Andersson and Niklas Ek
Supervisor: Ulf Wickström and Daniel Brandon

Timber beams were tested in a furnace exposed to parametric fire curves assuming opening factors of 0.02 $m^{1/2}$ and 0.04 $m^{1/2}$ according to Eurocode. Temperatures were carefully measured at several depths and compared with temperatures calculated with the finite element code Tasef. Predicted temperature distributions and charring depths were in general very good. Thermal properties as given in Eurocode were assumed. As shown in the diagram the predicted charring depth matched well with the measured in the heating phase.

Experimental fire study of Expanded Polystyrene insulation in concrete and lightweight concrete wall constructions

Author: Jacob Nellgård
Supervisor: Ulf Wickström

When expanded polystyrene insulation is burning and melting downwards in a slot between boards like in a wall the process is very slow. It burns like a candle as shown in the left picture. Notice that the boards of plywood and MDF are not even blackened except at the very top due to the ignition source. Further down they are just pre-heated. Not until the EPS had burnt all the way down to the bottom ignited the combustible boards by the EPS "pool fire" and burnt vigorously, see left picture. This study shows that EPS built in walls can burn very slowly and not be discovered initially but at much later stage develop into an intense fire.



EPS burning slowly in the gap between a wooden fiberboard and concrete wall. Not until all the EPS was burnt to the bottom, the wood started to burn vigorously.

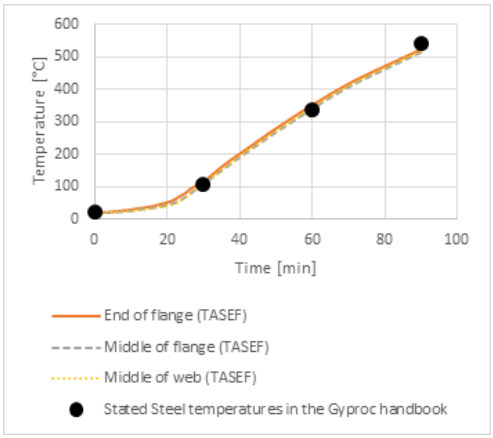
EPS burning slowly in the gap between a wooden fiberboard and concrete wall. Not until all the EPS was burnt to the bottom, the wood started to burn vigorously.

EVALUATION OF THERMAL PROPERTIES OF GYPSUM BOARDS -Determination of thermal conductivity based on cone calorimeter tests

Author: Johnny Chung
Supervisor: Ulf Wickström

This study describes how the thermal conductivity of gypsum at elevated temperatures can be determined based on small scale cone calorimeter tests. The aim is to be able to predict temperature of for example fire exposed protected steel structures by using computer programs like Abaqus or Tasef.

In this study a steel plate insulated on top by a gypsum board of the same size 100 mm by 100 mm was exposed to radiation in the cone calorimeter. The specimen was insulated on all sides and bottom to achieve well-defined almost 1-D thermal conditions. Finite element calculations with Tasef were then performed where the input conductivity was altered until best fit was obtained between calculated and measured steel temperatures. The specific heat or the specific volumetric enthalpy considering effects of water content and chemical reactions was kept unchanged according to values found in the literature. Then the conductivity as obtained by the small scale tests were applied to an analysis of an insulated steel section as shown in the figure below. The temperatures then computed matched very well with data found in a manufacturers' catalogue as shown in the diagram below.



Determination of the conductivity of insulation boards made of calcium silicate by test in the cone calorimeter

Author: Jacob Degler
Supervisor: Ulf Wickström

The conductivity of a calcium silicate (Promatect H boards) was determined based on small scale Cone Calorimeter tests. The specific heat was first determined including the latent heat due to evaporation of water and then the conductivity was determined by a best fit analysis, i.e. changing the conductivity at certain temperatures until measured temperatures in the cone calorimeter of a protected steel sheet fitted with calculated temperatures. The very credible values obtained were then used to predict temperature of protected steel sections in full scale tests. Both Excel and Tasef were used for the calculations. The best fit values obtained in this limited study is as shown in the table below.

Temperature [°C]	Conductivity [W/(m K)]
20	0.21
100	0.20
200	0.19
300	0.18
500	0.15
650	0.13

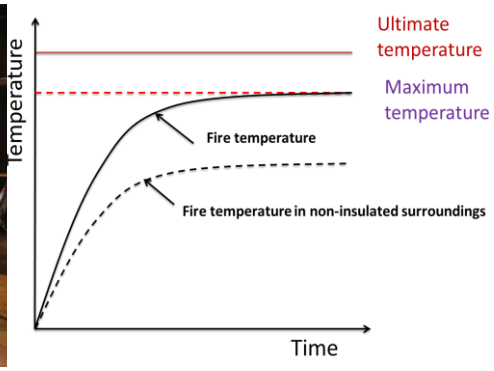
Conductivity of Promatect H boards as obtained in this study with TASEF using back calculations

Signed: Ulf Wickström

Doctoral defense

Alexandra Byström defended successfully her doctoral thesis on March 20th, 2017. The title of her thesis is 'Compartment Fire Temperature: Calculations and Measurements'. The thesis presents new models for calculating temperature of pre- and post-flashover compartment fires at three levels of complexity: analytical expressions, spread-sheet calculations, and finite element calculations. The

accuracy of the models are successfully validated by experiments using in particular plate thermometer measurements.



The thesis work was supervised by Professor Ulf Wickström and the opponent of the dissertation was Professor Sven Thelandersson, Lund University. The examination committee consisted of Professor Emeritus Kai Ödéen, KTH Royal Institute of Technology, Associate Professor Anders Lönnermark, Mälardalen University and RISE Fire Research, and Dr. Tuula Hakkarainen, VTT Technical Research Centre of Finland. Alexandra's thesis is available at http://ltu.diva-portal.org/smash/get/diva2:1072078/FULLTEXT01.pdf

Signed: Ulf Wickström

Text book on temperature calculation

A new book, "*Temperature Calculation in Fire Safety Engineering*", by Professor Ulf Wickström was published last year by Springer. Drafts of the book have been used for several years in courses for fire safety engineering students.

The book provides a consistent scientific background to engineering calculation methods applicable to analyses of materials reaction-to-fire, as well as fire resistance of structures. Several new and unique formulas and diagrams which facilitate calculations are presented. It focuses on problems involving high temperature conditions and, in particular, defines boundary conditions in a suitable way for calculations. A large portion of the book is devoted to boundary conditions and measurements of thermal exposure by radiation and convection. The concepts and theories of adiabatic surface temperature and measurements of temperature with plate thermometers are thoroughly explained. Also presented is a renewed method for modeling compartment fires, with the resulting simple and accurate prediction tools for both pre- and post-flashover fires. The final chapters deal with temperature calculations in steel, concrete and timber structures exposed to standard time-temperature fire curves. Useful temperature calculation tools are included, and several examples demonstrate how the finite element code TASEF can be used to calculate temperature in various configurations. "*Temperature Calculation in Fire Safety Engineering*" is intended for researchers, students, teachers, and consultants in fire safety engineering. It is also suitable for others interested in analyzing and understanding fire, fire dynamics, and temperature development. Review questions and exercises are provided for instructor use.

The book has been well received by reviewers like Vytenis Babrauskas and Craig Beyler. The former writes for example: 'Prof. Wickström's new book now forms an excellent next stepping stone for the student's path. Even though it is a modest-length textbook, the material is all tightly focused on fire science problems.'

Signed: Michael Försth

News from the Hong Kong Polytechnic University

AO-SFPE Exchange Meeting

The Asia Oceania - Society of Fire Protection Engineers (AO-SFPE) Exchange Meeting was held at Taipei, Taiwan in the afternoon of 2 November 2016.

The Exchange Meeting was chaired by Professor W.K. Chow, Chair of Asia-Oceania Chapters Coordinating Group, succeeding Professor A. Sekizawa in May 2015. Chapter representatives from Hong Kong, Mainland China, Macau, Japan, Korea and Taiwan attended.

Mr. C. Jelenewicz, Technical Director from the SFPE Headquarters, joined and gave a presentation on SFPE updates.

Another Arson Fire in Subway

An arson fire occurred [1] again in a train car at about 7 pm on Friday, 10 February, 2017. In contrast to the one occurred [2] in 2004 during non-rush hours, several passengers were injured [1] seriously. The train cars were quite full, though the details are not yet announced.

As reported by the management [1] to the public, the train did not stop to evacuate passengers immediately due to whatever reasons. The train continuously moved to the next station for exposing passengers to fresh air, evacuation, fire extinguishment and smoke removal. The station was closed and reopened the other day. The subway company will carry out a detailed investigation, and report to the public about the incident and further improvement later.

The following questions were raised on the strategy to move the burning train to the next station:

1. What is the Available Safe Egress time for evacuating passengers in the train and under what design fire?
2. What is the moving time for the train to enter the next subway station, and hence the Required Safe Egress Time (RSET) to evacuate the passengers?
3. What will be the RSET if the train door can be opened inside the subway tunnel, and there are pathways for passengers to travel out of the tunnel with smoke driven out by longitudinal ventilation.
4. The arson fire was reported to be 3 m long and 1 m wide, resulting in having several passengers seriously hurt. What happens if the fire is a 5 MW fire of size 3 m by 3 m, how many passengers will be affected?
5. What is the maximum passenger number designed in using a subway tunnel constructed 40 years ago?

It is observed that the traffic characteristics of the subway system designed in early 1970s might not be the same now. The above questions should be addressed properly through in-depth research studies. There are also concern on what will happen if the arson fire occurs in a train car on the East Rail Line with parallel traders. An immediate action appears to be working out appropriate fire safety management [3,4].

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1. South China Morning Post, "MTR firebomb attack at height of rush hour", p. A1, 11 February 2017.
2. W.K. Chow, "Fire safety in train vehicle: Design based on accidental fire or arson fire?", The Green Cross, March/April, 7 pages (2004).
3. W.K. Chow, "On the fire safety requirements for existing old buildings", International Journal on Engineering Performance-Based Fire Codes, Vol. 9, No. 1, p. 31-37 (2007).
4. South China Morning Post, "Inferno affairs", p. C10, 13 February 2017.

Signed: WK Chow, The Hong Kong Polytechnic University, Hong Kong, China

News from Kyoto University

COLLAPSE OF TEHRAN'S PLASCO BUILDING UNDER SEVERE FIRE

At 7:59 am on January 19th 2017, a call about a fire was received indicating it was on the eighth and ninth floors of the 17-storey steel-framed *Plasco* building in Tehran. Firefighters arrived at the scene in less than three minutes. Three hours later when the fire was thought to be under control, a partial roof collapse on the tenth floor triggered an outbreak of an aggressive fire. Due to the instability signs of the upper floors the firefighters quickly exited the building through the windows and staircases. Unfortunately some were trapped on the second floor where the staircase had already collapsed. Thirty minutes later the building came down in an instant and buried sixteen brave firefighters along with six other citizens. The 56-year-old *Plasco* building used the so-called *tube within a tube architecture* with closely-spaced steel columns mounted on a thick foundation box as the perimeter structure and a dense bundle of steel columns at its core. Apparently the building severely lacked sufficient fire-extinguishing equipment while its exposed perimeter columns and beams had least thermal protection. With the support of Kyoto University, the author carried out an in-place inspection right after the incident. By witnessing the sorrow of the stunned nation and the heroic rescue operation, the author committed himself as a young engineer researcher to do whatever it may take to increase the public's awareness toward fire safety measurements and assist fellow Iranian structural fire engineers and researchers to prevent similar incidents in the future.

Submitted by: M. Mahdi Raouffard, Kyoto University

News from Imperial College London

The Imperial Hazelab keeps growing in numbers, currently at 11 PhD students and 2 postdocs, with the addition of four full-time PhD students and two part-time students. The first group starts off with Muhammad Agung Santoso who is from Indonesia, where he studied fire-induced smoke movement in underground facilities at Universitas Indonesia. He started his PhD on smouldering combustion in tropical peat lands in September 2016, funded by the Indonesia Endowment Fund for Education (LPDP). Hailing from the UK, Matt Bonner joined after getting his MSc degree in Theoretical Physics at UCL and works on a project titled *"Fire Safety Optimisation of Façade Design"*, funded by a CASE award from EPSRC between ARUP and Imperial College. Eirik Christensen is a Norwegian PhD student who joined from the University of Edinburgh where he received a MEng in Structural

and Fire Safety Engineering. His project deals with the ignition of smouldering wildfires in regions of permafrost and is funded by the ERC grant. The final student from the four who started in the autumn of 2016 is Han Yuan, who is from Hunan, China and studied Thermal Energy and Power Engineering at Central South University (BSc, 2013) and Refrigeration and Cryogenic Engineering at Tongji University(MSc, 2016). Han is funded by Imperial President's PhD Scholarship. His PhD thesis focuses on multidimensional smouldering combustion in peatlands.

The two part time students are Mohammed Heidari who was part of the IMFSE program and who now studies probabilistic travelling fires for structural design funded by CERIB, and Edmund Ang who got an MSc in Advanced Computational Method from Imperial College and now studies tunnel fire dynamics and the fire throttling effect and works for AECOM.

The group also had a visitor from China, Jiuling Yang, who spent 6 months at Imperial College working on fire modelling using COMSOL.

Senior PhD student Egle Rackauskaite has submitted her thesis on travelling fires and is awaiting her viva. She will then continue to be a part of the group for one year as a post-doc working on improving the travelling fire methodology funded by EPSRC.

Hazelab alumnus Dr. Xinyan Huang who is now a post-doc at University of California at Berkeley was awarded the Katopodis prize by the Department of Mechanical Engineering at Imperial College for the best thesis submitted in the Thermofluids division for his thesis *"Fundamental Study of Smouldering Combustion of Peat in Wildfires"*.

