International Association for Fire Safety Science

A charity registered in England and Wales no 800306

Fire Safety Science News

http://www.iafss.org

April 2021, Issue No. 46

Rita Fahy, Editor

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: office@iafss.org

TABLE OF CONTENTS

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.

MEMBERSHIP REGISTRATION

Both current and new members can easily register online at www.iafss.org. *Current members: please sign-in before registering to maintain your account!*

One-Year Membership – 2021 (£25) Lifetime Membership (£300) Student Membership – 2019 (£5*)

BENEFITS OF MEMBERSHIP

- Symposia attendance at special member rates
- Free Digital Access to Elsevier's *Fire Safety Journal*
- Fire Safety Science News (Official Newsletter of the IAFSS)
- A vote in Association affairs**
- Discounted Symposium Proceedings

* Registered IAFSS academic members can nominate their students for free IAFSS student membership. Check website for details.

** IAFSS student members do not have a vote in Association affairs.

Please contact office@iafss.org with any questions about membership or how to register.

LETTER FROM THE CHAIR

When writing these lines, we are into the last preparations for the 13th symposium in Waterloo which will be our **first virtual one**. Already now we can say that this conference will be unique and bringing us to a new dimension within our Association and writing history. Although we all would have preferred to meet live, of course, and we will again one day! At the moment, we have 500 participants registered for the conference. It will be interesting to see how we can interact in this new type of forum. The interest and enthusiasm of all involved 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.

Changing to a virtual symposium is not done overnight. Therefore, I would like to **thank all members of all committees** for their efforts, all authors for sending papers, posters, images, etc. and for preparing their presentations for the symposium and of course all who will participate. 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. We also build our symposium on the local organisation and here the team in Waterloo has in fact done a tremendous job to shift in a short time. Well done! More information on the symposium can be found further in our newsletter.

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**. A first step was done by having our Business meeting online and to allow that our bylaws can be changed much more easily. The association is a charity and we have noticed in the management committee that it is necessary to move to more dynamic type of charity organisation without losing the grounds from our founding fathers.

One of the challenges we had during my second term was in fact moving from one secretariat to another. Sue Owen has helped us during the last four years in a perfect way but indicated from the beginning that it was a temporary solution. Therefore, I was very happy that I could obtain **a new secretariat** through Barb Waronek just before my term ended. Welcome to Barb and a big thanks to Sue for her fantastic work.

I do hope to see all of you virtually during the conference in one way or another. Enjoy our virtual symposium! And give us constructive feedback on how we can become better. I also would like to **thank you for the trust** you had in me during the last 7 years as chair. It was a pleasure for me to serve the Association! I wish my successor and the new committee which was elected a few weeks ago good luck.

Stay also safe and healthy.

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

IAFSS Management Committee 2020 Election: Report from the Election Scrutineers

The vote for the IAFSS 2021-2023 Committee was conducted during the period 1 October – 30 November 2020 using the SurveyMonkey ballot system. 253 IAFSS members voted in the election, and there were 27 candidates for office.

In January 2021, the votes were audited by the two election scrutineers, Chris Lautenberger and Anne Steen-Hansen.

Both scrutineers hereby confirm that the 24 persons below have received the highest number of votes (listed in alphabetical order):

Luke Bisby, UK
Pascal Boulet, France
Wan Ki Chow, China
Ritsu Dobashi, Japan
Rita Fahy, USA
Charles Fleischmann, New Zealand
Jason Floyd, USA
Ed Galea, UK
Michael Gollner, USA
Kazunori Harada, Japan
Patrick van Hees, Sweden
Longhua Hu, China
Brian Lattimer, USA
Naian Liu, China
Christian Maluk, Australia
Ken Matsuyama, Japan
Margaret Simonson McNamee, Sweden
Brian Meacham, USA
Bart Merci, Belgium
Yuji Nakamura, Japan
Arnaud Trouvé, USA
Yi Wang, USA
Beth Weckman, Canada
Jennifer Wen, UK

INTRODUCING IAFSS'S NEW SECRETARIAT – BARB WARONEK

As Patrick van Hees mentioned in his letter, IAFSS has a new Secretariat – Barb Waronek. Barb has been involved with several non-profit organizations, many with a scientific component. She joined The Combustion Institute (CI) in 2007, and served as Executive Administrator until her retirement at the end of 2019. In that role, she says she had the privilege of working with some members of IAFSS over the years, and is excited to reconnect with the combustion committee by working with all IAFSS members in the position of Secretariat.

As Executive Administrator of CI, she was responsible for daily operations, and keeping all the international sections connected and informed of policies. Website administration, membership information and payments, journal publication and symposia planning were all part of her duties. Respect for privacy, the need for confidentiality and the understanding of cultural views were critical to the success and growth of CI over the years.

Barb says, 'During these times of technology change, I hope that my experience will be beneficial to IAFSS. I look forward to working with the Officers and all IAFSS members during this transition. I am grateful for their support and the assistance of Sue Owen Wolf while I begin this new venture.'

Welcome, Barb!

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. 47), the deadline for submissions is September, 2021.

13TH INTERNATIONAL SYMPOSIUM ON FIRE SAFETY SCIENCE

13th IAFSS Symposium – registration open until Friday, April 16th

The (IAFSS) is delighted to announce that the 13th International Symposium on Fire Safety Science will be held as a virtual event during the week of April 26 to 30, 2021, hosted by the University of Waterloo, Canada.

Registration has re-opened. See our Registration page. Registration will be open until Friday, April 16th at 4 pm EST.

The Symposium is the premier fire safety science meeting in the world. It has been organized triennially since 1985 by the IAFSS. The program features invited lectures from the world's top fire science researchers, panel sessions showcasing fully peer-reviewed papers and posters highlighting recent work over the five days of the Symposium. In addition to the technical sessions, networking and social activities are planned where colleagues and friends can meet informally. Symposium activities will be preceded by a week of workshops from April 19 to 23, 2021 with presentations and discussions on current topics in fire safety science.

Research areas of interest include material behaviour in fires, fire dynamics, fire chemistry, structures in fire, fire suppression, wildland and WUI fires, evacuation and human behaviour, fire risk analysis and fire safety design. Other topics include fire detection and smoke control, explosions and industrial fires, fire codes and standards and fire safety management.

13th Symposium Committees

IAFSS Chair
Prof P van Hees, Lund University, Sweden

Local Host Co-Chairs
Prof E Weckman, Chair, U of Waterloo, Canada
Prof C Devaud, U of Waterloo, Canada

Symposium Co-Chairs
Prof M McNamee, Lund University, Sweden
Prof A Trouvé, U of Maryland, USA

Program Scientific Committee Co-Chairs
Prof N Liu, U of Science and Technology of China
Dr S McAllister, USDA Forest Service, USA

Program Communication Committee Co-Chairs
Dr K Boyce, Ulster University, UK
Dr Y Wang, FM Global, USA

Symposium Poster and Image Co-Chairs
Dr T Hakkarainen, VTT Technical Research Center, Finland
Dr J Floyd, Jensen Hughes, USA

English Language Mentoring Chair
Dr C Wade, Building Research Assoc, New Zealand

Awards Committee
Prof C Fleischmann, U of Canterbury, New Zealand
Prof M Gollner, U of California, Berkeley, USA
Prof J Wen, U of Warwick, UK

Symposium Proceedings Co-Chairs
Prof L Bisby, U of Edinburgh, UK
Prof B Merci, Ghent University, Belgium

Symposium Workshop Co-Chairs
Dr A Hamins, National Institute of Standards and Technology, USA
Prof G Rein, Imperial College, UK

Diversity Group Co-Chairs
Dr A Steen-Hansen, RISE Fire Research, Norway
Dr S Suzuki, National Research Institute of Fire and Disaster, Japan
Dr I Vermesi, Bureau Veritas, UK
Prof E Weckman, U of Waterloo, Canada

IAFSS Working Groups
MaCFP , Prof A. Trouvé, U of Maryland, USA
LOF&BE, Dr S. Manzello, NIST, USA

Proceedings to be Published in Fire Safety Journal

Submission and review of full papers for the 13th International Symposium on Fire Safety Science is complete and the suite of papers has been published as a special Proceedings issue of the Fire Safety Journal. Accepted conference manuscripts are not automatically included in the Special Issue of the Fire Safety Journal. To be included, each paper must be represented at the Symposium. Papers have also undergone a final review through the journal.

Invited Speakers

- **Mark Finney** (US Forest Service, USA) "The Wildland Fire System and Challenges for Engineering"
- **Anne Steen-Hansen** (Norwegian University of Science and Technology and RISE, Norway) "Learning from fire investigations and research – from reactive to proactive fire safety management"
- **Erica Kuligowsk**i (RMIT University, Australia) "Evacuation Decision-making and Behavior in Wildfires: Past Research, Current Challenges, and a Future Research Agenda"
- **Tara McGee** (University of Alberta in Edmonton, Canada) "Evacuating First Nations during wildfires in Canada"
- **Jinhua Sun** (SKLFS and Energy Fire Safety I**nstitute) "**Progress on research of fire behavior and fire protection of lithium ion battery"

The 2020 Howard Emmons Invited Plenary Lectureship

The 2020 Howard Emmons Invited Plenary Lecture will be delivered at the 13th IAFSS Symposium by **Professor Bogdan Z. Dlugogorski** of Charles Darwin University, Australia. The Emmons Lectureship is a prestigious recognition of distinguished career achievement in fire science and engineering. It is awarded by the IAFSS once every three years at the International Symposium on Fire Safety Science.

Professor Dlugogorski is distinguished for his contributions to the field of industrial fire safety and environment protection, especially through innovative development of safe industrial processes. Professor Dlugogorski founded and leads a large research group, with a strong focus on fire safety, and engaged in collaborative research and technology transfer. His achievements are recognized both within Australia and internationally, by a series of awards and fellowships. Professor Dlugogorski's personal contributions to the field of fire and process safety and environment protection are in four areas: (i) formation of toxic compounds in uncontrolled combustion (with focus on emissions of dioxins/furans, PCB and PAH in chemical fires, and from treated and contaminated wood); (ii) conversion of chlorinated and brominated wastes to useful material (including banned chlorofluorocarbons and halons, and byproduct hydrofluorocarbons); (iii) fire and explosion chemistry (including fundamental studies on chemical mechanisms of self-heating and ignition of coal, sensitization of emulsion explosives and mitigation of NOx formation in blasting); and (iv) mitigation of industrial fires (firefighting foams, gaseous agents and chemical fires).

Prof. Dlugogorski is a Fellow of the Australian Academy of Technology and Engineering, Society of Fire Protection Engineers, the Combustion Institute, Engineers Australia and Royal Australian Chemical Institute. Professor Dlugogorski has been awarded IAFSS Philip Thomas Medal of Excellence, NFPA Harry C. Bigglestone Award for Excellence and Lifetime Contribution Award from the Asia-Oceania Association for Fire Science and Technology. Professor Dlugogorski is currently Deputy Vice-Chancellor and Vice-President, Research and Innovation at Charles Darwin University, having previously held the positions of Dean of School of Engineering and Information Technology at Murdoch University in Perth and Director of Priority Research Centre for Energy at the University of Newcastle, Australia. He holds a DSc in Fire Safety Science and Engineering (Newcastle), PhD and MEng in Chemical Engineering (Montreal, McGill), and undergraduate degrees in Chemical Engineering and Geophysics (Calgary). He is immediate past chairman of the International Association for Fire Safety Science.

Professor Ai Sekizawa to be awarded Kunio Kawagoe Gold Medal

The 2020 Kunio Kawagoe Gold Medal will be presented at the 13th IAFSS Symposium in Waterloo, Canada to **Professor Ai Sekizawa** of the Tokyo University of Science, Japan. The Kunio Kawagoe Gold Medal is awarded by the IAFSS as a prestigious recognition of life-long contributions to and career achievements in fire science and engineering.

For more than 40 years, Prof. Sekizawa has dedicated himself to fire science and engineering while working at both government research institutes and prestigious universities in Japan, including the Fire Research Institute (now the National Research Institute of Fire and Disaster) and as a Professor at the University of Tokyo and Tokyo University of Science. During his career he has made significant contributions in different areas of fire science, such as fire risk analysis of residential fires, urban fires following an earthquake, and evacuation. His achievements in research are nt only of great importance for the promotion of fire safety science and engineering, but also of great contribution to the actual measures used to mitigate the fire risk of both

residential and post-earthquake fires.

Prof. Sekizawa has also been active in the promotion of fire science and its translation to practice. He established the Japan Chapter of Society of Fire Protection Engineers (SFPE) and has made a significant contribution promoting exchange among local chapters and fire experts in Asia Oceania as a Chairman of the co-ordination group. At the Graduate School of Global Fire Science and Technology at Tokyo University of Science, he has educated many students and young fire officials from Asian countries. He was President of the Japan Association for Fire Science and Engineering (JAFSE), the representative academic society on fire safety science in Japan (2008 and 2009). He also served on the management committee of the IAFSS from 2005 to 2017, including as Vice-Chair (2011 to 2017) and Secretary (2008 to 2011).

Prof. Sekizawa has previously been recognized with the Award of Japan Association for Fire Science and Engineering in 1992, the Peter Lund Award in 2011, the prestigious Arthur B. Guise Medal in 2014 from the Society of Fire Protection Engineers (SFPE). He is a Fellow of the SFPE and received the Lifetime Contribution Award at the 11th Asia-Oceania Symposium on Fire Science and Technology in 2018.

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

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. 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.

Proulx Award

Dr. Xinyan Huang, Assistant Professor at the Hong Kong Polytechnic University is the recipient of the 2020 Proulx Award. He is recognized for his research contributions that have impacted fire safety science and technology through: (1) pioneering understanding of smoldering wildfires by innovative experiments, developing the first-ever numerical model, and performing multidisciplinary research with the ecology and geoscience community, (2) improving our understanding of the flammability of materials and fire dynamics in the microgravity space environment, and (3) developing theories and techniques to understand the wire and cable fire and associated dripping phenomena. His work has been presented in over 40 peer-reviewed publications in journals such as *Combustion and Flame, Fire Safety Journal, and International Journal of Wildland Fire*. Dr. Huang has been very active in the fire science community, serving on multiple editorial boards and conference organizing committees. He has previously been recognized with multiple awards, including the Bernard Lewis Fellowship and the Sugden Best Paper Awards by the Combustion Institute and several best poster awards from the IAFSS and AOAFST.

At the Symposium, he will deliver a review paper drawn from his body of work.

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. Guylene Proulx (1960-2009), an expert in human behavior in fire at the National Research Council Canada and IAFSS Board member at the time she passed away.

Magnusson Award

Dr. Enrico Ronchi, Associate Professor at Lund University, Sweden, is the recipient of the 2020 Magnusson Award. He is recognized for his numerous research contributions that have covered a wide range of areas concerning human behavior in fire and fire evacuation. Dr. Ronchi's research includes work on different fire-related domains such as the verification and validation of evacuation models, pedestrian/crowd evacuation dynamics, emergency signage design, virtual reality and wildland-urban interface fires. He is also actively involved in teaching activities in the fire safety domain (being responsible for three courses in human behavior in fire and evacuation areas) and being the responsible at Lund University for the International Master of Fire Safety Engineering (IMFSE) Program arranged with Ghent University and the University of Edinburgh. His work has been published in over 50 peer-reviewed publications, and he commented in prestigious journals such as *Nature* and *the Physics of Life Reviews*. He is currently Associate Editor for the journals *Fire Technology* and *Safety Science*. He has also worked to translate his work into practice through his involvement with multiple committees and

publications with the ISO, SFPE and Italian and Swedish Governments.

He will deliver a review paper at the Symposium drawn from his body of work.

For the Magnusson Award, candidates must be within five to 10 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.

2020 Best Thesis Awards to be Presented at the 13th IAFSS Symposium

The IAFSS Best Thesis Award "Excellence in Research" recognizes the best research theses at either the PhD or master's level, in all the fields related to fire safety science and engineering. Three awardees were selected from the three IAFSS regions: Europe and Africa, the Americas, and Asia and Oceania. The awardees will have the opportunity to present their research at the 13th IAFSS Symposium. The awards committee also noted two honorable mentions. The awardees are:

Americas: **Joshua D. Swann** for the thesis, "A comprehensive characterization of pyrolysis and combustion of intumescent and charring polymers using two-dimensional modeling: a relationship between thermal transport and the physical structure of the intumescent char" conferred by the University of Maryland, College Park, USA, advised by Prof. Stanislav Stoliarov.

Europe and Africa: **Eric V. Mueller** for the thesis, "Examination of the underlying physics in a detailed wildland fire behavior model through field-scale experimentation" conferred by the University of Edinburgh, UK, advised by Dr. Rory Hadden and Prof. Albert Simeoni

Asia and Oceania: **Yongzheng Yao** for the thesis *"Fire Behaviors and smoke transportation law of tunnel fires under confined portal boundaries"* conferred by the University of Science and Technology of China, in collaboration with RISE Research Institutes of Sweden (RISE), advised by Prof. Heping Zhang and A/Prof. Xudong Cheng at USTC and Prof. Haukur Ingason and Dr. Ying Zhen Li at RISE.