Since the last newsletter, Hazelab leader Guillermo Rein has received the D. Peter Lund Award from the SFPE Board of Directors, an award that recognizes significant contributions to the advancement of the professional recognition of the fire protection engineer. He also received his Early Career Award offered by the International Association of Wildland Fire (IAWF) in Long Beach, California in November 2016. This spring Guillermo gave two keynotes*: "Smouldering Combustion in Science and Technology"* at the 5th Magdeburg Fire & Explosions Days in Germany and *"Challenges of today and tomorrow in Fire Science and Engineering"* at the SFPE Middle East Conference in Dubai, UAE.

Guillermo (left) receives the award from Dr. Tom Zimmerman, the President of the IAWF.

The group has also had a high number of accepted papers at the IAFSS Symposium, with 6 papers in total and one external collaboration. Second year PhD student Franz Richter has been awarded a Sheldon Tieszen Student Award for his symposium paper.

One of the most exciting news from the Imperial Hazelab is that the group has been featured on a Channel 4 documentary titled "Titanic: New Evidence" which investigates the possibility that a smouldering fire had weakened the Titanic before it hit the iceberg. An interview with Guillermo on this topic can be found at http://wwwf.imperial.ac.uk/imedia/content/view/5765.

Make sure to visit the group's website http://www.imperial.ac.uk/hazelab and follow them on Twitter at @imperialhazelab to get all the latest updates on what they are up to!

Signed: Izabella Vermesi, Imperial College London

News from the Fire Safety Engineering Group (FSEG), University of Greenwich

New Projects

FSEG have several new projects to report since we last contributed to the IAFSS Newsletter and news concerning a couple of recently completed projects and an on-going project.

Project GEO-SAFE

FSEG are leading the GEO-SAFE (691161) consortium of 17 partners from 7 countries (UK, Spain, Italy, France, Switzerland, Netherlands and Australia) undertaking research into all aspects of Wildfire. GEO-SAFE is a four year (2016 – 2020) RISE project funded under Horizon2020.

The aim of GEO-SAFE (Geospatial based Environment for Optimisation Systems Addressing Fire Emergencies) is to create a network enabling Europe and Australia to exchange knowledge, ideas and experience, thus boosting the progress of wildfires knowledge and the related development of innovative methods for dealing efficiently with such fires. Major outcomes of this project are implementing solutions and tools in fire suppression, life and goods protection, and implementation and training. The three main fire management domains addressed in

GEO-SAFE are: 'Fire Suppression and Fire propagation control', 'Life and Property Protection' and 'Implementation and Training'.

FSEG's main role in this project is in the domain of Life protection and the development of urban-scale evacuation simulation tools that can be used for both planning (urbanEXODUS) and to assist in live incident management (webEXODUS).

You can find out more about the FSEG role in GEO-SAFE from the FSEG web pages at: http://fseg.gre.ac.uk/fire/geo-safe.html

You can also find out more about the GEO-SAFE project from the project web pages at: http://geosafe.lessonsonfire.eu/

Project: Construction Site Evacuation

FSEG have a new project (May 2016 – April 2018), funded by IOSH, concerned with evacuation from construction sites. A significant risk to the health and safety (HS) of workers on construction sites is emergency evacuation associated with fire or some other on-site emergency. Evacuation during the construction phase of a building is one of the most challenging evacuation scenarios particularly given the ever changing nature of the construction site. Nevertheless, over the past 50 years around the world, very little research has focused on this topic. Clearly, during construction the evacuation plans and procedures for the completed building are not applicable. The layout of the building and even its interconnectivity may be changing on a daily basis requiring that evacuation plans are adapted and conveyed to the construction workers on a regular basis.

Two types of surfaces construction workers may be expected to travel over during emergency evacuation.

While construction sites may undertake regular evacuation drills as part of HS practice, these are seldom unannounced evacuation drills. Thus workers are usually aware that a drill will take place on a given day and in some cases at a given time. Thus workers can prepare for the drill and may pre-empt the evacuation. This inadvertently reduces the realism of the drill and it fails to test construction site workers' knowledge of the evacuation process, the effectiveness of the procedures in place and the effectiveness of the training processes employed

This project will be the first systematic fundamental study into the evacuation behaviour and performance of workers on construction sites and will provide important insight into, and quantification of, the likely behavioural responses of construction workers during evacuation situations. The project will also provide a unique data-set for the validation of evacuation models that can be used in the development and optimisation of evacuation procedures for construction sites. With this knowledge it will be possible to frame more realistic and achievable evacuation procedures improving the safety of construction workers and as a result emergency responders.

The project's objectives are to establish a unique evidence base characterising, for the first time, the actual performance and behaviour of construction workers during emergency evacuation. This information combined with computer simulation can be used to inform the development of more reliable evacuation procedures improving the safety of construction workers. Four unannounced evacuations are planned, the first being successfully run in early Feb 2017, the second was successfully completed at the end of Feb 2017 and the remaining two to be run later in 2017.

Find more about the project at: http://fseg.gre.ac.uk/fire/construction_sites123.html

In-Prep

FSEG are part of a Horizon2020 consortium that has just secured funding for a major project called In-Prep. The project will run for 4 years and is planned to start in September 2017. The project is concerned with urban scale disasters including, earthquakes, floods and terrorist situations. The FSEG role in the project will be to further develop the urbanEXODUS and webEXODUS modelling environments to provide a modelling environment to enable decision support for planning and real-time applications.

Various Other Projects

FSEG have been involved in a range of other projects in 2016, some of which are on-going into 2017:

- The development of a naval vessel damage control simulation environment that includes SMARTFIRE CFD fire simulation and maritimeEXODUS evacuation and crew movement simulation, in collaboration with the Australian DSTG.
- Assessment and optimisation of the evacuation performance of a high-rise office building in London using buildingEXODUS.
- Assessment of the evacuation capabilities of novel aircraft configurations for Airbus using airEXODUS.
- Experimental studies to determine physical walking capabilities of pedestrians over long distances, the impact of fatigue and the impact of terrain type, including steepness of grade and nature of surface e.g. paved, gravel, grassy. Studies undertaken with several collaborators including ISMANS France and Corpo Nazionale Dei Vigili Del Fuoco Italy.
- The development of an Auggmented and Virtual Reality Training Environment for Special Forces and fire and medical first responders responding to a terrorist attack in crowded places. This is part of the EU Horzon2020 project called AUGGMED (Automated Serious Game Scenario Generator for Mixed Reality Training). The scenarios to be considered in the project include a terrorist bomb resulting in a fire in an airport terminal within the UK (completed in July 2016), a terrorist bomb in a crowded underground station in Spain (completed March 2017) and finally marauding gunmen in a port in Greece (2018). Each demonstration increases the level of immersion in the VR/AR environment. Sophisticated modelling tools including buildingEXODUS and SMARTFIRE are providing the capability to accurately represent the reaction of the crowds and the development of the fire. This project continues into 2018, full details can be found on the FSEG web site at: http://fseg.gre.ac.uk/fire/auggmed.html

PhD Students

Graduating

FSEG PhD student Robert Brown successfully defended his PhD thesis, entitled, “Quantifying Human Performance During Passenger Ship Evacuation” on 5th July 2016. Both the external examiner, Professor Jin Wang (Liverpool John Moores University), and the internal examiner, Dr John Ewer, were very impressed with the work presented. Commenting on the PhD thesis, the examiners stated:

Prof Jin Wang, Dr Robert Brown, Dr John Ewer and Dr Peter Lawrence

"It was a confident and well-defended PhD that has the potential to help the IMO to refine its ship safety evaluation rules. The overall contribution to knowledge made by the candidate was well demonstrated in the two journal papers and a number of conference papers arising from the study."

“The research indicates an excellent understanding of the subject area, related mathematics and evacuation simulations and how these relate to the performance testing of passenger ships in international guidelines."

"The Thesis demonstrates a thorough and comprehensive body of research that is both novel, informative and worthy of the award of PhD."

Rob was supervised by FSEG staff Prof Ed Galea and Dr Peter Lawrence. Dr Brown will graduate at the University of Greenwich in July 2017. The quality of Rob’s research was also acknowledged by the Society of Fire Protection Engineers who awarded Rob the SFPE’s inaugural Dr Guylène Proulx OC Scholarship in 2015.

New Students

FSEG has three new PhD students who have recently commenced their studies into urban scale evacuation and waste fire. Sandra Vaiciulyte has a background in Communications and Development linked to Disaster Response behaviour on Social Media. She started PhD in August 2016 and is supervised by Dr Hulse, Prof Galea and Dr Veeraswamy. Her focus is on the identification, quantification and calibration of human response behaviours in large scale evacuation situations associated with wildfire.

David Martin has a strong background in Forest fire science research. He started his PhD in July 2016 and is supervised by Dr Veeraswamy, Prof Galea and Dr Lawrence. His focus is on the development of urban scale evacuation modelling capabilities. This will include the identification of requirements for urban scale evacuation models, integration of forest fire and evacuation models and the representation of terrain effects on pedestrian evacuation.

Ahmad Baddar has a 1st Class Honours degree in Fire Safety Engineering from University of Central Lancashire. He started his PhD in May 2016 and is supervised by Dr John Ewer,

Professor Mayur Patel and Professor Ed Galea. Ahmad is developing enhanced CFD physical models to simulate the complexities of burning waste bales. This includes flame spread, fuel collapse and melting as well as correlation to experimental studies.

Awards
Innovative research, conducted by FSEG, which will improve the evacuation of people with reduced mobility was recently recognised by an award from the Society of Fire Protection Engineers Foundation. Dr Aoife Hunt, an FSEG PhD student at the time that the research was conducted, was granted the foundation's SFPE 2016 Educational and Scientific Foundation Student Scholar Award. This award was established in 2006 by the Foundation's Board of Governors to recognise high-performing students who are conducting research to advance the science and practice of fire protection engineering. Nominations are accepted from undergraduate, graduate and post-graduate students and are judged on scientific quality and relevance of their research to the fire protection engineering profession.

Describing the award, Julie A. Gordon, SFPE Membership and Chapter Relations Manager stated, "You are being recognised for your research investigating the evacuation of people with reduced mobility (PRM) from multi-floor buildings and how this could be accurately represented within evacuation computer simulation models. Congratulations on receiving this prestigious honour and recognition from SFPE and your colleagues around the world. We are proud of your accomplishments and all you have done to advance the Society and the profession."

The knowledge gained from this research is being used by FSEG to enhance the EXODUS evacuation simulation software so that it can better represent the evacuation of people with disabilities.

Dr Aoife Hunt, successfully defended her PhD entitled, "Simulating Hospital Evacuation" on the 11th January 2016 and is the first female recipient of the SFPE Student Scholar award.

Courses
FSEG are again offering their well-established five day short courses in 2017,

- Principles and Practice of Evacuation Modelling: 24 - 28 April 2017
- Principles and Practice of Fire Modelling: 19 – 23 June 2017

The courses have been run each year since 1997 and so 2017 marks the 20th year in which the courses have been offered, probably making them the longest running short courses in computational fire engineering in the world. In that time we have trained well over 600 delegates from 44 countries in both fire and evacuation modelling, including, fire engineers, fire scientists, architects, fire fighters and regulatory authorities.

You can register on our courses from our web pages at: http://bit.ly/FSEG-SC

You can keep up with the latest news from FSEG and join in topical fire research and fire engineering discussions by following us on social media:

- FSEG facebook page: https://www.facebook.com/FSEG.UK/
- FSEG Twitter: @evacguy
- FSEG YOUTUBE: https://www.youtube.com/user/FSEGresearch
- FSEG LINKEDIN: https://www.linkedin.com/in/ed-galea-1297358/

News from the University of Maryland

Jose Torero has returned to UMD to serve as the John L. Bryan Professor in FPE and as Director of the Center for Disaster Resilience in the Department of Civil and Environmental Engineering. Torero comes from the University of Queensland in Australia, where he chaired the School of Civil Engineering. Prior to that, he held the BRE Trust/Royal Academy of Engineering Chair in Fire Safety Engineering at the University of Edinburgh. At UMD he will coordinate ongoing research activities in resilience, incorporate fire-related expertise, and establish and lead the Center for Disaster Resilience. He has developed cross-disciplinary degrees that integrate fire protection into other engineering disciplines.

Michael Gollner, Assistant Professor, will be awarded the IAFSS Proulx Award at the IAFSS 12th Symposium. This recognizes his scientific contributions to the understanding of flame spread, wildland wildland-urban interface fire spread, and fire whirls. The IAFSS Early Career Awards recognize admirable achievement by its members who have made significant contributions to fire safety science early in their careers

The FPE Department celebrated its **60th anniversary** March 10-12, 2017. There was a reception Friday night, lab tours and seminars Saturday afternoon, a banquet on Saturday night, and campus and area tours Sunday. Over 300 alumni, students, faculty, staff, and family attended the banquet. Department Chair James Milke (class of 1976) provided an overview of the department and memorial tributes to John Bryan and Harry Hickey were made by Art Cote (class of 1965).

The fire community lost a beloved individual on January 30, 2017. **Dr. Harry E. Hickey**, a former UMD FPE professor, passed after a long battle with dementia and Alzheimer's. Dr. Hickey had served in multiple roles in the fire protection field. His active fire services career spanned 52 years. He became the FPE Department's second full-time faculty member in 1960 and retired in 1985. He then served as Director of Fire Protection and Fire Chief at the Johns Hopkins University/Applied Physics Laboratory. He was a Principle Founding Member of the National Fire Heritage Center, a national fire-related archival initiative in Maryland, which preserves the written history of fire protection and the fire services in America in Howard County, Maryland.

Team UMDLoop won the Performance and Operations Award and placed in the top five for overall pod design at the January 27-29, 2017, **SpaceX Hyperloop Pod Competition** held in Hawthorne, Calif. The competition, which has been ongoing for more than a year, aims to advance the Hyperloop concept for a new form of transportation in which passenger-carrying pods travel between cities through above-ground tubes at very high speeds. During the three-day event, 27 teams from around the globe pitted pod against pod to see which teams would have a chance to test their creation in SpaceX's vacuum-sealed one-mile test track adjacent to its headquarters. The chief faculty advisor is Noah Ryder, a research associate and lecturer in the FPE Department.

The FPE Department provided an intensive short training course for six faculty members from the **Bangladesh University of Engineering and Technology** (BUET). The course, which was conducted January 3-25, 2017, was designed to give BUET engineers basic information on fire safety and train them on where to find additional information and resources independently. The idea for the training was in response to a series of factory fires that have occurred in Bangladesh over the last seven years, many of them fatal (e.g. a 2013 fire claimed over 1,000 lives). Instructors included James Milke, Arnaud Trouvé, Kenneth Isman, Bill Koffel, Justin Geiman, Noah Ryder, and Morgan Hurley.

UMD established a new research center of excellence with **United Technologies** Corporation's commercial businesses, UTC Climate, Controls & Security and Otis, which will lead to scientific advancements for safer, smarter and more sustainable building technology and climate controls systems design. The collaboration will initially support research projects for the FPE and Mechanical Engineering Departments. The FPE projects will consider battery fire safety to help promote safe and energy efficient infrastructure.

Signed: Peter Sunderland, University of Maryland

News from Lund University

Research

There are several on-going research projects and many of them are reported in open access Lund University reports. You can access our publications through our webpage: www.brand.lth.se/publications. A short presentation of some of our on-going research projects is given here.

International collaboration project with Waseda University

The Swedish Foundation for International Cooperation in Research and Higher Education (STINT) has awarded a grant in the area of "Evacuation in emergency situations" aimed at a research and education collaboration between the Division of Fire Safety Engineering at Lund University (Sweden) and the research group of Prof Tomonori Sano at the School of Human Sciences at Waseda University (Japan). For more information concerning the collaboration project you can contact Dr Daniel Nilsson at daniel.nilsson@brand.lth.se and Dr Enrico Ronchi at enrico.ronchi@brand.lth.se

Research project "e-Murray" on wildfire evacuation

The project "e-Murray - Modelling requirements for an open-access multiphysics approach to planning of urban evacuations caused by wildfire disasters" is currently ongoing. The project focuses on building a novel computational simulation framework to aid in the planning, preparation and training of a community in case of wildland fire evacuation. The e-Murray project has been funded by NIST and it includes a cross-disciplinary International consortium in which Dr Enrico Ronchi from the Division of Fire Safety Engineering at Lund University is Principal Investigator. Together with Lund University, the consortium includes the Fire Protection Research Foundation at the National Fire Protection Association (NFPA) in the USA, Imperial College London in the UK and the National Research Council in Canada.

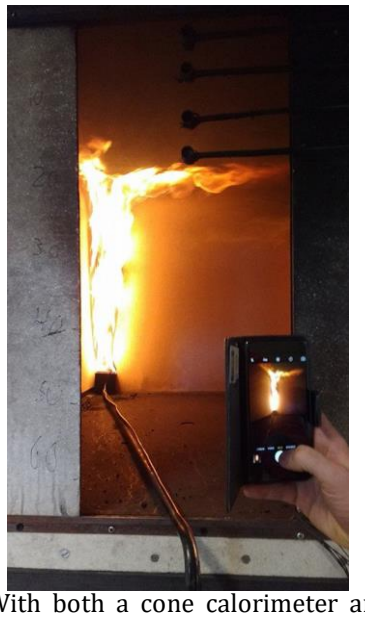
Educational development project "K-FORCE" in Western Balkans

The K-FORCE (Knowledge for resilient society) project on educational development in the area of Fire Safety Engineering and Disaster Risk Management in the Wester Balkans has started in fall 2016. This is a 3-year EU-funded Erasmus+ project on capacity building in Higher Education in the Western Balkans. Lund University is participating in the project through the Division of Fire Safety Engineering and the Division of Risk Management and Societal Safety. The main role of Lund University is to provide directions on the development of the first

Ph.D. Programme in the Western Balkans in the area of Fire Safety Engineering and Disaster Risk Management. More information on the project can be found at http://kforce.uns.ac.rs. If you have any questions concerning the K-FORCE project, please contact Dr. Enrico Ronchhi at enrico.ronchi@brand.lth.se.

The Fire Laboratory

The Fire Laboratory at the Division of Fire Safety Engineering at Lund University has a long history in fire science and it is of course connected to the education of fire protection engineers. We recently went through a refurbishment of the building, including the lab, and we are now up and running well at full speed again. The Fire Laboratory is primarily an educational lab and we run a total of fourteen lab classes spread over five different courses. We also have an extensive collaboration with the national fire academy at MSB Revinge, where we run a couple of the lab classes in larger settings. On top of this, we have a number of bachelor and master thesis projects every year.



The lab classes in our FSE program gives the students a deeper knowledge about fire behavior in materials and in rooms, as well as on sprinkler systems. These classes are supposed to complement and support seminars, lectures and assignments. The ambition is always to become better, to create better classes for the students and to give them the best possible education as we can in the fire laboratory.

Apart from the education, we also do research in the lab. Several of our doctoral students do experimental work during their thesis work and in many cases we have to build a special setup just for their experiments. In some cases, we also help the fire service and the police in their fire investigations. With both a cone calorimeter and a microcalorimeter we can also assist industry in product development. Creativity and ingenuity are the key components in our lab activities, and one is always welcome to pay us a visit. Of course, you can also follow us on Facebook as well as on Twitter (look for **@TheFireLaboratory** or **@TheFireLab**).

Upcoming events

The local arrangements committee for the 12th International Symposium on Fire Safety Science has been working hard to get all the practical pieces in place for the symposium in June. The symposium website (iafss2017.org) was continuously updated with information about the symposium and short movie clips to guide visitors to the symposium and in Lund.

For more information about the Division, please visit www.brand.lth.se. Our website is continuously updated with news.

Signed: Nils Johansson, Lund University

News from the University of Cantabria

GIDAI will host ISO Fire Subcommittee Meeting

The last meeting of the ISO/TC 092/SC 03 and SC4 subcommittees in Seoul approved the nomination presented by the GIDAI group to host the meeting in autumn 2017. So that during the days 16 to 20 October next year, the University of Cantabria will host the experts of the eleven working groups integrated in these subcommittees that address issues of threats to the fire safety of people and property and new approaches to fire safety engineering. These subcommittees are composed of experts representing more than 30 member countries and 14 observer countries.

The organization of the event will be carried out by the GIDAI research group, whose director Daniel Alvear has been participating as leader of the Spanish delegation in the ISO/TC 92/SC 4 sub-committee and expert in the activities of the different groups, and at European level in the activities of the working group CEN/TC 127/WG 8 of the European Committee for Standardization, CEN. Likewise, Professor Alvear was recently elected president of the national subcommittee AEN CTN23/SC8 "Fire Safety Engineering" which serves as a mirror to these in Spain and is one of eight that are part of the national technical committee CTN23.

International Conference on Research and Advanced Technology in Fire Safety 2017

The International Conference on Research and Advanced Technology in Fire Safety will be held ***20th-21st October 2017***, in Santander, Cantabria (Spain) and will be organised by the GIDAI Group, Fire Safety – Research and Technology, at the University of Cantabria.

This event is intended to recover the congress series which took place annually from 2004 to 2012 and they were a reference international conference on the fire safety engineering and research community. Now, we are ready to host another conference. We consider this initiative has provided a forum to exchange new ideas and current research with an important scientific base for the fire safety stakeholders.

The conference will provide an opportunity for scientific and industrial communities to meet and discuss their research and innovations on the following proposed topics:

- Combustion
- Fire dynamics
- Structural analysis
- Experimental research and data collection
- Fire computer modelling
- Evacuation modelling
- Tenability and toxicity assessment
- Emergency management
- Human behavior
- Evacuation and intervention

New research projects

Fire safety engineering is opening to the analysis of new processes and application opportunities. Managing the consequences of emergencies and terrorist attacks becomes a serious problem that has, as a key point, the appropriate definition of the protective actions of people involved. The Ministry of Economy and Competitiveness is granting the University of Cantabria for the research project DEFENDER. The project is divided into two main activities: 1) experiments of protective strategies and decision-making mechanisms performed by people involved in a terrorist attack and 2) development of mathematical and computational models.

Additionally, the Ministry of Economy and Competitiveness has decided to support financially the project "SIGNAL - Smart System for Incidents Management in Commuter Trains". The SIGNAL project aims to develop and test a management system for supporting decision-processes during incidents and emergencies in commuter trains focused on assisting passengers. Decisions will be based on the analysis of multiples alternatives with computational modelling and simulation, expert system and decision trees.

Finally, the University of Cantabria is also collaborating with SETELSA company in the public funded project ARIADNA – "New technologies for guiding evacuees in real-time". The aim of the project is to develop and test a prototype for supporting evacuation management in real-time. This system integrates existing infrastructures (CCTV, intruder detection, accessing control, etc.) with innovative management technologies (computer modelling and simulations and real-time decision supporting tools).

Experimental review of oxygen content at mixing layer in cone calorimeter

The Journal of Thermal Analysis and Calorimetry has published the paper "Experimental review of oxygen content at mixing layer in cone calorimeter". In this study, The GIDAI Group analyse the level of oxygen between the flame and the upper surface of the sample during the calorimetric cone tests. Usually the tests of calorimetric cone take place in an atmosphere with an oxygen level of 21%. The appearance of the flame on the sample being tested in the cone may cause the consumption of the oxygen on the surface of the sample. A modification of the sample holder was built up by adding two additional tubes for sampling gases in the mixture layer, one in the centre of the sample and another in the corner of the sample. Due to that modification, it can be measure the O_2 and CO_2 level during the test. Six products were analysed which can be classified in three main groups: lignocellulosic, thermoplastic polymers and thermoset polymers. Cone calorimetric results showed that for some of the materials analysed (PET, Nylon and PUR foam) the oxygen level at mixture layer decreased until values close to zero.

Internship in the FireSERT and the University of California, Berkeley (UCB)

The PhD student David Lázaro performed an internship of two months in the Fire Safety Engineering Research and Technology Center (FireSERT) of the Ulster University under Prof. Michael Delichatsios mentoring. During the internship, the PhD student has collaborated in the development of an engineering model to predict the response of intumescent paintings in case of fire. The developed model predicts the heat transfer and fire resistance of several types of constructive systems coated with intumescent paintings and incorporates the oxidation reaction of the intumescent paintings char to the

existing model. This reaction is very important to predict the behaviour of these intumescent paintings at high temperatures, since they allow simulating the decrease of the thickness of the paintings.

Additionally, the PhD student Alain Alonso performed an internship of 4 months at the University of California – Berkeley in the combustion and fire processes laboratory under the direction of Prof. Carlos Fernandez Pello. During this period, the PhD student has been collaborating in the tasks corresponding to the Saffire project, where UCB collaborates with NASA. This project consists of the study of the propagation of the flame on the materials under different pressure conditions, oxygen level and air flow velocity. Thanks to the tests executed in this project, it is determined under what conditions the fire propagation takes place and, if it occurs, what is the propagation velocity and the shape of the propagation of the flame. Same tests are repeated with the same conditions in the re-entry to the atmosphere of the unmanned spacecraft of NASA and the behaviour of those materials are monitored. One more factor is added in this occasion, the absence of the gravity. Thanks to that, it can be determined the influence in the process of propagation due to the lack of gravity.

News from the University of Ulster – FireSERT

New Director in FireSERT

Professor Ali Nadjai was appointed as the new director of FireSERT at Ulster University.

MSc Fire Safety Engineering at Ulster University

The MSc Fire Safety Engineering programme at Ulster, established in 1990, continues to be vibrant, attracting students both locally and internationally. Run in both full time, part time and part time block release modes, it has recently been accredited as Further Learning for CEng by the Chartered Institution of Building Services Engineers and the Energy Institute and is currently in the process of seeking accreditation by the Institution of Fire Engineers. The programme enjoys close links with industry – fire engineering consultants are directly involved in the delivery of design modules within the programme and the Northern Ireland Fire and Rescue Service have recently facilitated Compartment Fire Fighting Training at their site. This two day programme, during which students were trained in the use of breathing apparatus and then entered a compartment fire, was designed to provide students with a practical understanding of the challenges presented by fire fighting and an understanding of the need to respect this in fire safety engineering designs. A enjoyable and informative time was had by all!

Further information on the programme can be found at:

https://www.ulster.ac.uk/courses/course-finder/201718/fire-safety-engineering-13575

or contact Course Director, Dr Karen Boyce at ke.boyce@ulster.ac.uk

New Hiring

Dr. Eleni Asimakopoulou joined FireSERT as a Research Associate in Fire and Materials in February 2017. Eleni holds a PhD in fire safety and protection engineering, entitled "Development and Assessment of Experimental and Numerical Tools for Characterization of Externally Venting Flames and Evaluation of their Effect on Building Facades", defended in HMCS Laboratory at National Technical University of Athens in July 2016. Eleni's research activities will be focused on flammability and fire testing of innovative foam and glazing systems.

New Projects at FireSERT

1- Horizon 2020 project "EENSULATE" having the aim to develop innovative lightweight and highly insulating energy efficient components and associated enabling materials for cost-effective retrofitting and new construction of curtain wall facades. More details on the project can be found at http://www.eensulate.eu/

2- Characterization of TRAvelling FIRes in large compartments (TRAFIR, RFCS 754198) with Main partners Arcelor Mittal, Liege University, SP and University of Edinburgh.

Many studies of fires in large compartments reveals that they do not burn uniformly throughout the enclosure. They tend to travel and lead to highly non-uniform temperatures which implies a transient heating of the structure. Travelling fires are not considered in the Eurocodes : the main limit in developping models is the lack of large scale, realistic test results. This project aims to realize such tests and performing numerical simulations

to define the conditions in which travelling fire develops, to build an analytical model which evaluate the thermal effect and to create design guidance which improves structural safety.

3- Temperature assessment of a vertical member subjected to LOCAlised Fire - Dissemination- (Locafi+ RFCS 754072), with Main partners Arcelor Mittal, Liege University, CTICM, SCI and Timisoara University.