Honorable mentions:

James L. Urban for the thesis "Spot ignition of natural fuels by hot metal particles" conferred by the University of California, Berkeley, USA, advised by Prof. Carlos Fernandez-Pello

Francesco Restuccia for the thesis "Self-heating ignition of natural reactive porous media" conferred by Imperial College, London, UK, advised by Prof. Guillermo Rein

Notice of Plans for IAFSS General Meeting, Part 2

Dear IAFSS Member,

I trust you are doing well. I am writing with information about the 2021 IAFSS General Meeting, Part 2, which will be held on **30 April 2021, 13:00 UTC**. The draft agenda for the meeting can be found here.

First, thank you to those who were able to join us on 24 March 2021 for Part 1 of the 2021 IAFSS General Meeting (GM). This was our first ever virtual GM, and although we had a few minor glitches, the meeting went well. The draft minutes for the GM Part 1 are attached to the draft agenda for the GM Part 2. As you will see, the proposed amendments to the Rules of the Association were approved, which formally allows us to proceed with a virtual GM Part 2.

As previously noted, we are changing the procedures for the GM Part 2, taking into account lessons learned and experiences gained from the GM Part 1, and aiming for a more interactive meeting.

- To limit the potential for non-members to join the meeting, all eligible members will be required to pre-register to attend the meeting. You will need to contact the Secretariat to pre-register. Upon verification of eligibility, you will be sent a meeting link and password.
- To assist us in checking attendees against our membership list, when logging into the meeting, please enter using your name in English as it correlates to your membership application.
- Since the meeting time is limited, please try to log in five (5) minutes prior to the start of the GM. Please check your hardware and connections prior to the meeting time.
- As with the GM Part 1, we are aiming to have any action required for voting to be presented in a form that votes can be simple 'approve / disapprove / abstain' where possible. This is largely driven by the limited time for discussion and the time allotted for the meeting.

- In the case where there is a vote that requires a choice between options (for example, if there are three candidates for Scrutineer and only two positions available), each option will be voted on separately, and the options receiving the highest vote counts will be taken as approved.
- Details of actions requiring votes, as initiated by the Committee, will be posted to the IAFSS website by 17 April for review, and as appropriate, to allow time to submit proxy votes by members who cannot attend the 30 April meeting. It is expected that this will include:
    - Approval of past minutes of General Meetings of the Association (14 June 2017 and 24 March 2021)
    - Approval of the Treasurer's report
    - Nominees for Honorary Auditors of the Association (two positions)
    - Nominees for Scrutineers of the Association (two positions)
- Because time for discussion in the virtual GM Part 2 will be limited, any member who nominates members for the position of Honorary Auditor or Scrutineer, or proposes any action that will require a vote, or wishes to raise an item for discussion under Any Other Business, must **provide text of the item in writing to the Honorary Secretary no later than 13 April 2021**. This is to allow time for review, confirmation, and posting of the item by 17 April, and if needed, time to permit submittal of proxy votes by members who cannot attend.
- Due to time limitations, a maximum of five (5) minutes will be allotted for questions / discussion on any agenda item.
- Proxy voting forms, for those unable to attend, will be available on 17 April, once items for voting have been identified and confirmed. Note that it is intended to simplify the proxy form such that proxy votes will be given to the Honorary Secretary, unless another person is specifically designated. If another person is designated, confirmation is required from the designee, in advance of the GM, that they (a) agree to serve as proxy and (b) confirm that they will be in attendance at the meeting. This is to help assure that the proxy vote will be delivered and counted appropriately.

As a member, your participation in General Meetings and your vote on issues of importance to the Association is critically important. We ask that all who can attend and participate do so. For those unable to attend, and who would like to exercise their right to vote, you are asked to provide your proxy vote to the Honorary Secretary no later than 27 April.

Also, we appreciate that options for voting and discussion remain somewhat limited. However, we have presented a more flexible and participative arrangement for Part 2 of the GM, within the limitations of time and technology being used. Developing a more robust on-line GM approach for future meetings will be an action on the Committee going forward.

Again, thank you for your understanding and flexibility, and if you have questions for clarification, or comments on what has been proposed, please let me know. Thank you.

Respectfully submitted,
Brian Meacham
IAFSS Honorary Secretary *ad interim*

Updates from IAFSS working groups

Measurement and Computation of Fire Phenomena (MaCFP) Working Group

Second MaCFP Workshop (MaCFP-2, April 22-23, 2021)

The general objective of the "*IAFSS Working Group on Measurement and Computation of Fire Phenomena*" (the "MaCFP Working Group") is to establish a structured effort in the fire research community to make significant and systematic progress in fire modeling, based on a fundamental understanding of fire phenomena. This is to be achieved as a joint effort between experimentalists and modelers, identifying key research topics of interest as well as knowledge gaps, and thereby establishing a common framework for fire modeling research. The MaCFP Working Group is endorsed and supported by IAFSS (http://iafss.org/macfp/) and is intended as an open, community-wide, international collaboration between fire scientists. It is also intended to be a regular series of workshops.

The second MaCFP workshop (MaCFP-2) will take place on April 22-23, 2021, as a virtual pre-event to the 13th IAFSS Symposium (https://uwaterloo.ca/international-symposium-on-fire-safety-science/). The workshop will feature activities organized by both the Gas Phase Phenomena subgroup (on Thursday April 22, 2021, US EST) and the Condensed Phase Phenomena subgroup (on Friday April 23, 2021, US EST).

Gas Phase Phenomena subgroup: The workshop planned by the Gas Phase Phenomena subgroup will take place on April 23, between 9:00 AM and 12:00 PM New York Time (between 2:00 PM and 5:00 PM London Time). The program will focus on discussions of the following target experiments:

- Case 1 (Turbulent buoyant plumes): the Helium plume experiment previously studied at Sandia National Laboratories (*J. Fluid Mech*. 544 (2005) 143-171);
- Case 3 (Turbulent pool fires with liquid fuel): the methanol pool fire experiments previously studied at the University of Waterloo (Case 3a, Combust. Flame 105 (1996) 245-266) and also currently studied at the National Institute of Standards and Technology (Case 3b, *Fire Safety J*. 107 (2019) 44-53);
- Case 5 (Flame extinction. Flame radiation): the controlled co-flow round ethylene diffusion flame experiment currently studied at FM Global (*Proc. Combust. Inst. 37* (2019) 825-832; *Proc. Combust. Inst. 37* (2019) 3951-3958).

The MaCFP repository hosted on GitHub (https://github.com/MaCFP) contains all available experimental data corresponding to Cases 1, 3a, 3b and 5. Modeling groups are invited to participate in MaCFP-2 by simulating and sharing computational results corresponding to one or several of these cases. Information on how to format computational results and perform comparisons with experimental data can be found in the Guidelines document available at https://iafss.org/macfp/the-2020-macfp-gas-phase-workshop/. The Gas Phase Phenomena subgroup is also inviting the entire fire research community to participate in the open discussions that will be an integral part of the program on April 22.

Condensed Phase Phenomena subgroup: The workshop planned by the Condensed Phase Phenomena subgroup will take place on April 23, between 9:00 AM and 12:00 PM New York Time (between 2:00 PM and 5:00 PM London Time). The general objective of this subgroup is to establish a structured effort in the fire research community to make significant and systematic progress in modeling of condensed-phase processes responsible for the generation of gaseous fuel in fires. During this second workshop, the results of the measurements performed on a target material selected during the first workshop, cast poly(methyl methacrylate), will be presented. These results have been obtained by sixteen institutions from ten different countries and are available through GitHub (https://github.com/MaCFP/matl-db). The pyrolysis property sets formulated by multiple groups based on these results are currently being collected and will also be presented and compared through simulations of idealized zero- and one-dimensional pyrolysis experiments. In addition, the results of new full-scale experiments on the poly(methyl methacrylate) will be introduced as potential targets for future CFD simulations of flame spread on this material. These presentations will be complemented by ample time for discussion to give everyone an opportunity to express their opinion on the current results and future objectives of this subgroup. The subgroup is not limited to current participants. We welcome anyone interested in this topic and are looking forward to your participation. Further information, about the group can be found at http://iafss.org/macfp-condensed-phase-phenomena/.

Registration: Registration to the second MaCFP workshop is fully open. To register, follow instructions available at https://uwaterloo.ca/international-symposium-on-fire-safety-science/workshops.

Points of contact

Gas Phase Phenomena Subgroup: Bart Merci (bart.merci@ugent.be); Arnaud Trouvé (atrouve@umd.edu)
Condensed Phase Phenomena Subgroup: Morgan Bruns (brunsmc@vmi.edu); Isaac Leventon (Isaac.Leventon@NIST.gov)

Large Outdoor Fires and the Built Environment (LOF&BE) Working Group

IAFSS Permanent Working Group LOF&BE (Large Outdoor Fires and the Built Environment)

As an outgrowth of the 2017 Lund Workshops held in conjunction with the 12th IAFSS Symposium, the International Association for Fire Safety Science (IAFSS) established the permanent working group known as LOF&BE (Large Outdoor Fires and the Built Environment). LOF&BE aims to bring the IAFSS community together to tackle large outdoor fire problem such as wildland fires, wildland-urban interface (WUI) fires, urban fires, and informal settlement fires. LOF&BE consists of three subgroups. The Ignition Resistant Communities (IRC) subgroup is focused on developing the scientific basis for new standard testing methodologies indicative of large outdoor fire exposures, including the development of necessary testing methodologies to characterize wildland fuel treatments adjacent to communities. The Emergency Management and Evacuation (EME) subgroup is focused on developing the scientific basis for effective emergency management strategies for communities exposed to large outdoor fires. The Large Outdoor Fire Fighting (LOFF) subgroup is providing a review of various tactics that are used, as well as the various personal protective equipment (PPE), and suggests pathways for research community engagement, including environmental issues in suppressing these fires.

It must be noted that there lacks dialogue between standard and codes organizations and the greater academic research community, largely present in the IAFSS. The current large outdoor fire situation is global and has been

identified as a major fire safety science problem by both the IAFSS and International FORUM of Fire Research Directors. The problem is too great for any one organization to tackle independently. Colleagues active in standards and codes bodies and members of the fire service are encouraged to attend, in conjunction with those from academia and research organizations, to be able to have these important cross-cutting discussions.

Please join us at the 13th IAFSS for the exciting LOF&BE Workshops. Each one-hour workshop session will begin with an update of the current work for each subgroup before focusing on a facilitated discussion with participants centered on targeted questions:

April 19, 2021 (starting EDT 9AM, BST 2 PM, CST 9 PM)
1 hr EME Program - *Emergency Management and Evacuation During Large Outdoor Fire Disasters: Review and Discussion on Missing Pieces for the IAFSS Community to Tackle* (Moderator: Samuel Manzello, Presenters and discussion leaders: Sayaka Suzuki and Maria Theodori)

Around the Room Discussion with Targeted Questions - We Need You and Your Expertise

April 20, 2021 (starting EDT 9AM, BST 2 PM, CST 9 PM)
1 hr IRC Program - *Hardening Communities to Resist Large Outdoor Fire Disasters: Review and Discussion on Missing Pieces for the IAFSS Community to Tackle* (Moderator: Sayaka Suzuki, Presenters and discussion leaders: Alex Filkov, Daniel Gorham, David Rush)

Around the Room Discussion with Targeted Questions - We Need You and Your Expertise

April 21, 2021 (starting EDT 9AM, BST 2 PM, CST 9 PM)
1 hr LOFF Program - *Firefighting During Large Outdoor Fire Disasters: Review and Discussion on the Use of Emerging Technologies (e.g. Drones)* (Moderator: Sara McAllister, Presenters and discussion leaders: Xinyan Huang, Brian Lattimer)

Around the Room Discussion with Targeted Questions - We Need You and Your Expertise

Large Outdoor Fires & the Built Environment Working Group Webinar Series

Due to delay in hosting the 13th IAFSS Symposium, LOF&BE initiated a new webinar series. The webinars are running monthly and to date, four webinars have been delivered. These are listed below. LOF&BE also started its own YouTube channel, so anyone is free to watch any of these interesting webinars. The reception with the webinars has been positive with about 350 people pre-registering for the first four webinars! Please join us for upcoming webinars.

- November 2020 - *Welcome to LOF&BE Webinar Series and Snapshot of Recent Research Activities of Interest to Urban and WUI fires* - Samuel L. Manzello (NIST) Recording: https://youtu.be/BP1FROVmMHU
- December 2020 - Overview of Urban Fire Management in Japan - Sayaka Suzuki (NRIFD, Japan) Recording: https://youtu.be/dlTkWCXoroI
- January 2021 - *Blazing the Trail: Celebrating Indigenous Fire Stewardship in Canada* - Amy Christianson (NRC Canada, Canada) Recording: https://youtu.be/Lbh66oCuRR0
- February 2021 - *The Need for Fundamental Wildfire Behavior Research in the Context of the 2020 Fire Season in the Western USA* - Sara S. McAllister (USDA Forest Service, USA) Recording: https://youtu.be/fS67WeEJ60s

Please check here for the upcoming webinars: https://iafss.org/lofbe-webinar-series/

Signed: LOF&BE Co-leaders - Sayaka Suzuki (NRIFD), Sara McAllister (USDA Forest Service) and Samuel Manzello (NIST)

New IAFSS Working Group on Human Behaviour in Fires

A new Working Group on Human Behaviour in Fires (HBiF) has recently been established within IAFSS. This group will serve as a coordinating body that monitors, develops and guides research on all aspects of the broad discipline of human behaviour in fire. The primary objective of the group is to achieve measurable, positive impacts on life safety of people in building and outdoor fires, avoid duplication in research efforts across the world and present a unified representative voice for researchers in the field.

The HBiF Working Group will focus on a number of activities; e.g., developing:

- a template for HBiF data collection and reporting
- guidelines for ethical research when studying human behaviour in fires
- a research roadmap for the discipline of human behaviour in fires
- a webpage containing resources for interested stakeholders
- a glossary of terms for the field
- authoritative guidelines for verification and validation (V&V) of computer evacuation models

We will hold our first meeting on 19th April 2021 as part of the 13th IAFSS Symposium. At this meeting, we will establish a prioritized list of short-term and long-term activities, associated timescales and deliverables and assign activity leaders. Please plan to attend and provide your input on working group priorities!

We hope that you can join us in our efforts to increase the safety of people in buildings and outdoor fires around the world!

Sign up to be a member of the group! Please visit the Google Form to sign-up:

https://docs.google.com/forms/d/e/1FAIpQLSdocuzhONH5tdYafhteBqGf0kxkpd1cbT-wJFghwI21U9sOWA/viewform?usp=sf_link

Additional information about the HBiF Working Group can be found here: https://iafss.org/2020/12/21/new-iafss-working-group-on-human-behaviour-in-fires/

Signed: Erica Kuligowski, PhD (RMIT)

Sheldon Tieszen Student Award Recipients Announced

The Sheldon Tieszen Student Awards are sponsored by the International FORUM of Fire Research Directors (http://fireforum.org/), a group composed of the directors of fire research organizations throughout the world, which aims to reduce the burden of fire (including the loss of life and property, and effects of fire on the environment and heritage) through international cooperation on fire research. The award recognizes excellence in an IAFSS symposium paper in fire safety science by a student making a significant contribution to that paper.

Recipients:

Elias Bearinger, M.S. - "Localized Heat Transfer from Firebrands to Surfaces" by Elias D. Bearinger, Jonathan L. Hodges, Fengchang Yang, Christian M. Rippe, and Brian Y. Lattimer, Advised by Brian Y. Lattimer at Virginia Tech, USA.

Mohamed Beshir, Ph.D. - "Semi-empirical model for estimating the Heat Release Rate required for flashover in compartments with thermally-thin boundaries and ultra-fast fires" by M. Beshir, Y. Wang, F. Centeno, R. Hadden, S. Welch, and D. Rush. Advised by David Rush, University of Edinburgh, UK.

Jian Chen, Ph.D. - "Why are Cooktop Fires so Hazardous?" by Jian Chen, Yue Hu, Zhigang Wang, Ki Yong Lee, Sung Chan Kim, Matthew Bundy, Marco Fernandez and Anthony Hamins, Advised by Anthony Hamins at National Institute of Standards and Technology.

Carmen Gorska, Ph.D. - "Fire Dynamics in Mass Timber Compartments" by authors Carmen Gorska, Juan P. Hidalgo and Jose L. Torero., Advised by Juan P. Hidalgo, at the University of Queensland, Australia.

Juan Cuevas, Ph.D. - "Flame extinction and burning behaviour of timber under varied oxygen concentrations" by Juan Cuevas, José Torero, and Cristian Maluk, Advised by Cristian Maluk, Juan Hidalgo and José Torero at The University of Queensland, Australia.

Lauren B. Gagnon, Ph.D. - "Effect of Reduced Ambient Pressures and Opposed Airflows on the Flame Spread and Dripping of LDPE Insulated Copper Wires" by Lauren Gagnon, Carlos Fernandez-Pello, James L. Urban, Van P. Carey, Yusuke Konno, and Osamu Fujita, Advised by Carlos Fernandez-Pello and Van P. Carey at the University of California, Berkeley, USA.

Vinny Gupta, Ph.D. - "Ventilation effects on the thermal characteristics of fire spread modes in open-plan compartment fires" by Vinny Gupta, Juan P. Hidalgo, Adam Cowlard, Cecilia Abecassis-Empis, Agustin Majdalani, Cristian Maluk, and Jose L. Torero. Advised by Dr Juan P. Hidalgo at The University of Queensland, Australia.

Qi Li, Ph.D. - "Symmetric modeling of the thermal actions in a structural fire experiment on a long-span composite floor beam in a compartment," by Qi Li, Chao Zhang, and Guo-Qiang Li. Advised by Chao Zhang, Wuhan University (China) and conducted in cooperation with NIST (USA).

Andrea Lucherini, Ph.D. - "Influence of heating conditions and initial thickness on the effectiveness of thin intumescent coatings" by Andrea Lucherini, Juan P. Hidalgo, Jose L. Torero, and Cristian Maluk, Advised by Cristian Maluk, Jose L. Torero and Juan P. Hidalgo at The University of Queensland, Australia.

Martina Manes, Ph.D. - "Assessing fire frequency and structural fire behaviour of England statistics according to BS PD 7974-7" by Martina Manes and David Rush, Advised by David Rush at the University of Edinburgh, UK

Karina Meerpoel Pietri, Ph.D. - "Determination of the critical conditions leading to the ignition of decking slabs by firebrands" by authors Karina Meerpoel Pietri, Virginie Tihay-Felicelli, and Paul-Antoine Santoni., Advised by Virginie Tihay-Felicelli, and Paul-Antoine Santoni at the University of Corsica, France.

Natalia Flores Quiroz, Ph.D. - "Developing a Framework for Fire Investigations in Informal Settlements" by Natalia Flores, Richard Walls and Antonio Cicione, Advised by Richard Walls at Stellenbosch University, South Africa.

Xingyu Ren, Ph.D. - "Temperature measurement of a turbulent buoyant ethylene diffusion flame using a dual-thermocouple technique" by Xingyu Ren, Dong Zeng, Yi Wang, Gang Xiong, Gaurav Agarwal, and Michael Gollner, Advised by Michael Gollner at the University of California, Berkeley and Dong Zeng at FM Global

Felix Wiesner, Ph.D. - "Influence of ply configuration and adhesive type on cross-laminated timber in flexure at elevated temperature" by Felix Wiesner, Susan Deeny, and Luke Bisby, Advised by Luke Bisby and Rory Hadden. Work completed at The University of Edinburgh, Felix Wiesner now at The University of Queensland, Australia.

Nan Zhu, Ph.D. - "Transitional flame-spread and fuel-regression behaviors under the change of concurrent wind " by Nan Zhu, Xinyan Huang, Jun Fang, Lizhong Yang and Longhua Hu., Advised by Longhua Hu at the University of Science and Technology of China, China.

SFPE Foundation Frederick W. Mowrer Global Scholar Award - Call for Nominations

The SFPE Educational & Scientific Foundation established the Frederick W. Mowrer Global Scholar Award fund in September 2020. The fund awards an annual $1,000 (USD) scholarship to a student originating from a developing nation who is studying fire safety engineering or a related discipline at a post-secondary educational institution. The goal of this scholarship is to impact safety around the world by supporting students to develop fire protection expertise in countries with rapidly expanding infrastructure. Deadline for nominations is April 5. Note that the nomination form must be submitted by an SFPE member.

For more information, see https://www.sfpe.org/foundation/foundationawards/mowrer.

NEWS FROM MEMBERS

Key international cooperation research project granted by NSFC

An international fire research team of the State Key Laboratory of Fire Science (SKLFS)/University of Science and Technology of China (USTC), Lund University and Ghent University has been successfully granted a new five-year (January 2021 to December 2025) key international cooperation project funded by National Natural Science Foundation of China (NSFC) on *Fundamental study of compartment-facade fire dynamics with complicated flow field under ambient wind.*

Combining the large-scale combustion wind tunnel experimental platform and the compartment-facade fire experimental model of SKLFS/USTC, and advanced fire numerical simulation platforms/models of Lund University (Sweden) and Ghent University (Belgium), this distinguished international team will carry out close cooperation and in-depth research on compartment-facade fire science under the effect of complicated ambient wind flow field (front wind, sideward (different angles) wind, back wind), to reveal the evolution of the turbulent fire behaviors inside the compartment, the neutral plane transition at the opening and flame ejection criteria, as well as the evolution of the air entrainment physics and characteristic fire parameters (flame structures; temperature profile; heat flux distribution), and to develop theoretical and numerical models/methods for compartment-facade fire dynamics considering the practical boundary conditions due to complicated flow field under ambient wind in nature. This, addressing an important frontier challenge of urban fire, is expected to advance the community's understanding of compartment-facade fire science.

The Co-PIs of this international cooperation project include *Prof. Longhua Hu* of University of Science and Technology of China (China), *Prof. Patrick van Hees* and *Prof. Margaret Mcnamee* of Lund University (Sweden) and *Prof. Bart Merci* of Ghent University (Belgium).

Signed: Co-PIs-Longhua Hu (USTC), Patrick van Hees and Margaret McNamee (Lund U), Bart Merci (Ghent U)

News from Japan Association for Fire Science and Engineering (JAFSE)

Report on the ceremony of JAFSE 70th anniversary

Guests of honor and hosts in the ceremony.

The ceremony of Japan Association for Fire Science and Engineering (JAFSE) 70th anniversary was held in the Square Koujimachi of Tokyo Fire Department on Friday, November 20th, 2020 and was attended by the approximate 80 members. A new coronavirus (COVID-19) caused size and time reductions of the ceremony in consideration of risk of spreading the infection by this event. Videos shot in the venue were posted on the JAFSE website for all of the JAFSE members. And the cerebration gathering was canceled.

The ceremony was opened by the opening address from the vice president of JAFSE Prof Akihiko Hokugo, and the sitting 29th president of JAFSE Prof Ritsu Dobashi delivered an oration. Four guests of honor, the past 22nd president of JAFSE Prof Yoshiteru Murosaki, the director of the National Research Institute of Fire and Disaster (NRIFD) Yasuyuki Suzuki, the president of Fire Chiefs' Association of Japan Toshio Ando and the president of National Fire Equipment Society Takeshi Hashizume assisted and Mr Suzuki made a complimentary speech on behalf of them. Furthermore, a video message of a congratulatory address from the chairman of IAFSS Prof Patrick van Hees was displayed at the screen.

Prof Akihiko Hokugo and Prof Ritsu Dobashi.

Prof Murosaki delivered the commemorative speech entitled "Thinking back on the Activities for 70 years and Future Perspective" for about 20 minutes. The contents of speech were an intent of founding the JAFSE and the social situation of the time, the characteristics of JAFSE, the history of society activities and the vision. Especially, regarding the vision, he proposed that 1) we had to discuss about what we should have done in relation to actual fires at the present time, 2) we had to join fire-fighting field, architectural field and fire science field comprehensively as a cross-sectoral emic society without withdrawing to specialized narrow community, and 3) we could engaged in educational activities for children and development of institution-building of approaches to safety and connect to a broad range of fields through them. And he concluded his speech with the words that the JAFSE was required to enhance the organization sustainably to achieve issues facing our society and the JAFSE.

Displayed video message from Prof Patrick van Hees.

Prof Yoshiteru Murosaki.

Finally, the chairperson of General Affairs Committee Dr Tsuyoshi Nagaoka gave a closing address and the ceremony was closed by all participants clapping.

Signed: Assoc Prof Masayuki Mizuno, Tokyo University of Science

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

New Associated Partner USTC

The IMFSE consortium is very proud to announce the strengthening with University of Science and Technology of China as Associated Partner. The inclusion of the Chinese State Key Laboratory of Fire Science in IMFSE is a major step forward for the IMFSE program.

New IMFSE Contributor MBA

The group of IMFSE Contributors is still growing, with several companies and organizations extending their financial commitment to the IMFSE program for the coming years. Thanks to these contributions the IMFSE Management Board can grant additional scholarships and tuition fee waivers to talented applicants. Recently Modern Building Alliance decided to participate, setting the total of contributing companies to 15! Many thanks to all for their continued support, which contributes a lot to the success of the program.

The IMFSE FSE Day webinar series

Due to the pandemic, the FSE Day could not take place in its original format, but that does not mean it was cancelled all together! Instead, the IMFSE Consortium decided to organize a series of webinars, with presentations of several academics and contributors all relating to the central theme of 'Modelling as a fire safety design tool – challenges and benefits'. The previous seminars have been a great success, and the two final ones will take place on 2 and 30 March 2021.

Seminar Posters for the 27/10/2020 and 17/11/2020 webinars

IMFSE Graduation Ceremonies

Unfortunately the class of 2020 could not have its graduation ceremony in person, but a great online event was set up for them on 7 September 2020 to properly celebrate their graduation. Several speeches were held by academic and students, and all students got to present their thesis. There was an official proclamation by the Dean of Ghent University, and the Margaret Law Awards were granted as well. Especially for this cohort, the 'hall of fame' was created on the IMFSE Instagram (@imfse_erasmusmundus), go check it out!

On 21 June 2021, the IMFSE class of 2021 should have its graduation ceremony in Ghent, if possible. The IMFSE Consortium is waiting a little bit longer to make some final decisions, hoping it will become clear soon what will be possible on that day. Fingers crossed!

The Class of 2020 during the online Graduation Ceremony

SFPE IMFSE student chapter: Gold Award for Chapter Excellence

The SFPE IMFSE student chapter is a 2020 recipient of the Gold Award for Chapter Excellence! This as an award granted to recognize SFPE Chapters that demonstrate excellence in contributing to the needs of their members and the society. Congratulations to the board for all their efforts and hard work.

Awards & publications IMFSE staff, students and alumni

IMFSE alumna Carmen Gorska Putynska delivered an engaging TED talk for TEDxUQ on her fire research on how timber can contribute to tacking climate change.

Check out IMFSE alumna Laura Schmidt in this video made by FSEU on the occasion of the UN Day for Women's rights on 8 March, to celebrate the achievements and experiences of women in the field of fire safety.

Check out IMFSE professor Grunde Jomaas' research work on fire risks on board of a spacecraft in collaboration with NASA.

Signed: Lies Decroos, Erasmus+ Administrator

Alessandro D'Ausilio defending his PhD

News from Ghent University

PhD defense Alessandro D'Ausilio
On 29 September 2020, Alessandro D'Ausilio successfully defended his PhD, entitled 'Numerical study of a turbulent spray flame with large eddy simulations coupled with the conditional moment closure method'. The academic supervisors are Prof Bart Merci and dr. Ivana Stankovic. The full text is available on https://lib.ugent.be/

Master of Science in Fire Safety Engineering
In current academic year 20-21, there are 19 students following the Master of Science in Fire Safety Engineering at Ghent University. In 2020, five students successfully graduated from the MFSE program. Best wishes to our alumni!

Signed: Prof. Bart Merci, Ghent University

News from the Hong Kong Polytechnic University

New Research Centre for Fire Safety Engineering Established
The new Research Centre for Fire Safety Engineering was established as a key part of Prof. Usmani's strategic plan to revive fire safety engineering research at PolyU. Now, the PolyU fire group has six full-time academic staff and maintains a team of more than 20 PhD students and postdoc fellows. The BSE fire research was enhanced enormously by the recently won RGC TRS project SureFire worth HK$33 Million that applies artificial intelligence (AI) in fire safety engineering.

Fire Group attended the 12th Annual Symposium of HKIE Fire Division
Fire Group attended the 12th Annual Symposium of HKIE Fire Division. The theme of the symposium was "Practising Fire Safety for Cavern and Underground Development." The aim of our attendance is to study the knowledge and experience of recently completed projects locally and overseas, including possible new uses and smart smoke detection equipment.

Towards a more collaborative fire research environment

Dr. Liming Jiang is actively working on bolstering collaboration within the structural fire engineering community between different regions. His latest efforts resulted in an enhanced collaboration with Tongji University through his project "Hybrid Simulation/testing on structural responses in real fires" which was awarded funding from the State Key Lab for Disaster Reduction in Civil Engineering. In addition, he established a forum for students from Hong Kong and Shanghai to come together and discuss fire safety and smart firefighting. The forum will take place in Shanghai in the second half of 2021 and is supported by the Shanghai-Hong Kong University Alliance.

New team of SFPE HK student Chapter & Christmas - New Year gift exchange activity

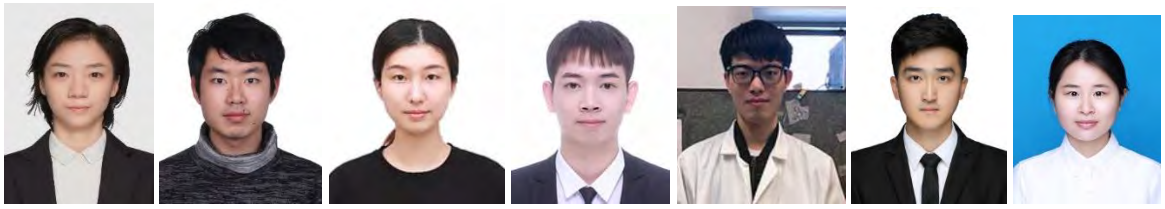
We are happy to announce a new team of officers for the SFPE HK Student Chapter: Shaorun Lin (President), Zhuojun Nan (Vice President), Siyan Wang (Secretary) and Xiaoning Zhang (Treasurer). We would also like to thank the first team of officers for their contributions in the past year. The fire group organised a gift exchange activity for Christmas and New Year. Based on the lucky draw each member received a present with which to welcome the new year.

Updates in Group Members

Two new postdocs, Dr. Han Yuan and Dr. Zhirong Liang and seven new PhD students join us this year. A Warm Welcome to our new members!

Dr Han Yuan is a postdoc fellow at the Hong Kong Polytechnic University. He received his PhD (2020) from the Department of Mechanical Engineering at Imperial College London, where he computationally studied the self-heating ignition and smouldering combustion of carbon-rich porous media. He got his ME and BE from Tongji University and Central South university, during which he focused on heat transfer and thermodynamics systems.

Dr. Zhirong Liang is a Research Associate at the Hong Kong Polytechnic University. He received his PhD in the speciality of Power Machinery and Engineering at Beihang University, during which his research mainly focused on analyzing the black carbon and organic carbon emissions originated from aircraft engine combustor and internal combustion engines.



Zhuojun Nan Tianhang Zhang Yuying Chen Zilong Wang Xiaoning Zhang Cheng Chen Jin Qiu

Caiyi acquired a grant from the the National Natural Science Foundation of China

Dr. Caiyi Xiong (Postdoc Fellow) has acquired a grant from the Young Scientists Fund of the National Natural Science Foundation of China (NSFC) 2020 for his research project titled "*Study on the Acoustically Driven Response and Extinction of Buoyant Diffusion Flame*". This project aims to reveal the underlying mechanism that governs the coupling effect of sound, flame, and fuel on the extinction process.

Shaorun receives the SFPE student research grant

PhD Candidate **Shaorun Lin** was awarded the Student Research Grant from the SFPE Educational & Scientific Foundation for his research project entitled "Megafire Mitigation: A Novel Methodology to Fight the Smouldering Wildfires". The aim of this study is to advance and enrich the wildfire-fighting strategy for suppressing smouldering wildfires.

First Year PhD Student Zhuojun Nan Wins the HKIE Essay Competition

For the second year in a row, the winner of the HKIE Fire Division Essay Competition was selected from amongst the PolyU Fire PhD students. Building on her previous experience as a graduate fire engineer in Arup - Shanghai, and her training as a PhD student at PolyU, **Zhuojun** focused on her winning essay on smart firefighting. In her article, she addressed the various stages of development required for establishing a successful smart firefighting system and how current technology can be leveraged to achieve a state-of-the-art fire monitoring and forecasting system.

Best Combustion Science Video Award & Best Poster Award

A popular science video made by **Caiyi, Yanhui and Xinyan** received the Best Video Award from the China National Symposium on Combustion. This video, with the name 'Storm Surge of Acoustic Wave', exhibits using of acoustic waves as a flame shield. This is the 3rd time we win this award.

Supan and Xinyan also won the best poster award from the symposium for the second year in a row.

Outstanding BSE Alumni Award 2020 to Fire Engineer

The Outstanding BSE Alumni Award recogniszes outstanding alumni for their accomplishments in BSE professions and their contributions to the community. 2020 is the 6th round selection. It is our pleasure to announce that **Ir Dr. TSUI Suk Chong, Fiona** (PhD at BSE 2008), has been awarded as the Outstanding BSE Alumnus of 2020. Ir Dr. TSUI is the Chairlady of HKIE Fire Division, Honorary Secretary of HKIE Fire Discipline Advisory Panel and Founding Member of MTR Projects Community of Practice, Women in Engineering to be launched. Fiona has many years practical experience on fire engineering, at role of railway client and at role of consultant to apply fire engineering principles and modelling protocols to formulate design solutions for both infrastructure and building projects including unique and special design features.

First of its kind in Hong Kong: Structural and Fire Safety Engineering Degree Program

The first of its kind BEng (Honours) in **Structural and Fire Safety Engineering** was launched at PolyU http://www51.polyu.edu.hk/eprospectus/ug/jupas/2021/js3777. This new four-year program aims to equip a new generation of engineers with the knowledge and skills to tackle complex interdisciplinary structural fire problems that face the industry. It is aimed that students graduating from the programme will be recognized by both the structural and fire divisions of the HKIE and will be qualified for progression towards chartership in either division. In addition to core subjects on structural engineering and fire engineering, students are expected to undertake a major design project and an individual capstone project by the end of their studies. It is hoped that this programme will pave the way for a safer built environment and a more robust collaboration between the disciplines of structural engineering and fire safety engineering.