LOCAFI+ represents the valorisation project of the RFCS project LOCAFI the main objective of which was to provide designers with scientific evidence that will allow them designing steel columns subjected to localised fires such as those that may be present, for example, in car parks. The technical objective of LOCAFI+ is to disseminate the methodology for the fire design of columns under localised fire to practicing engineers in several European countries by exploiting the results obtained in LOCAFI. The transfer of the developed calculation methods into practice will be achieved by national seminars and clearly structured design manuals

Conference SIF18
International Conference of Structure in Fire (SIF) 2018 will be in Belfast on the 6,7 and 8th of June. The conference website is available at https://www.ulster.ac.uk/conference/structures-in-fire-2018.

Signed: Prof. Ali Nadjai, FireSERT

News from University of Science and Technology of China (USTC), State Key Laboratory of Fire Science (SKLFS)

SKLFS at USTC has started a new 5-year Key Project funded by National Natural Science Foundation of China from January 2017 on *Fundamental Problems in Wind-blown Complex Diffusive Combustion and Fire Behavior of Solid Combustibles.* The diffusive combustion and fire behavior are more complex when wind is involved, as for example in wildland fires. Especially it is important to examine the effects of ambient wind on the pyrolysis, ignition, flame spread and extinction of a solid fuel, including boundary layer combustion, soot formation and interaction with flame turbulence and buoyancy. These fire dynamics and solid burning behaviors, differing remarkably from those solely under natural convection without wind, are still not well resolved or quantified in the community. The main objectives of this new research project are: (1) to reveal the pyrolysis, ignition and extinction behavior of solid combustibles in forced convection boundary layer generated by wind; (2) to develop new models for scaling the interaction of wind with flame turbulence and buoyancy as well as soot formation for the boundary layer combustion of solid combustible in wind conditions; and (3) to quantify the concurrent and countercurrent flame spread as well as blow off over solid combustible surface associated with complex heat and mass transfer with the forced convection boundary layer. This research, focusing on the effect of wind, will advance our understanding of solid combustible fire dynamics while at the same time will contribute to the fire protection in wind condition.

The research team of this project is led by Professor Longhua Hu (PI), being one of the top fire research scholars of the young generation in China. He had received several top prizes and awards, as for example the Newton Advanced Fellowship (sponsored by Royal Society, UK), Most-cited Chinese Researchers (sponsored by Elsevier), JSPS Fellowship (sponsored by Japan Society for Promotion of Science (JSPS)), Youth Science and Technology Innovation Talent Leader (Sponsored by Ministry of Science and Technology of China), National Top-Notch Young Talents of China (Sponsored by Chinese Government), ChangJiang Young Scholar (Sponsored by Ministry of Education of China), Excellent Young Scientists (Sponsored by National Natural Science Foundation of China (NSFC)) and LuJiaXi Youth Talent Award (sponsored by Chinese Academy of Science (CAS)).

Signed: Prof. Longhua Hu, USTC

News from Carleton University (Canada)

At Carleton University we continue to push innovative involvement in various areas supported by a number of consultancy companies and research institutions.

Human Behaviour in Fire

Student Lauren Folk's research on elderly care evacuations was presented at the 8th International Conference on Pedestrian and Evacuation in China. Her work, which is supported by ARUP Canada, involves development, validation and verification of Oasys' MassMotion software. This care home study is the first project of ours in the area of human behaviour in fire. The work has recently expanded to consider other occupancy and structure types as supported by ARUP with Erin Morrow, Dr. Michael Kinsey and Dr. Elisabetta Carattin as collaborators. Lauren will continue her graduate studies this summer under

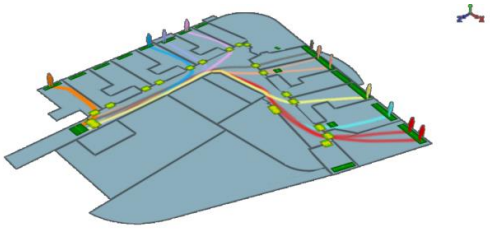


Figure 1 Recent work has been to develop Oasys Software MassMotion in collaboration with ARUP for aging population's infrastructure

Dr. Gales' supervision.

Our Human Behaviour in Fire course, which is in its second year of offering, continues. This year there are approximately 35 students enrolled (both graduate and undergraduate). Interested guest speakers are encouraged to contact Dr. Gales during the summer months.

Structural Fire Engineering

Matthew Smith recently graduated with his MASc thesis titled "*Towards a Performance-Based Fire Design Framework for Composite Steel Deck Construction in Canada*" with no corrections necessary. Matthew won the SFPE National Capital Region Chapter Scholarship for Fire Safety Engineering for his thesis and these results are currently being distributed through the Canadian Institute of Steel Construction. Matthew will be welcoming Carleton research student Ben Nicoletta over the summer with a research-consultant internship at the global firm, Entuitive. Ben was a recipient (yet again) of the prestigious NSERC undergraduate research award at Carleton and will be focusing on the fire design of polymer based construction. Ben's current research has been a collaboration with Prof Beth Weckman of the University of Waterloo and Prof Amir Fam of Queen's University.

Figure 2 We have been studying the effect of Adhesive breakdown in Engineered Timber. Results appear at the Fire and Materials conference.

Carleton had a great representation at this year's Fire and Materials conference. Prof George Hadjisophocleous, Dr. Gales, and three students had papers presented at the conference.

Christian Gonzalez, supervised by Prof Hadjisophocleous, presented work pertaining to timber connections in fire. Christian investigated the performance of concealed steel-timber connections under exposure to the standard time-temperature curve. Test assemblies were subjected to static transverse loads equivalent to 30% and 100% of their beam-to-column design moment capacity. Christian discussed the results obtained from the tests including the connection failure modes and charring rates.

Figure 3 Timber Connection Furnace Tests were also presented at the Fire and Materials Conference

Also presented by Prof Hadjisophocleous was the work of Carleton master's student Samuel Amankwah Boadi. Sam conducted six (6) full scale tests to investigate the structural resistance of unprotected hybrid steel-column and glulam-beam shear tab connections when exposed to a real fire. That presentation discussed the results obtained during the tests that included temperature profiles at sections of the timber beam close to the connections and the mid-span, as well as the failure modes and charring rates for each shear tab connection assembly. The influence of parameters of load ratio and the configuration of the shear tab connection considered were also presented.

Arlin Otto's presented research was a collaboration with NIST looking into various applications of digital image correlation technology. Arlin, who has been working with Dr. Gales, will be presenting an additional paper with fellow researcher Hailey Todd on heritage timber in fire at this years' Canadian Society for Civil Engineering's annual conference in Vancouver this summer. Her work focuses on fire spread along glulam, veneered lumber, and solid sections. Hailey Quiquero, also supervised by Dr. Gales, focused her Fire and Materials presentation on adhesive research. Hailey is now visiting the University of Canterbury in New Zealand. She is working in a collaboration with Dr. Tony Abu with the support of NSERC Canada's Michael Smith Foreign Study Supplement Scholarship this spring.

Fire Dynamics

Student Chloe Jeanneret, who has recently been performing a research assistantship with Dr. Gales' research team, will be participating in an exchange with Guillermo Rein's Haze lab this summer at Imperial College. This is, in part, an effort to adapt the travelling fires framework and methodology for Canadian use. The research collaboration will involve Mohammed Heidari from CERIB.

Other News

Dr. Gales was recently appointed chair of the Canadian Society for Civil Engineering's Fire Behaviour and Safety of Structures Committee. The committee's mission is to facilitate the transfer of ASCE initiatives in fire protection engineering. Colleagues interested in participating in that committee should contact Dr. Gales (john.gales@carleton.ca). Dr. Gales will also take on a role as Associate Editor in the John Wiley Journal, Fire and Materials this spring 2017.

Carleton student researchers (Hailey Quiquero, Ben Nicoletta, Seth Gatien, Natalie Mazur, Chloe Jeanneret, and Arlin Otto) were very successful in this March's scholarship and award competitions. These students secured $34,000 in funding from the likes of NSERC Canada, the Ontario Graduate Scholarship program to be used for this Spring and this Summer's work.

Signed: Hailey Todd and John Gales, Carleton University

News from University of North Carolina at Charlotte

Student and Faculty Response to the Historic 2016 Fires in the Blue Ridge Mountains

From October to December 2016, thousands acres were burned by dozens of wildfires in the Blue Ridge Mountains in the United States, primarily in Georgia, North Carolina, South Carolina, and Tennessee. Thousands of firefighters, some travelled in from all over the country, fought to contain the fires.

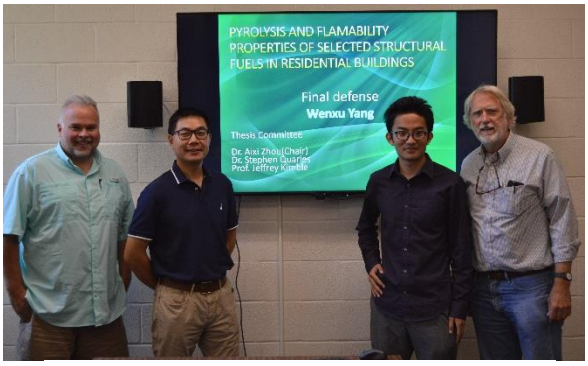
The fires in the Great Smoky Mountains National Park and Gatlinburg (Tennessee) were the worst. The Gatlinburg fires devastated the Gatlinburg and Pigeon Forge Areas. Gatlinburg is a vacation destination town of 4,097 that attracts more than 11 million tourists a year. The Gatlinburg fires on November 28, 2016, killed 14 people and injured 191 people, destroyed more than 2,500 structures, caused more than $500 million in direct property damage and $8.8 million in firefighting, and forced a week-long evacuation of Gatlinburg.

The Blue Ridge Mountains are about 2.5 hours driving from UNC Charlotte campus. Students and faculty members in the fire programs at UNC Charlotte were very concerned about the fires in the mountains. Several students (who are active-duty firefighters) were deployed to assist the firefighting efforts. Many alumni from the fire programs were actively involved in firefighting and emergency response. Faculty members have been actively involved in wildfire and WUI fire research, education, and outreach since 2007. Faculty members will be at workshops and field trips planned for promoting the lessons learned from the 2016 fires and the next steps to advance resilient landscapes and communities in the Blue Ridge Mountains.

Updates from Students and Faculty

Babak Bahrani and Wenxu "Phil" Yang successfully defended their MS theses and obtained their MS degrees in fire protection. The title of Babak's thesis is "Effects of Weathering on Performance of Intumescent Coatings for Structure Fire Protection in the Wildland-Urban Interface". His thesis work was supported by the Insurance Institute for Business and Home Safety (IBHS). The title of Phil's thesis is "Pyrolysis and Combustion Properties of Selected Structural Fuels in Residential Buildings". Phil's thesis work was supported by the Joint Fire Science Program.

Babak Bahrani's Thesis Defense



Wenxu "Phil" Yang's Thesis Defense

An undergraduate fire research team worked on a project sponsored by ICL Industrial Products on firebrand ignition of insulation foams. The purpose of this project was to investigate the ignition potential and combustibility characteristics of polyurethane (PU) insulation foam against burning firebrand attacks. The team designed and constructed a small firebrand generator and a small wind generator and performed foam specimen ignition tests. The team presented their findings at the 15th International Conference on Fire and Materials Conference in San Francisco, CA in February, 2017. Further testing will include using accelerated aging methods to investigate the ignition of aged foam specimens.

The SFPE-UNCC Chapter and FAST student organizations have been actively involved in many activities. Check out at: https://www.facebook.com/groups/287375221431281/ and https://www.facebook.com/UNCCFAST/. The SFPE and FAST groups performed their annual Mock Dorm Burns event in late March 2017 to promote fire safety on-campus and in the community. This annual on-campus fire event is a tradition at UNC Charlotte and is assisted by the fire and safety faculty and staff members and Charlotte Fire Department, and is sponsored by several industry partners.

Fire research at UNC Charlotte remains very active. Some recent and current funded projects include: "Fire ember production from wildland and structural fuels" sponsored by the Joint Fire Science Program, "Impact of fixed firefighting systems on road tunnel resilience, ventilation, and other systems" sponsored by the Fire Protection Research Foundation, "Performance of gels" and "Effect of weathering on the performance of fire retardant coatings" sponsored by the Insurance Institute for Business and Home Safety (IBHS), and "Firebrand ignition of insulation foams" sponsored by ICL Industrial Products.

Signed: Aixi Zhou (aixi.zhou@uncc.edu)

News from RISE Safety/Fire Research

Name change

The RISE institutes SP, Swedish ICT and Innventia have merged in order to create a unified institute sector and become a stronger innovation partner. At the beginning 2017 SP changed its name to RISE Research Institutes of Sweden, and SP Fire Research is now called RISE Safety/Fire Research.

Signed: Michael Försth

Director change

Björn Sundström has decided to step down as director for the unit called Safety at RISE, which includes the sections for Fire Research and Mechanics Research. This happened on the 15th of April on Björn's 66th birthday (Björn did an extra year after the ordinary retirement age in Sweden)!

Björn will keep working at RISE but not as director. He will remain as chairman of the board of RISEs subsidiary RISE Fire Research AS in Norway. He will also continue with his professorship working with education in Luleå. Further he will keep his international commitments and international work in various projects, while working on various research projects.

Since his start at SP in 1976, when he was employed as section manager for the reaction-to-fire group, Björn has done a marvelous job in developing the field of fire technology in general and the Fire Research department at RISE in particular. In 2010 he became director for the entire SP Fire Research, which has now expanded into RISE Safety as mentioned above. Some examples from Björn's career are; appointed expert in the European Group of Fire Experts for the Construction Products Regulation (CPR), he is a previous chairman of ISO/TC92 Fire Safety, he is the current chairman of the International FORUM of Fire Research Directors, he also received the Interflam trophy ("the Spoon") for his technical leadership of the CBUF-project (Combustion Behaviour of Upholstered Furniture). Much of the harmonization within reaction-to-fire in the CPR has been made possible thanks to Björn's research leading to a consistent system of test methods and classification criteria for building products. (Björn's thesis can be found here https://lup.lub.lu.se/search/ws/files/5444134/598792.pdf.) Recently he was invited to a workshop at the European Parliament to present some of the background work for the CPR, Construction Products Regulation, on products fire safety and to discuss the implications.