Signed: Dr. Xinyan Huang, The Hong Kong Polytechnic University, Hong Kong, China

Seven-fatality fire

A big fire occurred [1] on 15 November 2020 in an old 4-storey building in downtown areas of HKSAR, killing 7 with another 7 seriously injured. As the building was constructed over half a century ago before having tight requirements on fire safety provisions, only 1 evacuation exit was available. There were no active fire protection sprinkler systems.

After the big Garley Building fire in Hong Kong [2] in 1996, all old high-rise buildings are required to upgrade the fire safety provisions with reference to requirements around 1998. However, such requirements appear not easy to achieve, taking over 20 years without significant progress. Situation might be better in old commercial buildings because of their higher market value. Even so, upgrading of fire safety provisions is slow. Authorities have implemented a contingency plan and postponed the enforcement for a long period.

Very little progress has been made in old residential buildings because there are many difficulties. It is impossible to open another exit in a small unit. The structure of the building is not able to withstand even the weight of a sprinkler water tank, not to mention the transient pressure of water hammer.

The demand for housing in downtown areas is huge. It is unfair to force several hundred thousands of residents moving out because the buildings satisfied the codes at the time of construction. As land is expensive in downtown areas, there are plans on developing more housings in the big Lantau Island reclamation project. Before getting more land, little can be done, but this takes time, with a time scale of decades. Thus the housing problem cannot be solved quickly.

Old residential buildings in HKSAR are characterized by high fire load density and high occupancy, but with very little fire safety provision. There are commonly subdivided units (SDU) [3] inside such old buildings too. Fire hazards cannot be solved quickly just by exploring the fire science behind nor providing green firefighting strategy without good long track record to confirm giving no threats to firefighters in handling fires in such problematic old buildings.

The only feasible way appears to be upgrading software fire safety management, not the hardware fire safety provisions. Fire safety management would ensure that the most appropriate fire safety strategies are used, together with accompanying education and training of occupants.

Note that there are many other hazardous challenges such as the fuel tank storage in urban areas [4] which will give more disastrous consequences. Only with the synergism between science and management could such old tall building fires be prevented or readily controlled. Government can only implement fire safety management effectively with citizens' support, including safety culture in addition to technology and management.

Fire safety in those old tall buildings have to be tackled collectively with well-trained firefighters, experienced fire engineers and scientists who can apply innovative scientific principles to practical uses, and building users who support taking right actions with appropriate fire safety management. More importantly, safety culture should be promoted with higher responsibility.

Further, apart from full-time doctoral graduates in local higher education institutions, 5 part-time PhD students in fire engineering were graduated with degree conferred by The Hong Kong Polytechnic University in January 2021. Those students are full-time fire officers and practising building services engineer working in the industry, all supervised by Professor Chow. Examination process for them were slightly delayed due to social activities and virus control, with oral examinations and congregations held online !

References

1. D. Mok, "At least seven dead, several others critically injured as fire rips through flat in Hong Kong tenement building", South China Morning Post, 15 November 2020. https://www.scmp.com/news/hong-kong/society/article/3109950/least-eight-hurt-fire-rips-through-flat-hong-kong-tenement
2. 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).
3. K.K. Leung and C.L. Chow, "A brief discussion on fire safety issues of subdivided housing units in Hong Kong", Proceedings of the 3rd Residential Building Design & Construction Conference, Edited by Dr. A.M. Memari and S.K. Lowe, pp. 380-394 (2016).
4. H.Y. Ng, Y. Wan and W.K. Chow, "A study on fire hazards of oil tanks in urban areas with scale models", Eighth International Symposium on Scale Modelling (ISSM-8), 12-14 September 2017, Portland, Oregon, USA (2017).

News from Lund University

Education

The last semester has been dominated by distance studies at Lund University. In the first half of the autumn semester a hybrid solution was used, i.e. online lectures were complemented by on-campus teaching in smaller groups. However, during November all teaching was moved to online. This is especially unfortunate for our courses where we have laboratory work. We greatly value the importance of connecting theory and practice in our education, but this has been challenging in recent times. However, the teaching staff has been innovative and very good virtual material has been produced.

Research

The final report and a scientific paper based on the "WUI-NITY" project funded by NIST concerning the development of a platform for WUI fire evacuation modelling have now been published. This is the result of an International effort including Dr Enrico Ronchi and Dr Jonathan Wahlqvist from Lund University, along with researchers from the Fire Protection Research Foundation, Imperial College, Movement Strategies, National

Research Council of Canada and RMIT. A follow up project called WUI-NITY 2 has been funded by NIST in which a suite of V&V tests will be developed for WUI fire evacuation models and applied to the WUI-NITY tool. The work will be conducted during 2021.

During 2020, Dr Enrico Ronchi has been leading a project on the development of a risk assessment methodology for the use of crowd models to assess occupant exposure during the Covid19 pandemic and their implications in fire evacuation design. This work has been funded by the Italian company Cantene srl. The final report presenting the methodology and a scientific article presenting the proposed crowd model retrofit to assess exposure are both freely available for download.

A first publication of an ongoing three-year project (2019-2021) on the study of evacuation of people with disabilities funded by the Swedish Research Council FORMAS has been published. This is a multi-disciplinary effort involving researchers at the fire safety division (Dr Enrico Ronchi and Erik Smedberg) and at the health science faculty at Lund University. The aim of this project is to adopt established concepts in accessibility and health science (e.g. the International Classification of Functioning, Disability and Health) in the fire safety domain.

Dr. Marcus Runefors has been awarded a postdoc-project on hydrogen fuel-cells. Stationary fuel-cells, powered by hydrogen, is a technology under strong development to handle variations in output from renewable energy sources. However, hydrogen is a challenging gas from a safety perspective, for example, due to its small molecules that increase the risk of a leak, high laminar flame speeds and its proneness for transition to detonation (DDT). The project aims to develop methods for risk analysis and suggest models for consequence modelling as well as develop novel risk mitigation strategies both from a prevention and response perspective. The project is financed by the Swedish Civil Contingencies Agency (MSB).

The Division of Fire Safety Engineering was granted a FORMAS application for a new research project studying the perception of realism in Virtual Reality (VR). The objective of the project is to study how to improve the perception of realism for participants in VR experiments. To do so, first different real-world environments will be replicated in VR. Participants will be asked to assess both the real and the virtual environments, using tools for environmental assessment commonly used in Environmental Psychology. The results will indicate how the perception of the environment differs between VR and reality. With that knowledge, a new virtual environment will be developed, replicating the training protocol used at the University Hospital in Lund. Volunteers from the hospital's staff will then be assigned to a group and trained in the fire safety protocol in a VR or a real-world training facility. The VR training facility will be enhanced with elements of augmented virtuality (e.g. participants using a fire extinguisher in VR will have to hold a real one at the same time). A few months later, the volunteers will be put to a test in a real-world training facility in order to assess which training method has the highest level of retention. It is expected the levels of retention will be similar between both samples if the perception of realism in the VR training environment was improved. The researchers from the division that are involved in the project are Silvia Arias, Håkan Frantzich and Jonathan Wahlqvist.

There are several more on-going research projects and the result from many of them are reported in open access Lund University reports. You can access our publications through our webpage: www.brand.lth.se/publications

Positions and personnel

Dr. Håkan Frantzich is our new head of the Division of Fire Safety Engineering since January 1st. Dr. Frantzich has a long experience of working at Lund University and at the Division of Fire Safety Engineering. Dr. Frantzich is senior lecturer and Docent (Reader) in fire safety engineering and was until December 31, 2020 program director for the B.Sc. program in Fire Protection Engineering. Håkan replaces Prof. Patrick van Hees who has been appointed head of the Department of Building and Environmental Engineering (which includes the Division of Fire Safety Engineering and seven other divisions).

Dr. Nils Johansson is new program director for the B.Sc. program in Fire Protection Engineering. Dr. Johansson is senior lecture and has been teaching in various courses on the program for more than ten years.

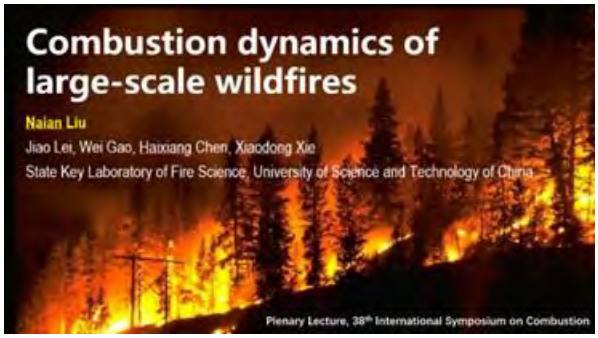
Lotta Vylund is new industrial PhD student at the division. Lotta is employed at RISE, and in her research, she will be focusing on problem-solving networks in the fire and rescue services and how such networks affect the efficiency of problem solving. The work will be conducted within the FIRE21, which is an interdisciplinary project together with DTU, NTNU and RISE, that will study problem-solving networks connected to the fire and rescue services in the Scandinavian countries. Prof. Margaret McNamee is project leader of FIRE21.

More information about the Division, are available on www.brand.lth.se. Our website is continuously updated with news.

Signed: Nils Johansson, Lund University

News from State Key Laboratory of Fire Science, University of Science and Technology of China

Prof. Liu Naian delivered a plenary lecture at the 38th International Symposium on Combustion



The 38th International Symposium on Combustion was held from January 24th to 29th, 2021, in Adelaide, Australia. Due to the rampant pandemic, the symposium was held online with the participation of more than 1,300 experts, scholars, and young students worldwide. Prof. Liu Naian at the State Key Laboratory of Fire Science, the University of Science and Technology of China, was invited to deliver a one-hour plenary lecture at the symposium.

In recent years, the increasingly severe problems of large-scale wildfires worldwide have been receiving ever-growing academic attention. The high-intensity burning behaviors in wildfires stem from the significant interaction of combustion with heat transfer and atmospheric flow under complicated fuel, meteorology, and topography conditions. Therefore, mitigating measures against large-scale wildfire disasters have grown into a challenging research focus for combustion scientists. The lecture, entitled as "*Combustion dynamics of large-scale wildfires*", depicts an overall pattern of the essential factors that lead an initial small-scale spreading flame to a large-scale wildfire beyond control. It is outlined that the complicated transformation of fuel preheating mechanisms determines the growth of surface fire spread, while varied large-size flame fronts and unique spread modes induced in specific fire environments play an essential role in fire spread acceleration. Additionally, multiple fires burning and merging often act as crucial steps for accelerating surface fire spread, generating large-size flames, and triggering unique spread modes. These major potential factors strike the energy balance of a low-intensity wildfire and push it to a high-intensity state. Several issues regarding intensely burning behaviors in large-scale wildfires are selected for in-depth discussions, for which an overview of the progress and challenges in research is presented. It is concluded that the fundamental exploration targeted at developing application tools capable of dealing with large-scale wildfires remains at its early stages. Opportunities for innovation are abundant, yet systematic and long-term research programs are required.

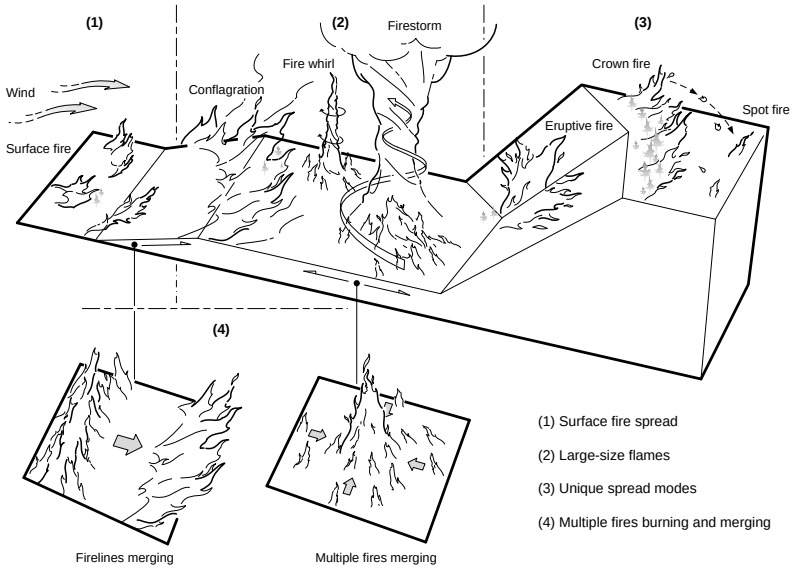


Figure 1. Schematic sketch of the potential factors leading a small-scale spreading flame to become a large-scale wildfire beyond control: (1) growth of surface fire spread, (2) large-size flames (conflagration, firestorm, and fire whirl), (3) unique spread modes (eruptive fire, crown fire, and spot fire), and (4) multiple fires burning and merging.

Figure 1 depicts a schematic sketch of the potential factors leading a small-scale spreading flame to become a large-scale wildfire beyond control, extracted from the lecture paper published in *Proceedings of the Combustion Institute* (https://doi.org/10.1016/j.proci.2020.11.006).

Signed: Prof. Naian Liu, State Key Laboratory of Fire Science, University of Science and Technology of China

International Cooperative Study on Satellite Remote Sensing of Wildfire

Satellites are able to provide regional to the global observation of fires at relatively high spatiotemporal resolution. In the past several decades, satellite observation has been widely used in fire monitoring, fire regimes, and fire emission studies, relying on accurate fire observation such as fire detection (omission and false alarms) and fire intensity. Assessing the performance of fire observations between satellites, thus, is very important for associated fire studies.

Recently, Prof. Rui Li from the State Key Laboratory of Fire Science, University of Science and Technology of China (USTC), in cooperation with Prof. Yves Bergeron (fellow of the Royal Society of Canada (Academy of Science)) and Prof. Osvaldo Velaria from the University of Quebec in Abitibi-Témiscamingue (UQAT), conducted a comparison study of fire observation between the Moderate Resolution Imaging Spectroradiometer (MODIS) and its successor the Visible Infrared Imaging Radiometer Suite (VIIRS) to explore their relative performance on fire detection and fire intensity monitoring in Northeast Asia. Associated results were organized and published at the journal of "***Remote Sensing***" (IF=4.5, 5-year IF=5.0) with the title of "*Fire Detection and Fire Radiative Power in Forests and Low-Biomass Lands in Northeast Asia: MODIS versus VIIRS Fire Products*".

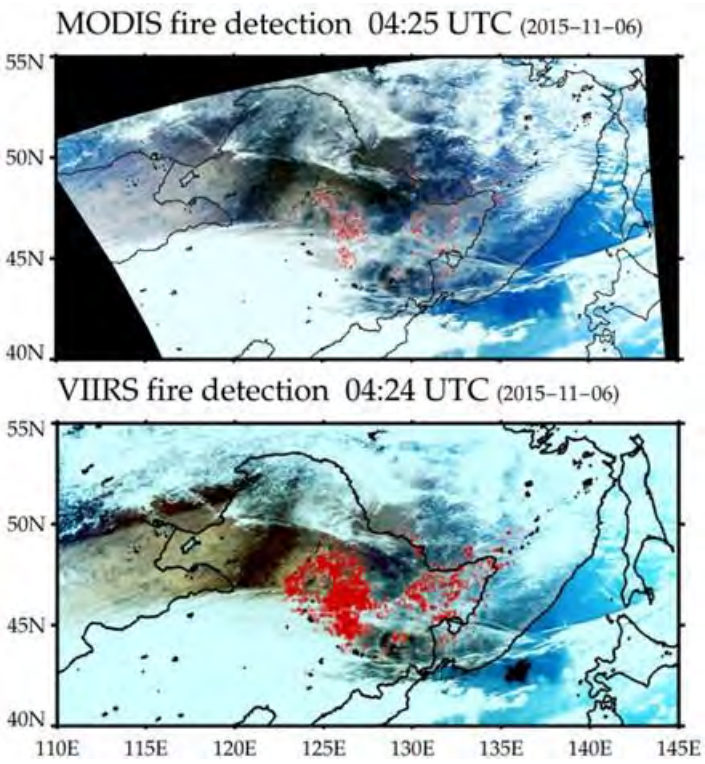


Figure 1. Fire case detected almost simultaneously by MODIS and VIIRS

The study showed that both MODIS and VIIRS missed some fires and have some false fire alarms. The fire detection omissions are more common over low-biomass lands (e.g. grassland and croplands) than forests (Figures 2), and are more significant for MODIS than for VIIRS, especially in low-biomass lands (Figures 2). The higher fire omission errors of MODIS than VIIRS are mainly attributed to its coarser spatial resolution (1 km at nadir) than VIIRS (375 m). With lower spatial resolution, it is more difficult for MODIS to distinguish fire signal from background in space especially considering its rapidly increasing pixel size along scan angle. On the other hand, the prevalence of low fire intensity in low-biomass lands can lead to more fires that are detectable for VIIRS below the detection capability of MODIS, explaining the significantly higher fire omission of MODIS than VIIRS in low-biomass lands. The commission errors (false fire alarms) are also existed for both MODIS and VIIRS, and are closely related to the vegetation types and the FRP value of the 'fire pixel' retrieved.

As for fire intensity, MODIS FRP retrieval is higher than that of VIIRS for those concurrently detected fires (Figures 2). One of the reasons is likely due to the attenuation of atmospheric absorption of carbon dioxide (CO2) at the VIIRS M-13 channel (3.97–4.13 μm) that was used for FRP calculation. Another possible reason is the higher background temperature estimation with VIIRS than MODIS during the calculation of fire FRP. However, there were many fires detected by VIIRS that MODIS omitted; these extra fire detections offset the effect of the lower FRP retrieved by VIIRS for those concurrently detected fires and finally led to an overall higher total FRP with VIIRS than MODIS (Figure 2).

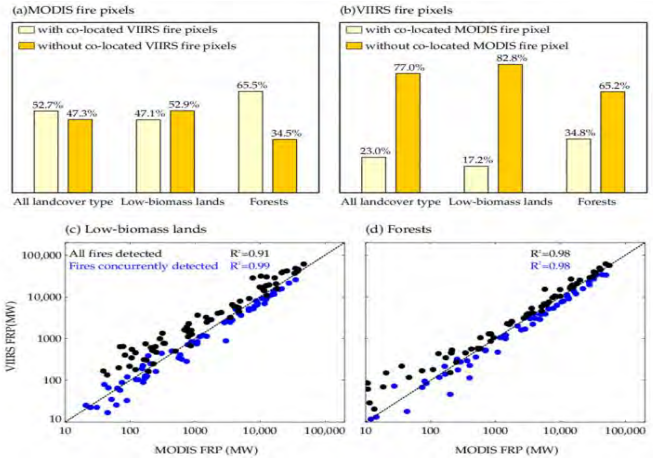


Figure 2. (a, b) MODIS and VIIRS fires with and without co-located fire detection from each other; (c, d) VIIRS versus MODIS monthly FRP during 2012–2017.

The above results will contribute to a better understanding of fire detection and FRP retrieval performance between MODIS and its successor

VIIRS, providing valuable information for using those data in the study of fire regimes and FRP-based fire emission estimation.

The work was supported by the National Natural Science Foundation of China (NSFC), the China Scholarship Council (CSC), and the Belmont Forum and JPI-Climate Collaborative Research Action with NSFC.

View full text: https://www.mdpi.com/2072-4292/12/18/2870
Author homepage: http://ess.ustc.edu.cn/faculties/detail-58.html
Email rli7@ustc.edu.cn

Signed: Prof. Rui Li and Naian Liu at the State Key Laboratory of Fire Science, University of Science and Technology of China

2nd National Symposium on Thermal Safety Science and Technology

The State Key Laboratory of Fire Science (SKLFS) at the University of Science and Technology of China (USTC) and the National & Local Joint Engineering Research Center of Thermal Safety Technology (ERCTST) co-hosted the 2nd National Symposium on Thermal Safety Science and Technology, on January 9-10 in 2021. More than 200 delegates from universities, research institutes, and academic groups gathered together in Hefei to discuss thermal safety science issues and progress. Online participation and discussion also took place by utilizing a live broadcast platform. Prof. Jie Ji and Prof. Weiguo Song served as the Program Co-Chairs.

Prof. Naian Liu, on behalf of SKLFS, delivered a welcome lecture on the opening ceremony of the symposium. Prof. Weicheng Fan (Tsinghua University), Prof. Xiangsheng Chen (Shenzhen University), Prof. Wan-ki Chow (Hong Kong Polytechnic University), Prof. Weiguo Song (ERCTST), and Prof. Jie Ji (SKLFS) delivered plenary lectures on the development of public safety technology, the progress in intelligent construction of underground space, the automatic fire suppression in railway systems, the thermal safety science and technology, and the monitoring and prediction of wildfire, respectively.

Nearly 100 regular paper submissions were received. Totally 8 topical reviews and 37 oral presentations were presented in the six parallel sessions of fire dynamics, fire prevention technology, industrial fire, fire testing,

human safety, and emergency response. The selected papers will be recommended to publish in journals of *Fire Safety Science* and *Fire Science and Technology*.

Signed: Prof. Jie Ji and Prof. Naian Liu at the State Key Laboratory of Fire Science, University of Science and Technology of China

2020 International Summit Forum on Energy Storage Safety held in Hefei

From November 18th to 20th, 2020, an International Summit Forum on Energy Storage Safety was held in Hefei, China. The theme of this forum is "Focus on Energy Storage Safety and Escort Industry Development". The forum is guided by Hefei Science and Technology department and the Management Committee of Hefei High-tech Industrial Development Zone, organized by the State Key Laboratory of Fire Science (SKLFS) and Anhui CAS- Zhonghuan Defense Equipment Technology Co.,Ltd., co-organized by China Energy Storage Alliance (CNESA), State Grid Anhui Electric Power Co.,Ltd., Hangzhou Gold Electronic Equipment INC.,Ltd., and Anhui Zhong Ke Jiu An New Energy Co.,Ltd. Nearly 400 expert representatives in the field of energy storage safety gathered together to discuss the policies, energy storage safety situation, potential safety hazards, and strategies concerning the global energy storage industry.

Prof. Jinhua Sun, Prof. Fuyuan Ma, Prof. Zhirong Wang, and Prof. Qingsong Wang delivered plenary speeches, which covered the subjects including the fire characteristics, current status of safety technology, and the future safety technology challenges of electrochemical energy storage power stations. Five major safety risk factors of electrochemical energy storage power stations were also analyzed. Some constructive suggestions were proposed on lithium-ion battery fire prevention and control technology, emergency procedure, and technical safety standards for battery energy storage power stations.

Signed by: Prof. Qingsong Wang and Naian Liu, and Wenxin Mei at State Key Laboratory of Fire Science, University of Science and Technology of China

Special Issue on Lithium Battery Fire Safety published in *Fire Technology*

Qingsong Wang, University of Science and Technology of China, China; Jennifer Wen, University of Warwick, UK; and Stanislav Stoliarov, University of Maryland, USA.

Lithium batteries are currently the predominant power source for portable electronic devices, electric vehicles, and electrochemical energy storage systems. However, fire safety issues are always a bottleneck hindering the large-scale application of this technology. Fire safety of lithium batteries has been a research topic since 1990s, and has been receiving more and more academic attention in recent years due to many lithium battery accidents. Lithium battery fire is a complex phenomenon, which involves multiple physical and chemical processes inside and outside the battery enclosure. The idea of this special issue stems from an exchange of knowledge and relevant experience among experts in the field of fire safety at the 1st International Symposium on Lithium Battery Fire Safety (ISLBFS) held on July 18 to 20 in 2019 in Hefei, China. The plenary speakers emphasized the importance of lithium battery fire safety and noted the progress made in this field. The following areas related to lithium battery safety are considered to warrant investigations: (1) Thermal runaway mechanism, (2) Fire dynamics, (3) Explosive behaviour, (4) Gas generation, (5) Fire suppression, (6) Thermal management, (7) Safer materials and designs, and (8) Fire safety assessment.

The special issue includes 16 original papers and 1 review with multidisciplinary contributions to different aspects of lithium battery fire and fire protection engineering. The papers provide us a comprehensive but not yet exhaustive picture of the recent research on lithium battery fire safety. See the complete Issue at https://link.springer.com/journal/10694/volumes-and-issues/56-6

The 2nd International Symposium on Lithium Battery Fire Safety (ISLBFS) will be hosted by the University of Science and Technology of China, from 25 to 28 August, 2021, in Hefei, China. The organizer sincerely invite colleagues interested in the fire safety science of lithium based battery to meet together and discuss ideas and share knowledge at this Symposium.

The webpage of 2nd ISLBFS: http://liion2.csp.escience.cn/dct/page/65558

Signed by: Prof. Qingsong Wang at State Key Laboratory of Fire Science, University of Science and Technology of China

Project launched to protect the heritage buildings in China from fire accidents

Fire prevention in Chinese heritage buildings faces a large challenge that such buildings are mainly composed of wood or brick-wood structures, while the utilization of such buildings is increasing for tourism. In recent years, there have been many fire accidents reported concerning the heritage buildings of China, such as the fire disasters in the old town of Lijiang, Yunnan (2013), in the old town of Dukezong, Yunnan (2014), at the Chang'an city site in Shaanxi (2016), at the Jokhang Temple in Tibet (2018), in the ancient city of Pingyao, Shanxi (2019), and in Wengding Laozhai, Yunnan (2021) (**Figure 1**). Recently, the Ministry of Science and Technology of China launched a project "Mechanism of Fire Spreading in Heritage Building and Key Technologies for Evaluation and Early Warning", with total funding of 20.46 million RMB. The project covers many research subjects, which include (1) ignition, burning, and spread of fire in wood structures of the heritage building, (2) fire risk assessment methods and fire control systems of heritage buildings, (3) electrical fire monitoring technology and anti-interference early warning technology of heritage buildings, (4) early detection for interference with environmental fires in heritage buildings, and (5) technology application demonstrations in two world cultural heritage sites (**Figure 2**).

Figure 1. (left) the fire in Dukezong ancient city fire Yunnan. (right) the fire in Wengding Laozhai fire Yunnan.

The project is led by the State Key Laboratory of Fire Science (SKLFS), University of Science and Technology of China, and the project leader is Professor Jie Ji. The partners include the Shenyang Fire Science and Technology Research Institute of MEM, the China Academy of Building Research, the China Cultural Heritage Information and Consultation Center, the Palace Museum, and Nanjing University of Science & Technology. The project is expected to develop fundamental theories, methods, models, and technologies for the fire prevention and control of Chinese heritage buildings, and the technologies are expected to be applied at the Potala Palace in Tibet and the ancient village of Hongcun in Anhui.

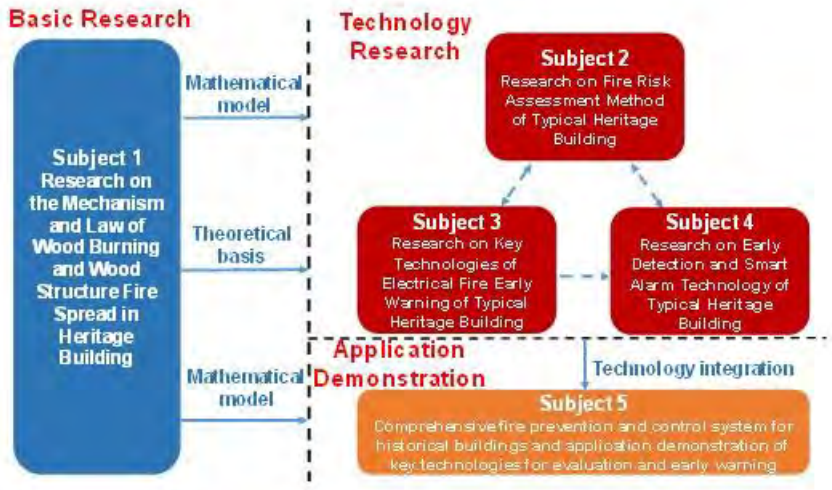


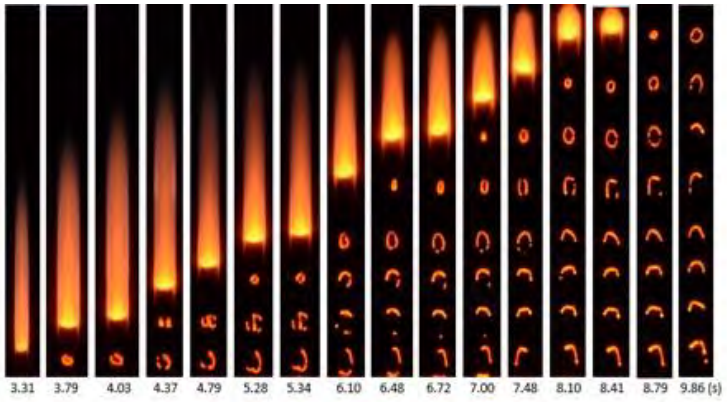
Figure 2. Project research content and supporting relationship

Signed: Prof. Naian Liu, Director of State Key Laboratory of Fire Science, University of Science and Technology of China

Research: upward flame spreading with periodic holes

The thermal-thin approximation, is a classic simplified model in fire safety science research. Namely, when the sample thickness is much smaller than the thermal penetration thickness, the temperature gradient in the sample thickness direction can be ignored. PhD student Wenlong Wang, under the supervision of Prof. Jun Fang, investigated upward flame spreading over thin material at sub-atmosphere chamber and observed periodic holes on the sample surface after the gas phase flame burns out for the first time. After symmetric ignition, a small systematical disturbance triggers asymmetric bilateral flames, which causes unbalanced heat feedback due to the unaligned flame base, while the flame tips remain align. With the evolution of time, this unbalanced effect is maintained and enlarged, thus eventually, one branch of flame dwells and rises in a cycle, associated with

periodical holes, due to the smoldering of the remaining char, while the other branch of flame extinguishes, due to self-induced buoyant blow-off with a low Damköhler number. This asymmetric bilateral flame spreading is controlled by the finite chemical kinetics, with the increased oxygen concentration, the pressure range of its existence is narrowed due to intensified chemical reaction. This investigation into the transient upward flame propagation behavior will enrich the flame spreading theory and is applicable to fire safety engineering.



Furthermore, the video of asymmetric bilateral flame spreading with blow-off and periodical holes has been posted at the official Facebook page of the International Combustion Institute (https://www.facebook.com/CombustionInstitute/videos/vb.156877934683414/1542004672645914/?type=2&theater).

Signed: Wang Wenlong, Ph. D Student, State Key Laboratory of Fire Science

Full scale experiment on fire spread of rural wooden buildings

The State Key Laboratory of Fire Science (SKLFS) from University of Science and Technology of China (USTC) is working on a project aiming at revealing the fire spread behavior of rural wooden buildings with coupling ambient effects. This project funded by the National Key R&D Program of China and the research task of SKLFS is led by Associate Professor Xiaolei Zhang.

Wengding village in Yunan province, China, before and after the fire

In the southwestern of China, such as Guizhou, Yunnan, and Guangxi province, construction materials are commonly taken locally, thus the local resident buildings in the countryside are mostly made up of wood or even thatch, showing the diversity of ethnic characteristics. Due to the heavy fire load, frequent use of fire and inadequate fire protection facilities, fire accidents occur frequently in these traditional villages and threaten the local residents. Moreover, fire is easy to spread because of flammable building materials and limited distance between the adjacent buildings. For instance, Wengding village, named as “the last primitive tribe of China” by the Chinese National Geography, was destroyed by fire in February 14, 2021, and a total of 104 buildings were consumed, resulting a huge loss of cultural relics. Resent years, Ministry of Science and Technology of the People’s Republic of China, together with other research institutes, are paying more attention on the fire research of rural wooden buildings.

During August in 2020, a full-scale experiment on fire spread in multiple wooden buildings founded by the above project was conducted successfully in Rongjiang, Guizhou province, with the joint efforts of SKLFS, China Academy of Building Research, Beijing University of Chemical Technology and Shenyang Jianzhu University. Four wooden buildings were installed on a slope land to model the fire behavior of building group located on hillside. The initial fire was a small-scale wood crib and was allowed to grow naturally. The data of the full-scale experiment, which include videos of fire growth in different rooms, temperature and heat flux evolution, and aerial images, are being obtained systematically. Local residents were also

Full scale experiment on fire spread of rural wooden buildings

attracted to watch the experiment. It is believed that this work could not only deepen the basic understanding of the spread of wood building fires and provide experimental results for future validation of the FDS model, but also strengthen the public consciousness of fire safety. The data obtained from the full-scale experiment will be accessed once the relevant work is published.

Nan Zhu (left) and Yuxuan Ma (right), who are PhD students of Prof. Longhua Hu from SKLFS of USTC, joined this experiment. They participated in the project design, facility installation and acquisition of temperature and heat flux data, and they analyzed the heat flux data after the experiment. Their hard work is sincerely appreciated!

Thanks to the valuable research work on "Transitional flame-spread and fuel-regression behaviors under the change of concurrent wind" published in 13th IAFSS Symposium, Nan Zhu was selected for "Sheldon Tieszen Student Award" recently. Congratulations to Nan Zhu!

Signed: Xiaolei Zhang and Longhua Hu, University of Science and Technology of China

News from the University of Science and Technology of China

The 11th National Academic Conference on Fire Safety Materials was successfully held by University of Science and Technology of China from December 18 to 20, 2020. The conference aims to build an academic exchange platform for counterparts, promote the development of fire safety materials science, expand its academic influence and attract more outstanding talents to join the basic research and technological innovation of fire safety materials.

During these unprecedented times, the conference adopted a combination of online and offline meetings. There were 26 invited reports, of which 4 were online reports. The online part will be attended by sub-sessions and individuals and the total number of participants is over 500.

Signed: Heng Yu, University of Science and Technology of China

News from Linnaeus University

FSUW Fire Safe Use of Wood – New website

The network Fire Safe Use of Wood (FSUW) is reactivating globally after a dormant period during the COST Action FP 1404, which ran from 2014 to 2018. FSUW is a global network of experts focusing on fire-safe applications of wood in construction.

One of the activities is developing a new website: www.fsuw.com. It contains relevant news on conferences, journals, guidance documents, projects and it is planned to publish a newsletter twice a year. Everyone is welcome to subscribe for the newsletter via the website.