Björn will take a well-deserved period of vacation: 1,5 months from mid-April, working three full weeks in June, and then another 1,5 months before coming back to work in mid-September working at 60%.

The new director will be Tommy Hertzberg who has been working at RISE for more than 15 years. Tommy has, among many achievements, been pivotal in building up the maritime fire research activities at RISE.

Signed: Michael Försth

Project to develop a European classification and testing method for facades in fire

RISE are leading a project to develop a European classification system for the fire performance of facades. Funded by DG GROW; the project formally started at the beginning of the year. The core project team comprises: RISE, Efectis, BRE, BAM and EMI.

The objective of the project is the development of a European approach to assess the fire performance of facades and the definition of all relevant details and classifications so that the method can be used for harmonised products standards (in CEN) and for European Assessment Documents (in EOTA) for the relevant construction products (kits) within the framework of implementation of Regulation (EU) 305/2011 and relevant national building codes.

The team have spent the first months creating a registry of existing regulations in Europe, with assistance from Fire labs and other organisations throughout the European Union and the European Free Trade Association.

Signed: David Lange, Lars Boström

Nordic Fire & Safety Days 2017

The Nordic Fire & Safety Days has grown to the largest conference on Fire and Safety in the Nordic countries. NFSD is an annual event carried out by the Nordic universities and research institutes involved in risk and fire

safety. The conference is held by RISE Research Institutes of Sweden, former SP Technical Research Institute of Sweden, in collaboration with Aalborg University in Copenhagen and the Technical University of Denmark, Lund University, Aalto University, Luleå University of Technology, Norwegian University of Science and Technology, University of Stavanger University College Haugesund and Iceland University as well as VTT Technical Research Centre of Finland Ltd and the Danish Institute of Fire and Security Technology.

The days put focus on risk and fire research in the Nordic countries. Contributions from other countries are more than welcome. The conference language is English. The topics cover:

- Fire dynamics
- Fire chemistry
- Fire detection and suppression
- Forensics
- Structural fire safety
- Off shore fires
- Transportation
- Management of rescue service
- Safety management
- Health and environmental risks
- Societal activities and resilience
- Risk and innovations
- Residential fires
- Decision-making
- Evacuation
- Crowd management
- Human behavior

Two Keynote lectures have been appointed:

Dr. Jürgen Troitzsch from Fire and Environment Protection Service FEPS, Switzerland will hold the first keynote lecture for the Nordic Fire & Safety Days 2017 on August 17th. The title of the lecture is Furniture fire properties and their importance for domestic fire safety.

The second keynote lecture, Fire brigade intervention method – accounting for the actions of the fire service, will be held on August 18th by Ed Claridge, Principal Fire Engineer, Auckland, New Zealand.

Open-project-preparation event

The Nordic Fire & Safety Days shall be a meeting point for all with interest in different aspects of fire and safety. The days will give a lot of opportunities and tie band between fire industry, municipalities and research institutes and universities. NFSD has become a platform for project development and this is why the NFSD consortium has decided to launch the organization of two Open-project-preparation events for the NFSD 2017. Here we will invite all delegates of the NFSD 2017 and funders.

More information can be found on the conference web site: www.conferencemanager.dk/NFSD2017, which is open for registration

Signed: Anne Dederichs

Risks associated with alternative fuels in road tunnels and underground facilities

Traditional vehicle fuels such as petrol and diesel are being exchanged at an ever accelerating pace by alternative energy carriers. From a risk perspective, not least batteries and gaseous fuels introduce new risks. Road tunnels and underground garages were identified as potential high-risk zones and in order to prevent incidents in connection with such a change in the transportation sector, regulations and practices should stay one step ahead. A research project at RISE was recently carried out to review current knowledge and Swedish stakeholder's view of the issue. The project was funded by the Nordic Road Association (NVF), and was intended to review and update current knowledge regarding alternative fuels.

Underground garages

Garage fires are relatively common. Most often they are caused either by arson or electrical failures. Most often the fire is limited to the vehicle of origin. The conditions for rescue operations in underground garages is already a great challenge with long entrance distances and heavy smoke resulting in problems of identifying the fire location. Air supply becomes a limiting factor and the risk of collapsing beams or ceiling equipment must be taken into account. Altogether, this means defensive tactics are chosen when possible.

Several government authorities can be considered to be responsible for safety in garages. The most obvious of these is the Swedish National Board of Housing, Building and Planning, which are responsible for regulations regarding the construction of buildings (BBR). BBR do not, however, take into consideration the fuels of the vehicles that may be parked in a garage within a building. Safety for vehicles that use alternative fuels in underground garages fall between the cracks, with the Swedish National Board of Housing, Building and Planning, the Swedish Civil Contingencies Agency, and the Swedish Traffic Administration all pointing to one another. Several gas explosions have occurred that seriously affected building structures. For an explosion in an underground garage most force will be directed against the ceiling and thereby threatening the stability of the structure, depending on how it is constructed.

Road tunnels

The European Union have issued regulations regarding safety in road tunnels of 500 m or more on the European road network. Swedish Traffic Administration ratifies regulation regarding safety in road tunnels in Sweden. These regulations do not factor in alternative fuels in vehicles, and the responsibility for managing these risks is placed on tunnel managers. In general tunnels are built to resist fire. The most challenging situation concerns evacuation in smoke, in particular for two-way tunnels. A number of studies have investigated the risk of vapour cloud explosions in tunnels due to release of gas from a vehicle. In summary, the large tunnel cross section and mechanical ventilation limits the size of explosive gas clouds from vehicle gas systems. There are no reported incidents of gas-cloud explosions inside road tunnels. In all known cases of bombs detonating inside tunnels, the structure have resisted explosion well. This is not surprising considering that they are enclosed by matter and have two openings where the pressure can be released.

Emerging risks
Although accurately predicting which types of fuel will predominate in the future is difficult, rules and regulations must be carefully designed so as to ensure safety for likely scenarios. Risks need to be understood and evaluated in order for efficient regulations to be introduced at an early stage.

Current handling of petrol and diesel are well-tested and relatively safe. However, not least petrol contributes to many vehicle fires and fatalities. Alternative fuels, in the form of either gas or electricity, will likely lead to fewer leaks that are ignited, and thus fewer vehicle fires in general. However, electric and gas-powered vehicles introduce new risks, e.g. release by toxic gases and explosions.

Little knowledge could be found concerning possible structural consequences from a vehicle gas container explosion inside an underground garage. Existing evidence suggests that such an event could be devastating, at least for some types of structures. Future research is required to clarify how large damages that would result on different types of buildings with underground garages. This is the key emerging risk that was identified.

For road tunnel constructions and road users the emerging risk from the alternative fuels that were studied are judged to be small. Following a gas release a small or no explosion can be expected. A pressure vessel explosion most likely result from a fire but is not expected to lead to additional casualties (assuming road users either perish or evacuate due to the fire in the first place) or any significant tunnel damages.

A critical aspect for underground garages and road tunnels is the rescue service operations, and the new dangers that vehicles with alternative fuels pose to them. At the moment there is much uncertainty concerning the best extinguishing tactic to avoid pressure vessel explosions.

Vehicle gas systems could be designed to better resist a pressure vessel explosion as the result of a fire. Related safety standards and practice should be improved. Automatic ventilation in garages and road tunnels must be adapted to detect gases emitted by electric and gas-powered vehicles.

This contribution is an extract from an article which appeared in Fire Risk Management and Tunnels and Tunnelling International. The complete article can be downloaded from http://urn.kb.se/resolve?urn=urn:nbn:se:ri:diva-29101

Signed: Jonatan Gehandler

Brandposten
RISE Safety/Fire Research also publishes a bi-annual newsletter of their activities, which is available to download here: http://www.sp.se/en/units/fire/information/brandposten/Sidor/default.aspx

Emerging Risks from Smoldering Fires
The research project EMRIS (Emerging Risks from Smoldering Fires) is in its final stage, here is an update on the project and the contributions from RISE Fire Research in Norway.

A smoldering fire is a fire without flames. It can start and propagate at rather low temperatures, and the combustion produces smoke with a high CO yield and a high content of other toxic gases. Smoldering fires can be difficult to detect and extinguish, and the combustion can last for long periods of time. Smoldering fires can develop into flaming fires and explosions and therefore represent a fire risk in dwellings, stored biomass, silos for storage of flour, powder and corn, in waste deposits and in goods transportation.

The research project EMRIS started in January 2015. The purpose of the project has been to learn more about the phenomenon of smoldering, with regard to initiation, development and

Participants at the EMRIS workshop in June 2016 in Haugesund, Norway. The EMRIS team consists of representatives from universities, research facilities and industrial partners in five countries.

possibilities for extinguishment. EMRIS is led by Professor Vidar Frette at the Western Norway University of Applied Sciences (HVL). Other partners and collaborators in the project are researchers from Otto-von-Guericke University Magdeburg (Germany), Lund University (Sweden), Imperial College London (UK), Weizmann Institute of Science (Israel), RISE Fire Research AS in Trondheim (Norway) and relevant industrial partners. The research project is funded by the Research Council of Norway over a period of three years, and the project will be finalized by the end of 2017.

There are several PhD-candidates in EMRIS, and we are very proud of that one of them also is a staff member at RISE Fire Research in Trondheim. Ragni Fjellgaard Mikalsen studies smoldering fires in wood pellets, and is now about to finish her experimental work that is the basis for her PhD thesis. Wood pellets are used as fuel for heating appliances, and development of smoldering fires in production sites and large storage units for wood pellets is a problem. Her work focuses on how factors like heat exposure, cooling and ventilation conditions affect the smoldering combustion in wood pellets. The aim is to understand more about the fundamentals of smoldering, so that fires can be prevented and extinguished.

Within the frames of EMRIS, RISE Fire Research is studying smoldering in wood chippings, using the test apparatus developed within the EMRIS project. The wood chippings are produced from recycled wood materials and during storage there is a risk that smoldering fires develops within the heaps of material. Ignition can be caused by self-ignition from exothermic chemical reactions in the material or due to hot particles which have been produced during the treatment of the waste. Factors like size of the granules, moisture content and heat exposure was studied, and the results from the study will be published shortly.

The results from EMRIS will be useful for development of fire preventing and fire restricting measures to be applied against smoldering fires in wood based materials.

Signed: Anne Steen-Hansen, Ragni Fjellgaard Mikalsen, Nina K. Reitan

News from BRANZ (New Zealand)

BRANZ currently has a range of fire research projects underway that form part of its Societal Impact of Building Fires research portfolio NZ Fire Research Roadmap. All of these projects are funded by the Building Research Levy.

Figure 1. Full-scale horizontal fire spread experiment with lateral loading

Limiting Fire Spread by Design

This project deals with different aspects of compliance with the New Zealand Building Code. The first topic (completed) dealt with the performance of light-timber framed walls under lateral loading as part of an investigation of the risk of fire spread across a property boundary. The typical requirement is that a boundary wall must be capable of withstanding a uniformly applied lateral load of 0.5 kPa post-fire – see this link for further details https://ir.canterbury.ac.nz/handle/10092/12157.

Figure 2. Reduced-scale vertical external fire spread experiment

The second topic (nearing completion) addresses external vertical fire spread using a series of reduced-scale experiments and modelling. These form the basis to develop guidance on fire safety engineering design to prevent fire spread from lower to upper floors in multi-storey buildings via external flame plumes.

The third topic (in progress) focuses on fire severity in relation to modelling of thermal exposure in fully developed fires, specifically relating to transient ventilation effects and barrier failure, as well as thermal enhancement.

Additional related research is also proposed to be done at the University of Canterbury to investigate and develop a new time-equivalence approach for structural adequacy.

Fire Safe Use of Timber Construction – Combustible Timber Linings

This ongoing project focuses on the reaction-to-fire behaviour of timber surface lining materials. The objective is to develop design HRR curves that make allowance for the contribution to the fire development of the (combustible) timber linings, in addition to the building contents. The research deals with both fully lined compartments as well as cases where only part of the surfaces are lined. To date, a series of ISO 9705 room experiments with heavy (i.e. thermally thick) timber lining have been conducted, which will form the basis for such guidance. It is also hoped that prescriptive guidance on surface area exemptions may also be possible. The experimental results to date indicate that it is not just how much timber lining is exposed, but also where the lining material is located.

Figure 3. ISO 9705 room experiment for partially lined compartment – burner 300 kW

Fire Spread from Lower Roofs

This ongoing project deals with the situation where a lower roof abuts or is adjacent to the external wall of a higher building. In this situation, there is a risk of external vertical fire spread occurring. The prescriptive requirements are that either the part of the roof within 5 m of the wall or any part of the wall within 9 m of the roof be fire rated. The objective of this project is to develop performance-based guidance on Code compliance.

Passive Fire Protection Quality

This ongoing project deals with remediation in existing buildings of passive fire protection of services penetrations. The New Zealand Building Act requires such work to be done to a standard that is as near as reasonably practicable (ANARP) to the current Code requirements. A risk assessment model is being developed to help quantify what ANARP is, with a series of fire resistance tests of non-complying systems being used to help calibrate the model.

Framework for Risk-Informed Fire Safety Design

This new project is an initial review of the deterministic procedures for demonstrating Code compliance in the current C/VM2 Verification Method for Fire Safety Design document. The objective for the first stage of the project is to identify the feasibility of introducing risk-based compliance options to C/VM2 using a probabilistic calculation framework.