Contact persons are Alar Just (Sweden), Andrew Dunn (Australia) and Michael Klippel (Switzerland). E-mail: info@fsuw.com

Signed: Birgit Östman Birgit.Ostman@lnu.se, Linnaeus University, Växjö, Sweden

News from Aalto University

Education

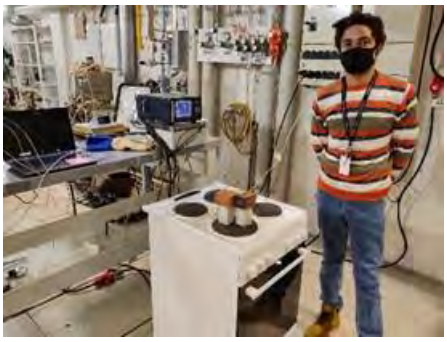
Deepak Paudel successfully defended his PhD thesis "Uncertainty management for the probabilistic simulation of the thermal resistance of fire barriers" in November 2020 in a Zoom defense, with prof Ruben van Coile of Ghent as opponent. After his defense, Deepak has continued his work with stone wool in an industry project. Now, in the end of Feb 2021, he is seeking for new opportunities!

Although the pandemic situation has reduced mobility, *Rongliang Pan* visits our group from China University of Mining and Technology since Dec 2020 for one year. His research topic is the fire dynamics inside curved tunnels. During his year at Aalto, he will explore the use of FDS complex geometry modelling in tunnel applications.

Research

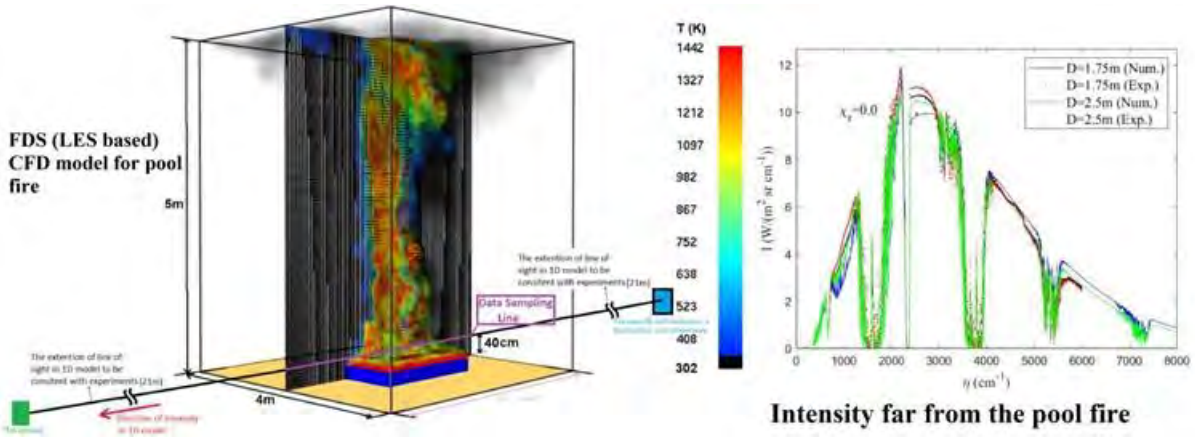
In addition to the individual research projects, many of us have carried out research of black PMMA, inspired by the IAFSS MaCFP Condensed Phase -subgroup activity. *Michalina Makowska* and *Farid Almachovan* found a way to measure the spectral absorption coefficient of black PMMA using UV-Vis and FTIR equipment. This required manufacturing super-thin films of the original NIST samples. Different techniques were tried, and finally they managed to prepare uniform-thickness films with the help of researchers from University of Turku. As a result, effective absorption coefficient calculation became possible, and the modelling group (*Aleksi, Farid, Morteza, Hadi,* and *Simo*) submitted their modelling results to the MaCFP phase 2.

In the end of 2020, we received funding from Palosuojelurahasto, to investigate the fire safety of electric cooktops. Together with the Finnish National Rescue Association (SPEK), Rescue College, and Finnish Safety and Chemicals Agency (TUKES), we are collecting information about incidents and statistics, especially among the vulnerable groups of people, characterizing the thermal environment of cast iron, ceramic, and induction cooktops, measuring their potential to ignite materials, and measuring the harmful gases and particles both in laboratory and real apartments. From Aalto, we have a pleasure to work with Indoor Air Quality -researchers *Heidi Salonen, Emmanuelle Castabnoli*, and *Raimo Mikkola.* MSc student *Tarique Jhatial* (photo) started as a research trainee in the project, measuring temperatures, IR images, power curves, and heat fluxes from stoves.



Thermal radiation remains one of the key research topics of the group. The recent improvements in experimental data, and computational models and resources allow obtaining very high-resolution spectral solutions, paving the way for new fire prevention and detection techniques.

Hadi Bordbar leads our effort to develop a unique computational framework to obtain fire emission spectra with a resolution as fine as 0.005 cm-1. Beside other opportunities, it provides new detailed insight to understand and model physics of radiation penetration into condensed materials as well.



Signed: Prof. Simo Hostikka, Aalto University

News from the University of Edinburgh

New Research Associate

Martina Manes has completed her PhD "Towards resilience evaluation of buildings when exposed to fire incidents based on English and USA fire statistics" under the supervision of Dr David Rush and Prof Luke Bisby. She is now working as Research Associate with Prof Grunde Jomaas and Dr David Rush on a project funded by the European Commission to close data gaps and pave the way for pan-European fire safety efforts. The project is carried out by a consortium of ten international fire safety institutions: Efectis, Lund University, National Fire Protection Association (NFPA), European Fire Safety Alliance (EuroFSA), Danish Institute of Fire and Security Technology (DBI), Confederation of Fire Protection Associations Europe (CFPA-Europe), Bundesanstalt fur Materialfoschung und Prufung (BAM), Vereiningung zur Forderung des Deutschen des Brandschutzes (VFDB), University of Edinburgh and Centre of Fire Statistics of CTIF (CFS-CTIF). The research analyses the terminology used and the data collected by the EU Member States and international countries regarding buildings fires to identify the collection difficulties and interpretation differences and to propose a common terminology and collection methodology. For more information visit the project website: https://eufirestat-efectis.com/

Current PhD projects

Georgios Kanellopoulos is a final year PhD student who is working on an experimental project entitled "External fire spread from timber compartments". Georgios is investigating the changes that occur in external spread due to the presence of timber linings in a compartment compared to a "traditional" compartment with inert boundaries. After completion of the last experimental campaign, he is in the process of writing up his thesis.

Vasilis Koutsomarkos is a PhD student whose research focuses on the development of an indexing method to assess a building's robustness towards a fire event, a property related to the capability of units to withstand certain stress levels without losing their function. After a thorough review of existing fire indexing methods and their underlying mechanics, a new robustness index is currently being finalised. It will be applied in building designs to finalise the research project, which aims to promote fire safety in the design process.

PhD student David Morrisset and his experimental tests

Carlos Walker-Ravena is a final year PhD student whose research in the wildfire group consists of investigating the flammability of natural fuel beds through experimental work using various experimental facilities. Natural fuel beds are porous, as opposed to typical built environment fuels, and so interpretation of the results is done through assumption of effective fuel bed properties. Inverse modelling is used in conjunction with a genetic algorithm in order to query how these properties change with fuel bed porosity. Apart from lab work, Carlos is involved in field experiments conducted in USA and Scotland with the goal of providing information for prescribed burning and wildfire danger rating systems.

New PhD students

In October 2020, David Morrisset started as a PhD student at the Edinburgh Fire Research Centre. David graduated from the California Polytechnic State University (Cal Poly) - San Luis Obispo with a Master's in Fire Protection Engineering in June 2020. He had worked with the University of Edinburgh fire group as a visiting researcher in the winters of 2019 and 2020. He is supervised by Dr Angus Law and Dr Rory Hadden and funded by the UoE School of Engineering and the Rushbrook Foundation. His research focuses on bench-scale flammability assessment, with a particular emphasis on solid flame spread mechanics.

Cameron Macleod graduated in 2020 from the University of Edinburgh with a MEng in Civil Engineering. In September 2020, he started his PhD entitled "Fire Hazard of Layered Construction Materials" funded by The Engineering and Physical Sciences Research Council Doctoral Training Partnership (EPSRC DTP) CASE (Collaborative Awards in Science and Engineering), and Design Fire Consultants (https://www.designfireconsultants.co.uk/). His project aims to assess the fire hazard posed by layered construction materials. Recently, it has been shown that layered materials pose a complex hazard due to the interaction between these multiple layers. Depending on the material used for the outer protective layer, and the mechanism used for layer bonding, a high heat exposure can cause the outer layer to melt or peel away and delaminate. When an initially protective layer fails, it exposes the layer beneath, which causes the fire behaviour to change significantly, and therefore has to be assessed as if it is a completely different composite material, with its own complex fire behaviour.

Hussein Mohammed started his PhD in November 2020 supervised by Prof Luke Bisby and Prof Giovanni Terrasi (EMPA/UoE). This project is co-funded by the Swiss Federal Laboratories for Materials Science and Technology (EMPA) and the UK Engineering and Physical Sciences Research Council (EPSRC) Doctoral Training Partnership. He will be investigating the behaviour of self-prestressed, self-compacting concrete at elevated temperatures, with a particular focus on spalling, its mitigation methods and the establishment of design criteria for elements made with such concrete. Hussein obtained his MSc in structural engineering from the University of Manchester in 2013, and he has been working in the construction industry ever since. He has been involved in the design and delivery of a variety of projects.

In June 2021, Antonela Colic will start her PhD, supported by the UK Engineering and Physical Sciences Research Council (EPSRC) Doctoral Training Partnership and OFR Fire and Risk Consultants. Her research interest lies primarily in the understanding of the *Response of Mass Timber Elements Subjected to Full Burnout Fires,* and the project will be supervised by Prof Luke Bisby (UoE) and Dr Angus Law (UoE), with industrial supervision provided by Dr Danny Hopkin (OFR). Antonela holds a postgraduate degree in Fire Engineering and a Master of Science in Structural Engineering, both from University of Zagreb. She is currently in the final year of the International Mater of Science in Fire Safety Engineering (IMFSE) programme and is about to graduate in May 2021. In her Master Thesis, supervised by Prof Luke Bisby, she is observing delamination and char fall off phenomena in mass timber structural elements.

Awards

Martina Manes and Mohamed Beshir received the IAFSS 2021 Sheldon Tieszen Student Award. The Award is sponsored by the International FORUM of Fire Research Directors, a group composed of the Directors of fire research organizations throughout the world, which aims to reduce the burden of fire (including the loss of life and property, and effects of fire on the environment and heritage) through international cooperation on fire research. The award recognizes excellence in an IAFSS symposium paper in fire safety science by a student making a significant contribution to that paper. The advisor noted that the students led a submitted publication to the symposium and, after careful consideration by the awards committee, was selected among the peers for the award.

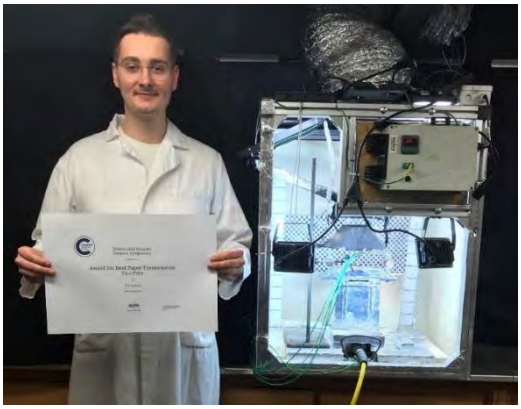
Lessells Travel Scholarship by the Royal Society of Edinburgh:

- 2019 Martina Manes - University of Queensland
- 2020 Mohamed Beshir - National Institute of Standards and Technology (NIST)
- 2020 Carlos Walker-Ravena - Pontificia Universidad Católica de Chile

The 2020 scholarships have been postponed due to the COVID-19 pandemic.

Tim Aspinall and his supervisor Dr Rory Hadden won best technical paper at the Defence Science Doctoral Symposium (DSDS20) for their paper "Thermomechanical Behaviour of Carbon Fibre Reinforced Polymer Exposed to Fire Conditions". It can be accessed and downloaded here: https://cord.cranfield.ac.uk/articles/conference_contribution/The_Thermomechanical_Behaviour_of_Carbon_Fibre_Reinforced_Polymer_in_a_Fire/13341887?file=25716677

Tim also won the Defence Science and Technology Laboratory (Dstl), Science and Technology Award for his work on the Thermal and Stress Inducing Device (TSID) which was developed to quantify the thermomechanical vulnerability of CFRP airframes.



Tim Aspinall showcasing his award certificate next to the experimental apparatus he has developed

11th International Conference of Structures in Fire 2020:

https://structuresinfire.com/corpo/conferences/SiF2020%20-%20Closing%20Ceremony.pdf

- Best Student Presentation Award Runner-up: "Robust circle tracking for deflection measurements in structural fire experiments" Felix Wiesner and Luke Bisby
- Best Presentation Award Runner-up: "A simplified representation of travelling fire development in large compartment using CFD analyses" Marion Charlier, Olivier Vassart, Xu Dai, Stephen Welch, Johan Sjöström, Johan Anderson, Ali Nadjai

Research Update: Improving the Resilience of Informal Settlements to Fire (IRIS-Fire)

The project was extended due to the COVID-19 pandemic and currently is close to an end. The final technical report is now under revision and will be published soon.

Nearly 30 reduced scale compartment experiments were conducted in the fire lab at the University of Edinburgh to understand the effect of different ventilation conditions on the fire dynamics and potential fire spread in informal settlements. The data from these experiments was analysed, used to validated the FDS model and published in two journal papers: https://doi.org/10.1016/j.firesaf.2020.103124 (will be presented and discussed in the upcoming IAFSS symposium by the IRIS-Fire PhD student Mohamed Beshir) and https://doi.org/10.3390/app11052380

With the help of the IRIS-Fire visiting Post-Doctoral Research Associate Dr Felipe Roman Centeno from the Federal University of Rio Grande do Sul, Brazil; the reduced scale validated model was then used to conduct a parametric study to understand the influence of wind on the onset of flashover within reduced scale informal dwellings. This work was published in Fire Safety Journal: https://doi.org/10.1016/j.firesaf.2020.103211

The burning of a single informal dwelling, UL Chicago

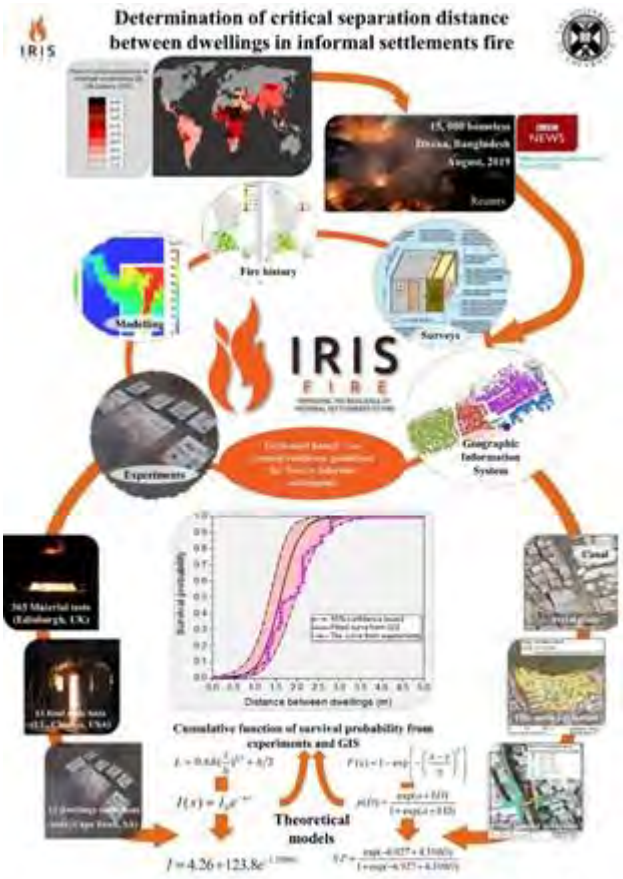
The data obtained from the full-scale experiments conducted at UL is fully analysed and has been published or under-review. The first paper discussing the conditions of the compartment's boundaries is now published and will be presented within the upcoming IAFSS symposium in April, 2021 by the former IRIS-Fire Post-Doctoral Research Associate Dr Yu Wang (currently a professor at State Key Laboratory of Fire Science, China): https://doi.org/10.1016/j.firesaf.2020.103076

The numerical modelling of these full-scale experiments is currently done and published or under-review, the main aim of the modelling work was to validate the FDS model using these experiments, provide efficient simulations (e.g., low computational power demand) and conduct parametric studies to further understand the fire dynamics of the informal settlements dwellings in different conditions. The first paper of this work is now published with open access in Fire Technology: https://doi.org/10.1007/s10694-020-01086-7

GIS and remote sensing techniques continued to prove being effective in different aspects, mapping historic fires, fire incidents and fire spread risks in informal settlements. It was found to be of critical aid to conduct fire spread risk models and determine the critical separation distance between dwellings for different informal settlements. The GIS and remote sensing work and contribution by the IRIS-Fire Post-Doctoral Research Associate Dr Lesley Gibson was published in different articles, for example: https://doi.org/10.1016/j.firesaf.2020.103053 (will be

presented in the upcoming IAFSS symposium in April 2021), https://doi.org/10.1016/j.ijdrr.2020.101736 led by the University of Edinburgh's PhD student Samuel Stevens.

The interdisciplinary approach using the findings from the material testing, large scale experiments, numerical models and GIS technique was found to successfully estimate the critical separation distance for the fire to spread within informal settlements. The outputs of this work was published with an open access in Fire Technology: https://doi.org/10.1007/s10694-020-01075-w.



Graphical abstract of the interdisciplinary work done by the IRIS-Fire team

Research Update: Characterization of TRAvelling FIRes in large compartments (TRAFIR)

The TRAFIR project, led by ArcelorMittal, and with funding from the Research Fund for Coal and Steel (RFCS) (Jul-17 – Dec-20), moved towards a final conclusion with the completion of all experimental and numerical work, and the final reporting is now underway. Contributions from Edinburgh have been mainly in explorations of different CFD based approaches to modelling these fires and in the implementation of the "analytical procedure" developed within the project into the SIFBuilder models, which is an OpenSees-based open source software framework (Dai 2018; Dai et al. 2020).

The progression of the work on the CFD simulations, using FDS, commenced with a detailed model calibration exercise based on the series of tests performed by University of Liège (Gamba et al. 2020). The computational domain had a plan dimension of 5 m and height 2.73 m, with cells within the porous crib structure of 15 mm, which was relaxed above the crib and towards the edges of the domain. The simulations were performed using the computational clusters ARCHER (UK National Supercomputing Service, per UKCTRF) and Eddie (Edinburgh Compute and Data Facility http://www.ecdf.ed.ac.uk/), each run taking around 170 hours for a 1200 s simulation, with 1.3 million cells, divided between 16 meshes. After tuning of model constants, in particular the ignition temperature of the wood, it proved possible to obtain a reasonable match the experimental values of fire spread, heat release rate, gas phase temperatures and burn-out. Model sensitivities were then explored in terms of a range of physical and numerical parameters, spanning HRRPUA, soot yield, heat of combustion, ignition temperature, wood thermal inertia and wood emissivity, with expected trends being shown and relatively high sensitivities particularly to the heat of combustion and ignition temperature.

The calibrated model was then scaled up to the large compartment scenario examined in the project (Nadjai et al. 2020), with enclosure dimensions of 15 m x 9 m x 3 m and a uniform fuel bed 14 m long by 4 m wide, and for which a series of three different openings were explored experimentally (areas 85 m^2, 30 m^2 and 10 m^2, respectively). These simulations are very computationally demanding and only made possible via the ARCHER(2) resource available via the UKCTRF project, nevertheless they have interesting potential to supplement expensive full scale tests (which may also be subject to the vagaries of the weather, when run outdoors).

In addition, following calibration of a simpler "wood block model" with respect to the same full-scale tests (Charlier et al. 2020a), extensive parametric studies were also undertaken on even larger scale compartments, up to dimensions of 70 m x 15 m x 3 m, i.e. an extent which it may be relatively impractical to study experimentally. This built on earlier work of the project using fire spread representations at the scale of individual cribs (Charlier et al. 2020b). Though much caution must be observed in interpreting these predictions, this type of approach does present a potential avenue for exploring the sensitivities of the development of a travelling fire, in terms of parameters such as fire load densities, global opening factors and compartment shape.

The final outcomes of the project will be made available soon via the "Publishable report" with a number of publications being updated to the project site on ResearchGate:

https://www.researchgate.net/project/TRAFIR-Characterization-of-TRAvelling-FIRes-in-large-compartments

More information on OpenSees for fire development can be found online:

http://openseesforfire.github.io

In parallel work, Dr Xu Dai (now working full time at NIST/BFRL on phase 2 of the "steel-concrete composite floor systems subject to fire") continues to progress research on the behaviour of steel-composite structure under travelling fire scenarios, in collaboration with our SAFE MSc graduate, Zhuojun Nan, now undertaking a PhD at the Hong Kong Polytechnic University (Nan et al. 2020).

Acknowledgement: project funding from Research Fund for Coal and Steel via Grant Agreement 754198; we are grateful to EPSRC (grant number: EP/R029369/1) and ARCHER for financial and computational support as a part of their funding to the UK Consortium on Turbulent Reacting Flows (www.ukctrf.com).

Charlier, M., Vassart, O., Dai, X., Welch, S., Sjöström, J., Anderson, J., Nadjai, A. (2020a) "A simplified representation of travelling fire development in large compartment using CFD analyses", Proc. 11th Int. Conf. Structures in Fire, Brisbane, Australia, 30 Nov-2 Dec 2020 doi:10.14264/5af38e2

Charlier, M., Gamba, A., Dai, X., Welch, S., Vassart, O. & Franssen, J.-M., (2020b) "Modelling the influence of steel structure compartment geometry on travelling fires", invited paper for ICE Structures & Building Journal – special issue on "Structural Design for Fire Safety", published online 15/10/20 doi:10.1680/jstbu.20.00073

Dai, X. (2018) "Extended Travelling Fire Method Framework with an OpenSees-based Integrated Tool SIFBuilder", PhD thesis, School of Engineering, University of Edinburgh, UK

Dai, X., Welch, S., Vassart, O., Cábová, K., Jiang, L., Maclean, J., Clifton, G.C. & Usmani, A. (2020) "An Extended Travelling Fire Method Framework for performance-based structural design", Fire & Materials (Special Issue Paper) 44(3):437-457, doi:10.1016/j.firesaf.2017.04.001

Gamba, A., Charlier, M., Franssen, J.-M. (2020) "Propagation tests with uniformly distributed cellulosic fire load", Fire Safety Journal 117, 103213, doi:10.1016/j.firesaf.2020.103213

Nadjai, A., Alam, N., Charlier, M., Vassart, O., Dai, X., Franssen, J.-M., Sjöström, J. (2020) "Travelling fire in full scale experimental building subjected to open ventilation conditions", Proceedings of the 11th International Conference on Structures in Fire, Brisbane, Australia, doi:10.14264/987a305

Nan, Z., Dai, X., Chen, H., Welch, S. & Usmani, A. (2020) "A numerical investigation of 3D structural behavior for steel-composite structures under various travelling fire scenarios Proc. 11th Int. Conf. Structures in Fire, Brisbane, Australia, 30 Nov-2 Dec 2020, doi:10.14264/a1068ab

Signed: Prof Grunde Jomaas, University of Edinburgh

News from the University of Canterbury

Education:
The University of Canterbury is excited to welcome a new cohort of students into the Fire Engineering postgraduate program, consisting of more than 28 students who will benefit from a high quality academic formation in fire engineering.

We are also pleased to announce that the students will benefit from the upgraded course "Fire Engineering Design", which will run throughout a complete year with an important involvement of numerous New Zealand's Fire Engineering companies acting as mentors of the students. At the end of the course, the students will have the opportunity to display their designs in an event and to be awarded with a prestigious scholarship offered by SFPE New Zealand.

Additionally, more than 10 final-year undergraduate projects related to difference aspects of fire engineering (human behaviour, structural fires, fire dynamics, fire detection and wildfres) have been completed during the year 2020. The number of projects will be doubled during the present year, showing that the interest of the students in fire sciences is growing considerably.

Labs:
The new fire laboratory (~5MW capacity) and the Virtual Reality (VR) laboratory will be fully operational in the present year. These new capabilities will allow for upgrading the quality and extend of the research leaded by the group.

Achievements:
Professor Daniel Nilsson was recently appointed as Head of Department of Civil and Natural Resources Engineering at

the University of Canterbury. He will start his new position on 1st March, and is expected to lead the department during the following 3-to-5 years.

The UC fire group is currently involved in several projects related to different aspects of wildfires. These projects are particularly important considering recent exposure of New Zealand's urban communities to destructive wildfires (Port Hill and Lake Ōhau):

1. Analyzing Wildfire Evacuation Behavior with GPS data (Daniel Nilsson)
2. Modeling Evacuation Behavior in the 2019 Kincade Fire in Sonoma County, California, and
3. Tasman fire evacuations (Daniel Nilsson)
4. Experimental Investigation of New Zealand Vegetation Flammability in Rural- Urban Interface Locations (Daniel Nilsson and Andres Valencia)
5. Fire-Atmospheric turbulent interactions analysis through UAV and high-speed infrared analysis (Andres Valencia).

Andres Valencia will present his work entitled "Reduced Order Modeling for Fire Sprinkler Sprays" during the upcoming 13th IAFSS symposium to be held in Waterloo, Ontario, Canada. The paper concerns a new model for sprinkler's spray performance analysis developed through a recent collaborative work with the University of Maryland. He has also been awarded with the FRG (Fire Risk Group) micro-grant to advance the knowledge on fire spread mechanisms.

Professor Daniel Nilsson was involved in two publications and one workshop in the field of Human Behaviour and evacuation, namely "A Virtual Reality study of behavioral sequences in residential fires (Arias, Nilsson & Wahlqvist) and "Unannounced evacuation experiment in a high-rise hotel building with evacuation elevators – A study of evacuation behaviour using eye-tracking" (Mossberg, Nilsson & Andrée).

Associate Professor Anthony Abu and Professor Alessandro Palermo hosted the annual congress of the International Association of Bridge and Structural Engineering (IABSE) from 3rd to 5th February 2021. As a result of global travel restrictions the event was successfully held online, using an innovative conferencing platform. The online nature however allowed for a richer, more diverse, programme with 15 keynote presentations on various topics, including two on fire engineering from Prof Luke Bisby (University of Edinburgh) and Prof Venkatesh Kodur (Michigan State University).

Associate Professor Anthony Abu, Professor Charles Fleischmann and Professor Rajesh Dhakal have recently secured industry funding to investigate the residual performance of fire-stopping systems after seismic damage. The project is for three years and will investigate residual fire resistance after various degrees of seismic activity. It is expected to lead to the development of design guidance for the design of these systems in seismically active countries.

Signed: Andres Valencia-Correa, University of Canterbury

News from the University of Ulster

Education

Education at Ulster (like everything else in the past year) has taken on a new look. Since March 2020, most of the teaching on the MSc Fire Safety Engineering has been on-line. Whilst initially challenging for both students and staff, the move to on-line encouraged us to rethink how we engage with the students and how can best support them in their learning. We congratulate all our 2019-20 students (pictured here before COVID-19) who were successful in completing their MSc and we look forward to celebrating properly with them when their postponed graduation ceremony can eventually take place!. We are immensely proud of each one for overcoming personal challenges presented by COVID-19 pandemic. Many students (from India, Saudi Arabia, Oman and France) were separated for long periods of time from their families and spent long periods of time in isolation when they eventually could return to their home country. Particular congratulations are due to Faris Alzharani (pictured back row, far right) who won both the Jensen Hughes' Best Student and Best Dissertation Awards.

On-line teaching of course brings new opportunities. In September 2020 we were delighted to welcome 15 new full-time students and our biggest ever cohort of part-time students with on-line learning and job circumstances providing the opportunity and time to access their studies differently. All students continue to adapt and benefit from wider engagement with practitioners and other researchers in the field, and being able to access their studies in a more flexible manner. We look forward to learning together and to what the next year will bring!

Research Projects:

1. **TRAFIR: Characterization of TRAvelling FIRes in large compartments** (Partners: Arcelor Mittal, Ulster University, Edinburgh University, RISE, Liege University, Ulster Staff: Ali Nadjai and Naveed Alam)

This work, which formed part of the European RFCS project has now been completed and the final report submitted to the EU Commission in March 2021.

The results from the large-scale tests conducted at Ulster are of significant value. The lack of test data related to the travelling fires and the applicability of existing design curves and models have, until now, been based on data collected during small compartment tests; their applicability to larger compartment sizes in modern buildings is therefore limited. The results from the large-scale tests will provide useful data related to the travelling fires and fires in large compartments which can inform future parametric studies and the development of empirical design methods for future use.

2. **EENSULATE** (Ulster Staff: Jianping Zhang)

This Horizon 2020 project which involves 14 European partners, aims to develop innovative lightweight (35% weight reduction compared to the current best performing modules), highly insulating energy efficient components as well as associated enabling materials for cost-effective retrofitting and new construction of curtain wall facades. Two journal papers have been published (in *Fire Technology* and *Thermochimica Acta*) on the experimental study of the flammability and fire performance of multi-component insulation foams developed from Polyisocyanurate (PIR). The project is now in its final phase and tests on the complete system, consisting of novel vacuum insulated glazing (VIG) and a spandrel with the developed insulation foams, are being conducted in a fire resistance test furnace to evaluate its fire performance against that of traditional triple glazed units (TGU).

3. **Protective Clothing under Extreme Fire Conditions**

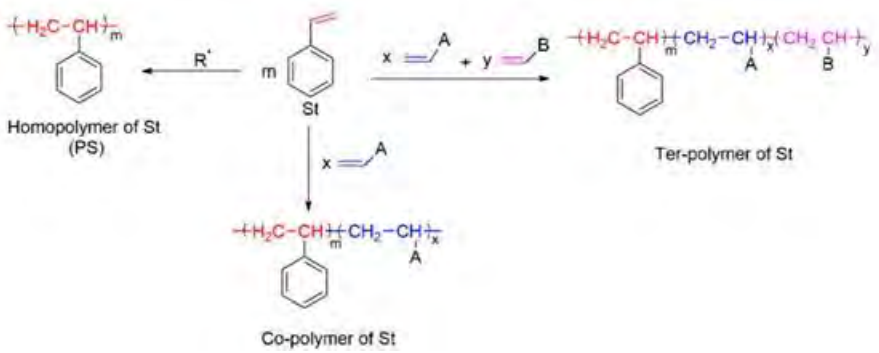
Dr Seng-kwan Choi has recently secured international research funding from the Korean National Fire Agency, Korean Government Development of Emergency. This project (4 years duration) will investigate the experimentally and numerically the fire performance of firefighting protective clothing under extreme fire conditions.

4. **New Generation of Precast Concrete Sandwich Panel Façade Resistant to Fires**

We are delighted to welcome a new Research Assistant in Structural Fire Engineering. Dr Dali Bondar, appointed in August 2020. Dali will work with on this industrial project, the focus of which will be to develop an innovative product for pre-cast concrete sandwich panels that can satisfy current and future demands for a high level of fire safety rating on facades. A large-scale façade fire test will be undertaken in the near future.

5. **Improving fire resistance of styrene-based polymers through P-N synergism of reactive fire retardants**

Dr Svetlana Tretsiakova-McNally continues her experimental work aimed at the improving fire resistance of styrenic polymers. The reactive modifications of styrene-based polymers with P-containing aliphatic, and aromatic fire retardants along with N-containing components, were carried through solution and suspension polymerization processes. The funding for this study is provided by the prestigious Royal Society of



Reactive modification of polystyrene with P- and N-containing fire retardants

Chemistry (RSC). The investigation of P-N synergistic actions and the mechanism of the flame retardance is on-going.

6. **Collaboration project between Fuzhou University (China) and Ulster University (UK) funded by NNSFC: National Natural Science Fund of China** (Partners: Dr. Jianwei Li (China), Prof Jane Zheng (UK), Prof Ali Nadjai, Dr Jianping Zhang (FireSERT))

   This 4-year research programme commenced in January 2021. The research will involve two-way coupled 3D simulation and inverse modelling of forest fire-meteorology based on fine-scale observed data. The study will focus on investigating the following four aspects to suggest possible solutions: 1. how to measure construct fine scale wind field calculation model comprehensively; 2. how to research and establish large-scale mountain fire and atmosphere coupling mechanism; 3. how to simulate mountain fire and atmosphere coupling based on DDDAS; 4. how to select typical case studies and verify virtual forest fire environment simulation.

7. Phd Study

FireSERT is pleased to welcome a new Phd researcher, Robert Bray, who joined in September 2020, and has since successfully completed his initial assessment. Robert works under the supervision of Jianping Zhang, Sengkwan Choi and Svetlana Tretsiakova-McNally in the area of flame ignition and extinction of polymeric materials in under-ventilated conditions.

Peter Cassidy is reaching the final stages of his Phd study which aims to improve fire safety of older adults by equipping carers and others with whom they are in close contact. The *Safer Together Project* represents a co-production between Peter's research, the Belfast Health and Social Care Trust and Northern Ireland Fire & Rescue Service. The output of the project, funded by the Social Work Strategy NI, is a bespoke package of resources to increase the fire safety awareness of those working and living in the community. The project has recently been brought to life in the form of educational videos, risk aide memoirs, leaflets and safety devices all aimed at assisting and supporting social workers and service users to reduce fire risk in the community.

We congratulate Paul Akagwu for his successful defense (December 2020) and award of Phd. Paul's work (supervised by Faris Ali and Ali Nadjai) was entitled '*Experimental and Numerical Study of Bolted Web-flange Steel Connections in Fire*'. The work presents a unique study on elevated temperature moment rotation curves and his valuable and important conclusions will make a significant contribution to global research efforts into the performance of steel in fires.

Congratulations are also due to:

- Marion Charlier (PhD student) who was runner up for Best Paper Presentation in the SIF2020 Symposium, Brisbane, December 2020.
- Dr Naveed Alam for the receiving the award of Best Thesis in the Faculty of Computing, Engineering and Built Environment, May 2020
- Aloshi Baby (Phd student) for her participation in Flash Points, a science communication competition organised by the SFPE student chapter for students studying fire science across the UK
- Hossein Tavanarezaei (Phd student) who recently won the12th National Festival of Research and Innovation in Urban Management award for his master's research entitled '*Insights towards the efficient angle design of pedestrian crowd egress point bottlenecks*'. This research was published in Transportmetrica A and was conducted at the University of Tehran under the supervision of Dr Kayvan Aghabayk.