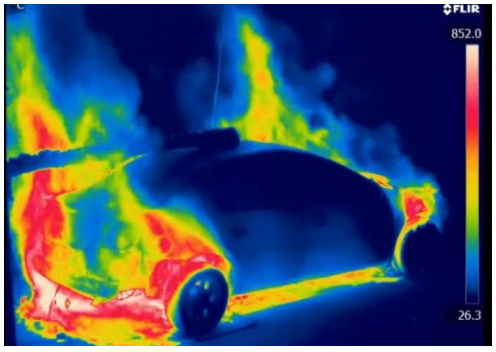
Signed: Greg Baker, BRANZ

News from the National Research Council of Canada

Fire Testing of Electric Vehicles and their Battery Packs

Over the last three years, NRC has been working with Transport Canada to examine the safety of electric vehicles (EVs) and their battery packs, in particular their response in a potential fire. The purpose of this work is to inform Transport Canada of the potential hazards of EVs compared with internal combustion engine vehicles (ICEVs) and to guide the development of technical regulations for EVs.

NRC has conducted full-scale fire tests on individual battery packs and on electric, hybrid electric and conventional gasoline-fueled vehicles. One series of tests, conducted in general conformance with the external fire exposure test requirements of UL 2580, looked at the thermal response of EV battery packs to controlled 2 MW fire conditions simulating a fuel-spill fire. A second series of tests compared the response of battery EVs, plug-in hybrid EVs and conventional ICEVs to the same fire exposure. Additional work is ongoing to evaluate thermal propagation within EV battery packs. In all tests, the batteries and vehicles were kept in as realistic a condition as possible.



Results from this work have been presented in several forums, including the 4th International Conference on Fires in Vehicles (FIVE 2016) in Baltimore, USA, and the 2016 Electric Vehicle Symposium and Exhibition (EVS29) in Montreal, Canada. For further information on this research, please contact Cecilia Lam (Cecilia.Lam@nrc-cnrc.gc.ca).

Fire Testing of Lithium Ion Batteries

Recently, there have been a number of news stories outlining the potential for fires caused by lithium-ion batteries. On September 8-9, 2016, NRC hosted an international workshop on lithium-ion battery fire safety

issues, co-sponsored by Underwriters' Laboratory (UL). This was attended by 60 key international stakeholders from industry, academia, government, emergency services, and the military. The workshop was designed to explore the levels of awareness and concern on the issue with a number of sectors (energy, aviation, surface transport, etc.), and to look at the stages in a battery's life-cycle (construction, transportation, installation, protection, mitigation, and response). The overall purpose was to highlight genuine safety challenges faced, previous lessons learned, and actions that need to be taken as we go forward - to safeguard the public and an important and growing industry.

In addition to senior management from NRC and UL, a number of renowned speakers on the topic attended including Dr. M. Stanley Whittingham and Dr.Judy Jeevarajan (of UL, formerly of NASA). Issues of particular concern to the built environment are the introduction of these battery units within houses and buildings with their very high energy densities and the fact that traditional fire suppression approaches are not as effective due in part to the fact that these batteries can generate their own oxygen to sustain fire. At the household level these are often being used in conjunction with solar arrays to provide night-time power. Some utilities are also beginning to invest in utility size battery facilities (buildings or significant sized components of buildings) to help with peak load management. Issues of concern to the aerospace industry include the powering of onboard systems using battery units, the loading and storage of the units in the hold, the introduction of these units into the cabin by passengers and crew, and the management of any fire incidents that develop. Many of these issues were discussed in an effort to raise awareness and to help direct efforts to meet the safety challenges faced. For further information on this research, please contact Russ Thomas (Russ.Thomas@nrc-cnrc.gc.ca) or Steven Gwynne (Steven.Gwynne@nrc-cnrc.gc.ca).

Upcoming Research on Climate Change

NRC has recently engaged in a significant exploration into future research needs given projected climate change effects (as mentioned here https://www.canada.ca/en/national-researchcouncil/news/2017/02/in_response_to_theincreaseofextremeweathereventsthenationalresea.html). This addresses numerous areas. One eventuality examined is the likelihood and severity of future wildfires, especially those affecting property and infrastructure (so called Wildland Urban Interface fires). The potential for such impact was horribly realized in the Fort McMurray fire in 2016. In recent months, NRC has (along with several research and industrial partners) engaged in a scoping exercise to determine research gaps, current practice and state of the art mitigation and adaptation approaches. This analysis has identified a number of areas where work is required – requiring new facilities, new competencies and/or new work. Once the findings of this provisional work has been processed and reviewed, it is hoped that NRC will continue on with the effort in 2017 and beyond – adding to existing expert capacity in North America. For further information on this research, please contact Noureddine Benichou (Noureddine.Benichou@nrc-cnrc.gc.ca) or Steven Gwynne (Steven.Gwynne@nrc-cnrc.gc.ca).

Signed: Steven Gwynne, NRCC

News from Commonwealth Scientific Industrial Research Organisation (CSIRO) Australia

The Docklands Lacrosse façade fire led to a busy science agenda for CSIRO in 2016. Prior to this fire event, CSIRO had collaborated with the University of Ulster and the Fire Protection Research Foundation to complete a major review of the fire hazards of combustible facades (http://www.springer.com/gp/book/9781493928972). This research guided CSIRO's very active participation in the Standards Australia committee that drafted a new Australian Standard for the testing and classification of combustible facades. It also facilitated the publication of a guide for combustible external walls in Australian residential high rise buildings and the ongoing development of a BS 8414 full-scale façade test facility at the CSIRO's North Ryde laboratories. These new facilities will extend the services that CSIRO already provides to assist the manufacturing and construction industry's response to the known combustible façade issues.

CSIRO 5MW Calorimetry Hood

Research into wall and ceiling linings has continued with Mr. Russell Collins recently completing his Master's Degree thesis through Victoria University which dealt with the correlations between small-scale ISO 5660-1 tests and ISO 9705 room fire tests.

CSIRO is also delighted to announce a major improvement of its experimental facilities. At our Sydney (North Ryde) laboratories we have installed a new calorimeter hood in the full scale testing hall, designed to cater for fires up to 5 MW. Our Melbourne (Clayton)

laboratories have relocated from their old Highett site, which closed in December 2015 following 71 years of operation as materials and construction research facilities. Construction of totally new laboratories reinforces CSIRO's commitment to building technologies, and includes new capabilities for bushfire, calorimetry, and acoustical testing.

As part of the relocation to Clayton, a new room fire test facility allows evaluation of residential smoke alarms and commercial smoke detectors to both Australian and international standards. Standards Australia recently published an updated residential smoke alarm standard AS 3786:2014, which is broadly similar to ISO 12239 and EN 14604. Additionally, standards in the AS 7240 series, which are modified adoptions of the EN54/ISO7240 series, have been published and adopted into Australian regulation throughout the last decade. This newly commissioned CSIRO facility has been accredited by the National Association of Testing Authorities for testing fire detection systems and accessories to this series of standards, continuing the laboratories' 51 years of unbroken accreditation.

CSIRO Test furnace at North Ryde

Brand New Calorimetry Hood (cleaner than it will ever be again)

Kitchen fire in the large scale CSIRO burn hall

CSIRO Room Fire Test Facility for smoke detection equipment

Signed: Alex Webb, CSIRO

News from National Research Institute of Fire and Disaster (NRIFD), Japan

Large urban fire investigation

A fire broke out in Itoigawa-city, Niigata, Japan, in the morning of December 22nd, 2016. This fire destroyed 147 houses, and burned almost 30,000 m^2, and is the worst urban fire since Sakata fire in 1976. It was a windy day, average wind speed was 9 m/s with a gust of wind 24 m/s. Wind caused several spot fires and firebrands were observed everywhere. Thanks to the early warning for the evacuation, only 2 residents and 15 volunteer firefighters were injured.

Initial investigation was performed on 25th and 26th December by 6 staff with National Research Institute of Fire and Disaster, Japan, and the main focus of this was investigating the situation and initial interviewing to local residents. Investigations are still under way.

Research project

New 5-year projects started FY 2016 (April) and first year is going to end. NRIFD has 3 main fire related projects out of 10; Large Outdoor Fires, Evacuation and Fire Investigation.

Large outdoor fires are problems all over the world – especially urban fires and post-earthquake fires in Japan. As cities in Japan were densely populated, one fire could result in large, uncontrollable fires if anything goes wrong. The objective of the research project on 'Large Outdoor Fires' is to prevent from damage in large fires by understanding mechanism of fire whirls and spot fires. In addition, development of technology to measure necessary information during outdoor fires- wind velocity, temperature by aerial system is also one of the targets of this research project.

'Evacuation' project focus on evacuation in nursing homes. It is important to know their cognitive and physical abilities in the case of emergency. Researchers have observed several evacuation drills as a first step. Safe evacuation tools for people in nursing homes will be developed in this project.

As NRIFD has Investigation Division as well as Research Division, it is also important to support fire departments' investigations. This project focuses on the developing better tools for 'Investigation'. One of objectives is to understand the ignition phenomena and make a database of different ignitions. Another is to investigate the proper onsite collection and analysis methods, which will not affect the analysis later performed in the lab. Last is to develop the way to understand and recreate the fire accurately. This is important as NRIFD often recreates fire incidents to understand phenomena correctly.

Signed by Sayaka Suzuki, NRIFD

News from NFPA and the Fire Protection Research Foundation

New report: *Evaluation of LPG Pool Fire Heat Flux – A Literature Review* (March 2017)
Liquefied Petroleum Gas (LPG) is used widely in a large number of applications, including utility, cooking and heating appliances. The main components of LPG are propane and butane, which can be used safely if risks can be managed in acceptable levels. However, LPG may leak and a pool fire may occur if ignition sources are existed. The heat flux from the pool fire will increase personnel risks and cause significant damages to individuals, process equipment, storage tanks and appliances. Therefore, appropriate management of these risks is a critical part throughout the processes of production, transportation and utilization of LPG.

In order to have a better understanding of the heat flux of LPG pool fires and determine the acceptable separation distance between the vaporizer and LPG storage tanks, this research tried to collect available experimental data of LPG pool fires. Download the full report, for free, from the Foundation website.

New report: *Variables Associated with the Classification of Ammonium Nitrate – A Literature Review* (March 2017)
Ammonium Nitrate (AN) "is a chemical compound produced in both solid and liquid forms that is commonly used in fertilizers". The burning rate of technical-grade AN falls within the Class 2 oxidizer criteria in Annex G of NFPA 400, 2016. The loss history of AN also indicates potential for unstable reactive hazard properties, uncontrolled decomposition and/or detonation under circumstances that are not fully understood. In the most recent revision of NFPA 400, Hazardous Materials Code, the Technical Committee (TC) classified Ammonium Nitrate as a Class 2 Oxidizer. However recent hazardous material incidents involving AN have resulted in differing views regarding the reactivity of the compound and whether or not it should be considered an unstable reactive in NFPA 400. The different behaviors of AN in different fire situations make it difficult to determine the appropriate safe practices for AN storage and handling. There are also discrepancies between the NFPA and International Fire Code (IFC) classifications of Ammonium Nitrate. As a result there is a need for additional data to assist in the proper classification/treatment of AN. An examination of existing data involving the reactivity of AN will assist the NFPA 400 TC in determining the appropriate classification of Ammonium Nitrate, and perhaps point to a need for future Ammonium Nitrate testing.

The purpose of this project was to summarize the available information on the different forms of Ammonium Nitrate and how they are classified. This will be accomplished through a two-step literature review: summarizing the available information on AN classification from chemistry and code-based documentation, and identifying the variables which led to AN instability from existing test data and results. Download the full report, for free, from the Foundation website.

New report: *Fire Alarms and At Risk Populations* (February 2017)
To understand the impact of fire alarm notification signals on individuals with sound and light sensitivities, the Foundation conducted an initial literature review to determine what information could be found on this topic. This literature review discovered that there was very limited information on the topic and the NFPA 72, National Fire Alarm Code, Technical Committee needed more technical information to develop guidance on how to

address this issue. This project gathered additional information on how fire alarm notification signals impact high risk populations by conducting targeted interviews with experts (e.g. teachers, therapists, etc.) Download the full report, for free, from the Foundation website.

New report: *Lithium Ion Batteries Hazard and Use Assessment – Phase III* (November 2016)
This report is part of a multi-phase research program sponsored largely by the Foundation's Property Insurance Research Group (PIRG) to develop guidance for the protection of lithium ion batteries in storage.

The first two phases of this project addressed a hazard assessment and a large scale flammability characterization, with the initial report completed in 2011 and a follow-up report completed in 2013. The latter of these two earlier efforts provided useful information on the performance of packaged small format batteries in storage. This indicated that a practical sprinkler protection solution, similar to that used for other common stored commodities, will be effective.

In order to confirm this finding, a third and final phase of the test program was conducted and the results are addressed by this report. This consisted of large scale testing (8-24 pallet loads) to ensure that the proposed sprinkler system will be effective in controlling this specific fire hazard.

You can also download an associated FM Global technical report, "Development of Protection Recommendations for Li-ion Battery Bulk Storage: Sprinklered Fire Test. Videos from three fire tests, which were part of the research, can be viewed on YouTube.

New report: *Impact of Fire Extinguisher Agents on Cultural Resource Materials* (November 2016)
A variety of different fire extinguishing agents are utilized in portable extinguishers used in museums, galleries, cultural centers, historic houses and libraries. This overall report is a compilation of two sub-reports - "Quantifying the Impact of Portable Fire Extinguisher Agents on Cultural Resource Materials Agent and Fire Exposure Test Report" and "Assessing the Impact of Fire Extinguisher Agents on Cultural Resource Materials".

The primary goals of this project were to establish a reproducible test protocol that could be used for future testing and that would permit the reporting and assessment of comparable test results by disparate testing entities, and gather information about the responses of a range of selected materials when exposed to the most commonly used portable fire extinguisher agents over both the short and long-terms.

Research and Analysis Newsletter
To see the latest studies, statistics and information about fire from NFPA, check out our most recent bi-monthly newsletter at http://f.e.nfpa.org/i/47/272412627/20170518_RA_AllStafflink.html.

News from ARUP

CONFERENCES
Arup engineers presented at the SFPE conference in Dubai, 19th-23rd March – Susan Lamont (UAE), "Delivering the Fire Strategy for Abu Dhabi International Airport Midfield Terminal Building – Design to Operation"; Peter Johnson (Australia), "New Tools, Strategies and Policy Directions for Performance Based Building Codes and Fire Safety Engineering in Australia"; John Barrot and Jelena Ivanisevic (US), "Top 10 Fire Safety Challenges in Passenger Terminal Design"; Susan Deeny and Judith Schulz (UK), "Fire Safety in Stadia: Performance of Roof Structures"; and George Faller (Spain), "Garment Factory Safety Program in Bangladesh." Susan Lamont was Conference Co-Chair.

Peter Johnson (Arup Fellow), along with co-authors Jake Pauls, Dr Brian Meacham and Dr Brian Ashe, presented a paper entitled "Built Environment Codes, Standards and Practice – The Impact on Public Health and Safety" to the World Congress on Public Health, held from the 3 - 7 April 2017 in Melbourne, Australia.

RESEARCH
Xiaoyun (Ivy) Wang has just joined Arup in Melbourne and has almost completed her research into road tunnels fires at the University of Canterbury in New Zealand. Arup is also sponsoring two teams of final year undergraduate students undertaking major projects at the University of Canterbury on use of CLT/LVL timber in office developments and the fire performance of glulam timber connections, with support from Arup fire engineers in Australia as well as timber building expert David Barber from Arup in the US.

Arup are engaging a new PhD student at the University of Edinburgh, UK to advance understanding of the detailed response of structural components at the fire limit state. Specifically, this PhD project will examine the behaviour of concrete composite construction in fire, focusing upon the performance of the shear studs and slab reinforcement through a combination of modelling and experimental work. The project is co-funded and supported by Arup through EPSRC's Industrial CASE scheme.

OTHER NEWS FROM ARUP
Follow these links to other news stories in Arup.com:

http://www.arup.com/news/2016_07_july/05_july_new_tate_modern_officially_opens

http://www.arup.com/projects/birmingham_new_street

http://www.arup.com/news/2016_09_september/02_september_arup_fire_engineers_help_set_capital_alight_to_mark_350th_great_fire_of_london_anniversary

http://www.arup.com/projects/london_1666

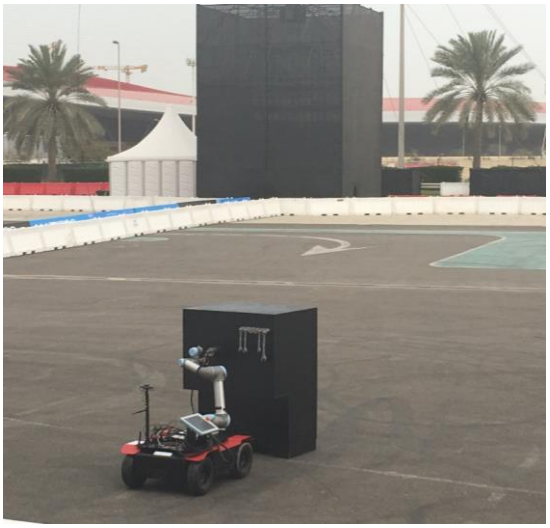
News from Jensen Hughes USA

JENSEN HUGHES, the global market leader in the fire protection engineering, fire code consulting and related life safety services industry. We now have over 1200 professionals in 75 offices in 12 countries serving thousands of clients around the world. In addition, the company continues to provide significantly to the development of safety standards as well as contribute to the technical literature. JENSEN HUGHES is excited to report on several new activities across the company in our mission of Advancing the Science of Safety.

Raj Arora has joined JENSEN HUGHES as President of Strategy and Business Development, and he is responsible for leading our strategic planning process as well as the business development and marketing efforts of our company. Raj joins us from JCI/Tyco based in Zurich, Switzerland where he has been VP & GM of their $1B Global Fire Detection and Special Hazard Products business, as well as being their Enterprise Business Leader for their transportation vertical market. Prior to Tyco, Raj was an Executive VP and an equity partner of Arora Engineers, an MEP/FPE consulting firm based in Philadelphia and he began his career at ADT Security Services. He has a B.S. in Fire Protection Engineering from the University of Maryland and is a licensed Fire Protection Engineer.

Pete Costa has joined JENSEN HUGHES as President of Field Operations, and he is responsible for leading our global fire protection, code consulting, and security practices. This includes our U.S., Canadian and International regional leadership. Pete joins us from Honeywell Building Solutions based in Dubai, UAE where he has been Vice President and General Manager for life safety, security and energy efficiency solutions and projects throughout the Middle East, Russia, Turkey, Central Asia and Africa. Previously, Pete was VP & GM for Honeywell's Western Europe region and VP of their global Critical Infrastructure Security business.

Dr. Albert Simeoni, PhD has joined JENSEN HUGHES as the new Director of Wildland Fire Services and Simulation in their Framingham, MA office. Dr. Simeoni has 19 years of experience and is an internationally recognized leader in wildland fires, building protection and fire science. He is a Certified Fire and Explosion Investigator and has developed experimental, analytical, and numerical techniques to better understand fire dynamics and to predict fire behavior. Albert will play a vital role to develop and guide the wildland fire research and development program and develop scientific tools and methods to help support root cause analysis, fire event reconstruction, structural design, and vegetation management. His extensive research background assist in our growing R&D group.



JENSEN HUGHES continues its research collaboration with Virginia Tech, assisting in leading a team in the international competition Mohamed Bin Zayed International Robotics Challenge (MBZIRC 2017) for fully autonomous systems. The two different robots designed, built, and programmed for the competition were a group of unmanned aerial vehicles (UAVs) and an unmanned ground vehicle (UGV) with a manipulator. Dr. Brian Lattimer and Dr. Alan Lattimer of JENSEN HUGHES led the autonomous unmanned ground vehicle (UGV) robot with a manipulator, and developed the software architecture and artificial intelligence for the robot. The task focused on having the UGV find a board with wrenches and selecting the correct size wrench to turn a valve. Out of over 100 teams, the team placed 14th and the UGV robot successfully completed the valve turning task.

Several staff also attended the Fire and Materials Conference in San Francisco, CA to present research papers including Jerry Back and Jason Sutula on battery fires, Brian Lattimer on aluminum residual structural properties, and Kevin Lewis and his group with numerous forensics related papers.

Signed: Brian Lattimer, JENSEN HUGHES

News from Fire Research Department of Building Research Institute (ITB) – Warsaw Poland

The end of 2016 and the start of 2017 was a busy time for the ITB. Two new researchers did join our Fire Research Department team (37 strong at the moment), and two of our employees obtained their PhD's from the ITB Scientific Council:

- Dr Grzegorz Krajewski for his work on air barriers used for separation of compartments in fire conditions;

- Dr Wojciech Wegrzynski for his work on the flow of smoke through large vertical openings and underneath projecting balconies.

Both PhD's were awarded the distinctions for their great applicability and will be further developed by the Institute. Papers related to the research should be published further this year.

Our Fire Testing Laboratory continuously expands - the testing facility for pressure differential systems, that already meets the requirements of prEN 12101-6 standard, has been officially open and the first commercial tests are on their way. It must be noted that this facility is built in cooperation with Warsaw Technical University, and does already generate a lot of attention both from Polish and European manufacturers. Also, within the field of pressurisation of evacuation routes, ITB had developed a mobile laboratory kit, designed for continuous measurement of airflow within stairways. This approach allows more robust evaluation of the system performance than the commissioning methods used up to date and was already put to use on some major Warsaw skyscrapers. The other large facility under development, the Fire Research Department Wind Tunnel, is finally growing out of the ground – the hall building is under construction, and the tunnel itself will soon enter the tender phase. The new facility will open our research capabilities to the performance of natural ventilators, and to the field of experimental validation of wind effects simulated by CFD software. A major paper in the field of performance of natural smoke vents was published earlier this year (doi: 10.1016/j.jweia.2017.01.014), and another paper on the use of wind engineering in FSE was presented during the FEMTC2016 conference in Malaga, Spain. Our researchers are working strongly on further expanding the results of both studies. The first effects from the physical experiments in the wind tunnel are expected by the end of this year. We also invite our colleagues from other research institutes to cooperate with us in the field of combining the wind and fire engineering – it is very rare that a wind tunnel with the turbulent layer is so widely available to a fire specialised department.

The year 2017 brings us a lot of opportunities to share the experiences with the world – our employees are preparing for this year major event - IAFSS in Lund, and other international events such as SFPE ME 2017 in Dubai and IFireSS in Naples. We hope to see you there!

Signed: Wojciech Wegrzynski

News from Olsson Fire & Risk UK

Olsson Fire & Risk (OFR) is delighted to welcome Danny Hopkin and Andy Passingham to the UK team and Warren Poh as the Managing Director for the NZ team.

Andy Passingham – Director, UK

Andy will provide further industry leadership for our already successful UK team. Andy has a high profile as a fire engineer not only in the UK and Europe, but internationally, with a 30 year career delivering some of the most iconic buildings across several continents. In addition to expanding the team technically, Andy will be establishing our new office location in Bath.

Dr Danny Hopkin – Structural Fire Lead, UK

Danny will be the new Global Structural Fire Engineering Lead, based in London and will work throughout the UK and with our structural fire specialists globally. He holds a doctorate in the fire performance of engineered timber. With 9 years' experience in the sector, including as a researcher with the Building Research Establishment (BRE), he has developed broad expertise extending to heat transfer, fire dynamics, quantitative risk assessment (QRA) and Computational Fluid Dynamics (CFD).

Warren Poh – Managing Director, New Zealand

Warren has been with us for quite some time now, and has built our New Zealand business into what it is now - one of the top 3 fire engineering businesses where we compete nationally and locally for the large and small

projects. Hence, Warren has now formally stepped in as a business owner and MD of the business, which is a recognition of his hard and successful work of the last few years.

Developing Skills and Knowledge Sharing

Within their first few weeks with OFR, both Andy and Danny have hosted presentations, run CPD sessions and been a visiting lecturer at the University of Sheffield:

- During February Andy gave a presentation in Birmingham to The Electricity Storage Network. This seminar was on Fire Engineering Approaches to Battery Storage Facilities; detailing the use of fire engineering approaches to develop a methodology to derive design fire criteria for large battery storage facilities. This was then used in conjunction with three dimensional radiation modelling to assess the potential impact of design fires in the facility on adjacent buildings in terms of external fire spread.
- Danny has given two presentations at the Applications in Structural Fire Engineering Conference, and was a visiting lecturer at the University of Sheffield to the structural engineering MEng / MSc students in March. He covered the practical application of reliability based methods in structural fire engineering, covering a case study for a recently completed high-rise project in Mumbai.
- In addition to the above, Danny will be leading the revisions of PD 7974-1 and 3, covering enclosure fire dynamics and fire resistance, respectively. He is the co-chairman of both committees and has convened two working group meetings with leaders in the field including other consultants and academics.
- Finally, we are leading a professional development short course instigated by the Institution of Structural Engineers in April. This is covering structural fire engineering and is intended to introduce structural engineers to structural design for fire safety. More info here: https://www.istructe.org/events/hq/2017/cpd-course-fire-safety-update.

Awards and Recognition

The OFR annual University of Canterbury Scholarship recipient is going to Sacha Holt. The scholarship is a fully paid Master Scholarship endorsed by the University.

Congratulations to Simon Lay, who was shortlisted for the category 'North West Start-up Director of the Year' at the North West IoD Director of the Year Awards 2017.

Signed: Kate Swinburne, Olsson Fire & Risk UK

News from the International Water Mist Association

IWMA wins CV Magazine's 2017 Health & Safety Award

The International Water Mist Association (IWMA) has won CV Magazine's 2017 Health & Safety Award. IWMA has been named "Best Fire Suppression Technology Advocacy – Germany and has received the "Award for Excellence in Sustainable Safety Technology Development".

IWMA to hold Water Mist Seminar in Poland

The International Water Mist Association (IWMA) would like to announce that plans are now definite to hold a water mist seminar in Poland. The event will take place in Cracow on 15th November 2017. More detailed information will be available soon. There will be no admission fee for delegates. Interested parties can register from 30th June 2017 onwards via the IWMA webpage.

During this one-day seminar speakers will explain the meaning of the technology within the firefighting world. They will talk about systems in practice as well as maintenance requirements. Delegates will be able to update their knowledge on standards, guidelines and approvals and listen to the insurances' point of view. The seminar will be accompanied by an exhibition.

UPCOMING CONFERENCES

International Fire Safety Symposium 2017 (IFireSS 2017) – 7-9 June 2017, University of Naples Federico II (Italy)

This event, organized by the Department of Structures for Engineering and Architecture and CIB, represents the second edition of the International Fire Safety Symposium held in Coimbra, Portugal in 2015. The Symposium will be held at the Federico II Convention Center, Naples, Italy.

The Symposium aims at collecting and disseminating the advanced results of scientific research concerning fire safety. It represents an opportunity to share research, technology and expertise among peers in an international

forum. The Symposium is addressed at the international scientific community but also at the most advanced industrial and professional representatives, in order to inspire debate on critical issues concerning fire safety.

CONTACTS: Visit the official conference website for more information: www.ifiress2017.unina.it or contact the iFireSS secretariat: ifiress2017@unina.it

2nd Nordic Fire & Safety Days – 17-18 August 2017, Aalborg University – Copenhagen

The Nordic Fire & Safety Days has grown to the largest conference on fire and safety in the Nordic countries. NFSD is a yearly event carried out by the Nordic universities and research institutes dealing with risk and fire safety. The conference is held by SP Technical Research Institute of Sweden in collaboration with Aalborg University in Copenhagen and the Technical University of Denmark, Lund University, Aalto University, Norwegian University of Science and Technology, University of Stavanger, University College Haugesund and Iceland University as well as VTT Technical Research Centre of Finland Ltd and the Danish Institute of Fire and Security Technology. The NFSD consortium agreed to hold the conference once more in Copenhagen, due to its central location.

The days put focus on risk and fire research in the Nordic countries. Contributions from other countries are more than welcome. The conference is in English.

The conference topics include: fire dynamics, fire chemistry, education curriculum, forensics, structural fire safety, off-shore fires, management of rescue services, residential fires, fires in transportation, safety management, healthy and environmental risks, societal activities and resilience, risk and innovations, decision-making, evacuation, crowd management and human behaviour.

We hereby announce the titles of the keynote lectures. The title of the lecture on August 17th is *Furniture fire properties and their importance for domestic fire safety* and on August 18th 2017 is *Fire brigade intervention method – accounting for the action of the fire service*.

The webpage is open for registration.

Signed: Anne Dederichs (SP, DTU) and Lars Schiøtt Sørensen (AAU) on behalf of the NFSD consortium

Suppression, Detection and Signaling Research and Applications Symposium (SupDet 2017) – 12-14 September 2017, Hyattsville, MD, USA

The 2017 Suppression, Detection, and Signaling Research and Applications Conference (SUPDET 2017) will be a joint conference with the 16th International Conference on Automatic Fire Detection (AUBE '17). The joint conference will be held September 12-14, 2017 at the College Park Marriott Hotel & Conference Center, Hyattsville, MD. Registration is now open. For more information about the program see http://nts.uni-duisburg-essen.de/aube/aube17/aube17.html.

Signed: Eric Peterson, Fire Protection Research Foundation

8th International Symposium on Scale Modelling (ISSM8) – September 12-14, 2017, Portland Marriott Downtown Waterfront, Portland, Oregon, USA

The 8th International Symposium on Scale Modelling (ISSM-8) will be held in Portland, Oregon, USA in September 2017. The conference will be hosted by Dr. Mark Finney from the US Forest Service, and co-sponsored by the Institute of Research for Technology Development (IR4TD), University of Kentucky and Scale-modeling division at JSEM (Japanese Society of Experimental Mechanics).

Scale modeling covers almost all fields of engineering and is often applied to fire, medicine, meteorology, biology etc. How to find the scaling law has been separately developed in various areas of engineering, although it should be commonly applicable. In this symposium, we bring all ideas/strategies to find scaling laws and how to operate/design the scale model experiment (even numerical experiments).

At ISSM-8, will have three keynotes speakers in fire by Prof. Forman Williams (UC San Diego), Dr. John DeRis (FM global), Prof. Jim Quintiere (U Maryland) and two topical review speakers. Two special sessions on Forest Fire (coordinated by Mark Finney, Sara McAllister, and Michael Gollner) and Material research (coordinator: Yang-Tse Cheng) will be planned, in addition to the general session.

For more information please visit the website, http://www.me.tut.ac.jp/ece/issm8/index.html

Signed: Michael Gollner, University of Maryland

17th International Symposium on Aerodynamics, Ventilation & Fire in Tunnels (ISAVFT 2017) –September 13-15 , 2017, Lyon, France

Tunnel ventilation is a small part of the cost of a tunnel, however, it is often crucial for sizing the civil engineering works and therefore their cost, and in allowing a given type of traffic. There is an ever increased pressure upon designers and engineers to develop more cost-effective solutions for tunnel construction without compromising safety. BHR Group's International Symposium on Aerodynamics, Ventilation and Fire in Tunnels has been the premier international event providing delegates with opportunities to discuss new research and developments, to consider innovative solutions and to explore technology breakthroughs. Its technical quality makes this event an essential diary date for everyone concerned with tunnels and tunnelling.

Underground facilities are ubiquitous in today's world, and more and more is demanded from them, in terms of economic efficiency, safety and sustainability. Aerodynamics and ventilation are often a key factor for these issues. Major fields covered by the symposium are:

- Maintainability, design for maintenance, total cost of operation
- Pollution levels, Portal emission
- Aerodynamics and acoustics
- Thermal comfort in underground facilities
- Fire and smoke, design, simulation
- Fire suppression system
- Innovative road vehicles in tunnels (electric, hydrogen, driver-less cars...)
- Retrofitting of tunnels, mid-life update
- Risk analysis and assessment
- Commissioning and testing
- Response to fire, post fire investigation
- Discussion / development of guidelines
- Sustainability, energy efficiency, carbon contents
- Contractual impact on project delivery
- Equipment (fans, sensors, dampers, etc.)
- Control and monitoring

The event will enable a debate on current hot topics within the community and include lectures from prestigious and keynote speakers, peer-reviewed presentations and posters. Don't miss this opportunity to network with the world's leading experts at this premier event!

For more information on the conference please visit http://www.bhrgroup.com/events

Signed: Dr Pierre Carlotti, Directeur, Laboratoire Central, Préfecture de police

CALLS FOR PAPERS

International Conference on Research and Advanced Technology in Fire Safety (FIRE SAFETY 2017)

The Call for Papers for FIRE SAFETY 2017 is open. The symposium will be held at the University of Cantabria, Santander, Spain, October 20-21, 2017.

Papers are invited on the topics below and others falling within the scope of the meeting. Papers should be between 10-15 pages, including title, abstract, body text, tables, figures and references and should be submitted by June 15. Delegates may also attend without submitting a paper. Submit your abstract online or by e-mailing the Conference Secretariat below. More information is available at http://www.firesafety2017.unican.es

- Combustion
- Fire dynamics
- Structural analysis
- Experimental research and data collection
- Fire computer modelling
- Evacuation modelling
- Tenability and toxicity assessment
- Emergency management
- Human behavior
- Evacuation and intervention

10th International Conference on Structures in Fire

You are invited to submit an extended abstract (two pages) describing the results of your latest scientific research or innovative applications of structural fire engineering no later than 22 December 2017. The submission for full papers will open in March 2018. Please submit your abstract Online.

The focus of the conference is on the behaviour of structures under fire exposure, including the art, science and practice of structural fire engineering. The following topics are addressed:

- fire and thermal models of fire resistance evaluation
- Numerical modelling of structures exposed to fire
- Simple calculation methods
- Experimental studies
- Material behaviour at high temperatures
- Validation
- Practical applications and case studies
- Global structure fire behaviour

- Steel, concrete, masonry, timber, aluminium and composite structures.
- Thermal and mechanical model interface (e.g. CFD-FE)
- Probabilistic aspects of structural fire engineering.

For more information see the conference website at: https://www.ulster.ac.uk/conference/structures-in-fire-2018

UPCOMING EVENTS – 2017-2018

2017

Jun 7-9	International Fire Safety Symposium 2017 (IFireSS 2017) - University of Naples Federico II (Italy) - www.ifiress2017.unina.it
Jun 12-16	12th International Symposium on Fire Safety Science (IAFSS2017) – Lund (Sweden) – http://www.iafss2017.se
Jul 3-6	16th European Meeting on Fire Retardant Polymeric Materials (FRPM 17) – Manchester (UK) - http://www.frpm17.com/
Jul 30-Aug 4	26th International Colloquium on the Dynamics of Explosion and Reactive Systems (ICDERS2017) - Boston (USA) - http://icders2017.com/
Aug 7-11	Summer School on Fire Dynamics Modeling - Jülich (Germany) - http://www.fz-juelich.de/ias/jsc/EN/Research/ModellingSimulation/CivilSecurityTraffic/FireDynamics/Events/SummerSchool2017.html?nn=1198632
Aug 17-18	Nordic Fire & Safety Days - Aalborg University Copenhagen (Denmark) - http://www.conferencemanager.dk/NFSD2017/nordic-fire-safety-days-2017.html
Sep 6-8	7th International Conference on Safety and Security Engineering – SAFE 2017 – Rome (Italy) - http://www.wessex.ac.uk/conferences/2017/safe-2017
Sep 10-12	Structural Safety under Fire & Blast (CONFAB 2017) – London (UK)- https://www.fireandblast.co.uk/
Sep 12-14	Suppression, Detection and Signaling Research and Applications Conference (SupDet 2017) – Hyattsville, MD (USA) - http://www.nfpa.org/supdet2017
Sep 12-14	8th International Symposium on Scale Modeling – Portland OR (USA) - http://www.me.tut.ac.jp/ece/issm8/index.html
Sep 13-15	17th International Symposium on Aerodynamics, Ventilation & Fire in Tunnels (ISAVFT 2017) – Lyon (France) - https://www.eventsforce.net/bhr/frontend/reg/thome.csp?pageID=35123&ef_sel_menu=990&eventID=108&eventID=108
Sep 17-20	2nd International Meeting on Fire Safety and Emergency Preparedness in the Nuclear Industry – Toronto (Canada) - https://www.cns-snc.ca/media/fsep-2017/
Sep 25-26	17th International Water Mist Conference (IWMC) – Rome (Italy) - http://www.iwma.net/home/
Oct 12-13	5th International Workshop on Concrete Spalling due to Fire Exposure - Borås (Sweden) - http://conferencemanager.events/firespallingworkshop/the-event.html
Oct 20-21	International Conference on Research and Advanced Technology in Fire Safety (FIRE SAFETY 2017) – Santander (Spain) - http://www.firesafety2017.unican.es/

2018

Mar 14-16	8th International Symposium on Tunnel Safety and Security – Borås (Sweden) - http://istss.se/
May 21-24	Fire Continuum Conference – Missoula MT (USA) - http://firecontinuumconference.org/
Jun 6-8	10th International Conference on Structures in Fire – Belfast (UK) - https://www.ulster.ac.uk/conference/structures-in-fire-2018

OBITUARY – Professor Georgy Makhviladze, University of Central Lancashire

We have received very sad news that Professor Georgy Makhviladze passed away on 31st May 2017 in Moscow.

Georgy was 72 years old. After more than 20 years in the Institute for Problems in Mechanics, Russian Academy of Sciences, Georgy was appointed as the Chair in Fire and Explosion Engineering at the University of Central Lancashire (UCLan) in 1993. In 1994 he established the UCLan Centre in Fire and Explosion Studies and he did enormous contribution in the development of Fire Safety Engineering nationally and internationally. He performed and oversaw numerous projects in fire safety engineering research and education. He was very active in IAFSS and one of the organisers of the International Seminar of Fire and Explosion Safety. Georgy was a Great Man and he will be sadly missed by his Family, Friends and Colleagues.

Signed: Andrei Chamchine, PhD, International Lead for School of Engineering

MEMBER ANNOUNCEMENTS

Awards

Kuibin Zhou, Sayaka Suzuki, and Samuel L. Manzello won the 2016 Tibor Z. Harmathy Award by Springer Nature. This award is presented annually to the authors of the best paper published in Fire Technology led by a student. The paper may be found on-line: *Experimental Study of Firebrand Transport* (Volume 51, Issue 4, pp 785-799, 2015). This study provides high fidelity measurements to validate transport models of firebrand showers, and further insights into firebrand generation.

Sayaka Suzuki (NRIFD, Japan) and Samuel L, Manzello (NIST, USA) won the 2016 Journal Paper Award from the Combustion Society of Japan (CSJ). Each year, CSJ awards the best paper published in the past 5 years, with papers selected from: Combustion and Flame, Proceedings of the Combustion Institute, Combustion Theory and Modeling, and the Journal of Combustion Society of Japan. The title of the awarded paper was: The Size and Mass Distribution of Firebrands Collected from Ignited Building Components Exposed to Wind, Proceedings of the Combustion Institute 34 (2013) 2479–2485. The co-authors of the paper with Suzuki and Manzello was Yoshihiko Hayashi (currently National Institute for Land and Infrastructure Management, Japan). This paper describes the development of simple, repeatable experimental methods for firebrand generation from structure component combustion. The work demonstrated that experiments using simple building components provided insight into firebrand generation from full-scale structures.

JOBS

National Fire Protection Association (NFPA)

Applied Research Director

Join NFPA in a new position designed to bridge the resources of the research community to NFPA's advocacy and standards programs. The applied research director will follow major research conferences and synthesize and bring that information back to NFPA and its stakeholders as well as be available as a technical resource for some of the major issues facing fire and life safety. The Applied Research Director will support NFPA's strategy as a fire safety knowledge and information provider by analyzing, curating and communicating relevant research in support of our mission. For details on requirements and to apply, look under Careers at www.nfpa.org.

Worcester Polytechnic Institute (WPI)

FPE Assistant/Associate/Full Professor, Posting Number *F00210P* **–** *see* https://careers.wpi.edu/postings/4069

The Fire Protection Engineering Program at Worcester Polytechnic Institute (WPI) invites applications for one tenure-track or tenured faculty position at the Assistant, Associate or Full Professor level.

We are seeking individuals who value innovation, creativity, diversity, inclusion and collaboration. Applicants at the tenure track level must show potential for an innovative and sustainable research and teaching career. Applicants at the tenured level must have a demonstrated record of outstanding research, excellent teaching and established leadership. The FPE program expects faculty to be involved in a balance of research, teaching and service.

The successful candidate is expected to have a PhD or equivalent degree in fire protection engineering or a closely-related engineering discipline. The candidate will be expected to develop an externally funded research program and teach graduate and undergraduate courses in and/or related to fire protection engineering

alongside faculty from affiliated departments. A successful candidate would have a demonstrated record of accomplishment in a core area of fire protection / fire safety engineering, such as compartment fire dynamics, fire protection systems performance, fire performance of structures, wild land fires, fire risk analysis, or human behavior and fire. Full professors with leadership experience and a combination of academic and professional experience in fire protection engineering are encouraged to apply.

Additional information about the program, faculty, research and facilities can be found at https://www.wpi.edu/academics/departments/fire-protection-engineering

Job postings on the IAFSS Website

Remember, you can always check the website for current job postings at the bottom of the front page.

CALL FOR CONTRIBUTIONS

To continue succeeding with this newsletter, it is important that we receive contributions from the IAFSS membership at large. Please consider submitting articles, letters to the editor, images, news, announcements or job openings related to fire safety science of IAFSS members. These could be collected from your department, institution, country or region. Please send your contributions to the Editor (Rita Fahy, rfahy@nfpa.org).

Letters to the Editor are most welcome, anytime, in response to newsletter content or any other topic related to the IAFSS.

For the next issue (No. 42), the deadline for submissions is September 30, 2017.

http://www.iafss.org

2014-2017
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