Other news:

The *Journal of Structural Fire Engineering* (originator and editor Faris Ali) sponsored the Best Poster and the Best Short Presentation at the 11th International conference of the SIF2020, Brisbane, Australia.

Prof Ali Nadjai was invited by the Northern Ireland Assembly to participate in a live discussion (BBC News, 13 January 2021) on the new amendments in the recently updated Approved Document B (guidance in support of Building Regulations). The points of concern related to façade safety and the impact of the recent changes of the regulation on safety.

Signed: Karen Boyce, University of Ulster

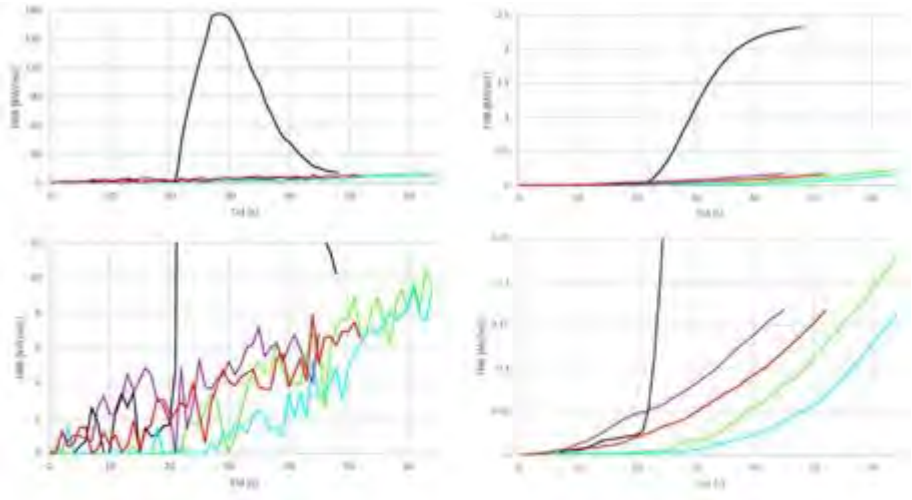
News from Luleå University of Technology

Phase changing materials and fire safety

Alexandra Byström, Jonathan Wolf (bachelor thesis student in the Fire Protection Engineering program), and Michael Försth, Structural and Fire Engineering, have reviewed the use of phase change materials in buildings, with focus on fire safety perspectives. Phase change materials are used to stabilize and change temperature variations over time. This is achieved when the materials undergo a phase change. From a fire safety perspective it is important to bear in mind that among the buildings materials with added phase change materials that can be found on the international market, it is relatively common with mixing of combustible organic phase change materials, above all different types of paraffines. The introduction of new combustible materials into buildings means that the building process will be more sensible to errors, mistakes, and deficiencies. For example, a gypsum plasterboard with combustible phase change material can easily, by mistake, be placed as the outer lining, when in fact this board was supposed to be protected by a non-combustible plasterboard. The conclusion from the project was that before combustible phase change materials are accepted in building projects it is important with a holistic analysis, where pros and cons are compared and weighted against each other. The pros are energy savings and temperature stabilization. Cons are among other things increased sensitivity to fire protective errors, other impaired properties such as load bearing capacity of the building material, as well as the environmental impact of the building seen from a lifetime perspective, including demolition and recycling. The results are been presented in a report and a webinar and a journal article is on its way. The research was funded by Brandforsk.

Environmentally friendly flame retardants

Associate Professor Anna-Carin Larsson and Dr Anuttam Patra, Chemistry of Interfaces, are investigating and developing flame retardants based solely on non-toxic natural products. The main component is phytic acid, which is used by plants to store phosphorus, and can be found, e.g. in nuts and grains. The flame retardant mixtures have so far shown excellent flame retarding behavior on cotton. Cone calorimetry studies in collaboration with Professor Michael Försth and Dr Alexandra Byström, Structural and Fire Engineering, show very little heat release. Previous tests on pure flame retardants, as well as saw dust treated with various flame retardant mixtures have enabled a detailed description of the decomposition process at a molecular level, analyzed with state of the art spectroscopic techniques. The research is funded by Brandforsk. Over the years, the project has drawn interest from several Fire Protection Engineering students, who have contributed to the project. For more details, see https://www.brandforsk.se/forskningsprojekt/2020/studier-av-miljovanliga-flamskyddsmedel-for-cellulosabaserade-material/



Cone calorimetry (at 20 kW/m²) for cotton samples treated with various mixtures of phytic acid-based flame retardants. Black line is an untreated sample. Left: HRR (kW/m²), Right: THR (MJ/m²). Figure credits by Aleksis Nevanperä Ymerstam.

Some of the results have been published in Green Materials: Patra, A., Kjellin, S., & Larsson, A.-C. (2020). Phytic acid-based flame retardants for cotton. Green Materials, 8(3), 123–130. https://doi.org/10.1680/jgrma.19.00054

Research project on home care and fire safety

Among the people who die in fires, the elderly stand out in the statistics. At Luleå University of Technology research is done on how staff at the home care services feel that they can contribute to increased fire safety. In questionnaires and interviews public as well as private home care organizations, including the personnel who works directly with the elderly, have been asked questions regarding to what extent they work with ensuring fire safety, what hinders and enablers they see for this work. The research team is currently summarizing the results which will be available in a report in mid March, when also the results will be presented in a webinar. The project is a collaboration between researchers in Nursing and in Structural and Fire Engineering at Luleå University of Technology and is funded by Brandforsk.

Päivi Juuso, Alexandra Byström, Petter Hansson (bachelor thesis student in the Fire Protection Engineering program) and Carina Nilsson have investigated how home care personnel in Sweden work with fire safety in the homes of elderly people. Michael Försth is missing in the photo. Photo: Luleå University of Technology

New colleague

Oisik Das is a new employee at the Division of Structural and Fire Engineering. Oisik joined LTU as an associated senior lecturer in material science department on August 2019 but transferred to the current group on 1 November 2020, where he works mainly with Prof. Michael Försth and Prof. Gabriel Sas.

Päivi Juuso, Alexandra Byström, Petter Hansson and Carina Nilsson. Photo: Luleå University of Technology

Oisik has extensive background in materials research including biocomposites, biochar, polymer processing, material characterisation, nanoindentation, pyrolysis, etc. His special interest is flammability of composite structures and materials wherein he investigates the reaction-to-fire behaviour of polymeric composites used for structural and semi-load bearing applications. He also conducts research on novel fire retardants such as naturally-occurring lanosol, which is obtained from marine red algae. Additionally, his recent research interests pertain to the fire behaviour of concrete structures and wooden façades. Oisik was one of the first researchers to demonstrate a balance between mechanical and fire-retardant behaviour of composites using sustainable biochar. He is currently leading a STINT project, that is attempting to propagate the aforementioned phenomenon using biopolymers and renewable materials.

A comparison of polymer sample attaining a V0 rating (the highest ranking) with lanosol as fire retardant.

Reaction-to-fire test using a cone calorimeter

Flammability test being done by Oisik using limiting oxygen index.

Oisik is very passionate about pedagogic activities and has recently published an article stating some key strategies for continuing experimental research during university and lab closures as a result of pandemics. Below are some images of Oisik performing fire tests. We are very happy and proud to have Oisik on board our team.

Signed Michael Försth

News from the University of Central Lancashire (UCLAN)

University of Central Lancashire (UCLan) hosts its new Fire, Oil and Gas Laboratory at the new award-winning £35 million Engineering Innovation Centre (EIC). Identified as a signature project within Lancashire's Strategic Economic Plan, the EIC secured £10.5 million worth of funding via the Lancashire Enterprise Partnerships' Growth Deal with the Government. The new facility has also received £5.8 million from the European Regional Development Fund (ERDF) and £5 million from HEFCE's STEM Capital Fund.

Education

Since 1991, UCLan has been offering an extensive range of specialised fire safety engineering, fire engineering and hands-on fire-fighting BEng, MSc, foundation and research degrees, courses and CPD programs to the fire industry. Since 2007, UCLan has seen over 8000 fire professionals graduate from its undergraduate and post graduate accredited courses, with many going on to play an active role in helping to improve fire safety in buildings and related infrastructures internationally.

Facilities

The purpose-built Fire, Oil & Gas Laboratory includes excellent facilities for both fire safety engineering and fire chemistry in teaching and research. The fire programmes are also supported by access to the facilities at Washington Hall, the UK's International Fire, Training and Development Centre. The facilities at Washington Hall

include several fire grounds, flashover units, breathing apparatus units, sprinkler demonstration units, fire extinguisher areas, and a large fire house where several fire scenarios can be simulated.

Positions, personnel and new group members

We currently have 5 PhD student and Anoop Warrier from the partner International College of Engineering and Management (ICEM) in Oman, will be joining us this March 2021 working on façade fires. His project will explore the influence of different construction techniques on the mechanisms of external fire spread using experimental and numerical approaches.

Our new Fire. Oil & Gas Laboratory

Abdulla Alakalbi is studying fire behaviour of glazed buildings in hot countries. Joseph Adhoge is attempting to more accurately model oil storage facilities with CFD. Naif Alharbi is studying the dispersal of a toxic cloud in a city-centre tower-block environment. Angus Sangster is studying fires at recycling plants. Angus has performed many experiments and identified several categories and new phenomena. Robin Duffey is examining fake news and how information affects decision making during emergency command situations. Tsun Bong Tsan is our student in Hong Kong and as a professional fire engineer, works on alterations to tall and complex buildings to achieve acceptably fire safety.

Research

The Combustion, Explosion & Fire Engineering (CEFE) Research Group is involved in the "SAFE: Operational Strategies Aiming at Effective Fire Evacuation" project started January 2021. UCLan's CEFE team along with fire rescue services will work closely to answer fundamental questions regarding effective operational techniques for high rise residential buildings, methodically test evacuation strategies and fill existing gaps. A new Research Assistant and Research Associate will be joining us soon to work on this project.

There are several more on-going research projects on aircraft cabin air quality, sprinklers activation, combustion fluid flows, condition monitoring of electric transformers and reservoirs, two zone modelling, reliability engineering, façade fires and development of pedagogic approaches in fire engineering.

Award/Prizes:

UCLan's fire team has been awarded the International Best Practice Award 2019 for its good practice and innovation in learning and teaching in fire programs internationally.

Signed: Eleni Asimakopoulou, UCLAN

News from the University of Queensland Fire Safety Engineering Research Group (UQFire)

New arrivals

Ms Samia Razzaque joined UQFire in October 2020 to commence her PhD studies on a research project investigating thin intumescent coatings and the effectiveness to use these in engineered mass timber structures. Samia's empirical studies will experiment with currently available and new intumescent coatings developed in collaboration with industry partners. Samia has many years of experience with an intumescent coatings' manufacturer.

Mr Wenxuan Wu joined UQFire in January 2021 to commence his PhD studies on the smouldering potential of timber after bush and compartment fires. He previously obtained his Bachelor of Safety Engineering and completed graduate studies in Chemical Engineering from Southwest Petroleum University in China. In 2020 he also graduated with a Master of Fire Safety Engineering from The University of Queensland. His doctoral studies investigate the necessary conditions for sustained smouldering to occur in exterior timber infrastructure (e.g., electrical transmission poles and railway sleepers) after bushfires have passed through. Smouldering after bushfires can lead to destruction of critical infrastructure long after relatively minor fires have passed through. A better understanding of this process will be used to develop mitigation measures.

Mr Tomas Bravo joined UQFire UQ in January 2021 to commence his PhD studies on a research project investigating long span floor timber systems, with focus on carrying multi-performance criteria studies: serviceability, dynamic response, fire, etc. Tomas' work will seat at the interface between structural engineering,

mass timber manufacturing, material science, and fire engineering - hoping to develop new manufacturing and design engineering methods for a better design of long span floor timber systems.

Recent Graduates (December 2020)

Dr Andrea Lucherini was awarded a PhD with a thesis entitled *"Fundamentals of thin intumescent coatings for the design of fire-safe structures"*. https://doi.org/10.14264/uql.2020.1021

Dr Angela Solarte was awarded a PhD with a thesis entitled *"Fire performance assessment for the design of safe laminated bamboo structures"*. https://doi.org/10.14264/uql.2020.948

Dr Mateo Gutierrez Gonzalez was awarded a PhD with a thesis entitled *"Fire analysis of load-bearing bamboo structures"*. https://doi.org/10.14264/5974aa1

The following students were awarded a BEng-MEng (Civil+Fire Safety Engineering) degree: **Ms Angela Arum, Ms Jessica Barton, Mr Michael Cheung, Ms Rosy Hartl,** and **Mr Brett McGiveron**. Also, **Mr Bernabe Zaragoza Solis** was awarded a MEngSc (Fire Safety Engineering) degree.

Dr Andrea Lucherini *Dr Angela Solarte* *Dr Mateo Gutierrez Gonzalez*

Awards

Dr Juan Cuevas, Dr Andrea Lucherini, Dr Carmen Gorska, Mr Viny Gupta have all been awarded the **Sheldon Tieszen Student Award**, sponsored by Forum, for their work at The University of Queensland detailed in their papers due to be presented at the 13th International Symposium on Fire Safety Science.

The School of Civil Engineering at The University of Queensland awarded **Ms Rosy Hartl** with the **2020 Most Outstanding Student in Fire Safety Engineering** and also with the runner-up award for 2020 Best Research in Master of Engineering.

As in the past two years, UQFire once again won the **Golden Pinecone** in the annual Christmas Tree Fire Safety Demonstration that is hosted by The University of Maryland. The UQ delegation scored the highest mean group score of all 34 institutions from around the globe and special kudos are due to UQ PhD student **Julian Mendez**, who scored the highest individual prediction.

ARC Future Timber Hub

In February 2021 the ARC Future Timber Hub completed a highly successful Research Showcase. The lunchtime webinars on each of the Hub projects included webinars on two projects led by UQFire.

- **A prototype hybrid Timber-FRP with enhanced fire and serviceability performance** https://www.youtube.com/watch?v=uiUXOMQBs0E
- **Exploring the self-extinguishment mechanism of engineered timber in full-scale compartment fires** https://www.youtube.com/watch?v=M8Ekb1gSiaM

SFPE UQ Student Chapter

The main initiative of the UQ-SFPE Student Chapter is to organize seminars to promote continued learning outside the classroom and as a mean for fire safety industry professionals to interact with the SFPE students researching and studying fire safety.

Despite pandemic related restrictions the SFPE UQ Student Chapter has continued to actively host and organize educational events to promote and develop knowledge within the discipline of fire safety engineering. Recent seminars were held on T*hermal inertia as an integrative parameter for building performance* and *Studies for the Design of Fire-Safe Bamboo Structures* by **Dr Gerado Soret** (Queensland Fire and Emergency Services) and **Dr Angela Solarte** (Monash University), respectively. These events were broadcast online, and we were pleased to see high attendance for our events, making these seminars a major success with attendance of both students and industry professionals.

12th Asia-Oceania Symposium on Fire Science and Technology

The 12th Asia-Oceania Symposium on Fire Science and Technology (AOSFST), https://aosfst2021.com, will be hosted by the Fire Safety Engineering Research Group at The University of Queensland. The conference is organised in collaboration with Charles Darwin University, Griffith University, Monash University, Victoria University, The University of Melbourne, Queensland University of Technology, RMIT University, University of New South Wales, University of Canterbury, and Massey University. **AOSFST 2021 will take place between the 7 and 9 December 2021**.

The main focus of the AOSFST series of conferences is to provide an opportunity for researchers, practitioners and engineers to share and discuss their research related to fire safety science and engineering in the Asia-Oceania and around the world. Research and engineering outcomes presented at AOSFST should include fundamental work that progresses the understanding and application of fire safety engineering and science.

As the key conference in the Asia-Oceania region, AOSFST is a venue for networking and where the latest research is presented. In addition to the plenary and parallel sessions of the conference, AOSFST 2021 will provide an opportunity for further discussions both formally following presentations and informally through the planned receptions, meals and other breaks.

Structures in Fire 2020

SiF2020 is now behind us and we are enjoying the feeling of satisfaction for what we believe was a job well done. We want to once again thank everyone who attended and participated in SiF2020: delegates, speakers, session chairs, scientific committee, track leaders, steering committee, local organising committee, and students-staff at The University of Queensland.

All of the papers from Structures in Fire 2020 are now available from the UQ library's website. https://espace.library.uq.edu.au/view/UQ:2c0762e

By the end of SiF2020, the data analytics were:

- 87 articles
- 87 online presentations
- 2 workshops (OpenSees and fib)
- 509 delegates
- 360 questions during Live Q&As (≈ 3.5 questions per presentation)
- 1,776 votes for Best Presentation Awards (≈ 3.5 nominations per delegate)

If you have any questions, feel free to continue to email us at sif2020@uq.edu.au; we look forward to seeing you again for SiF2022. Huge thanks to our event sponsors NETZSCH, AFAC, and Omnii, and to our awards sponsors the Journal of Structural Fire Engineering and the International Association for Fire Safety Science (IAFSS). During SiF2020, the following awards were presented:

Best Student Paper Award

- 1st place: Developing real-time hybrid simulation to capture column buckling in a steel frame under fire - Ramla K Qureshi, Negar Elhami Khorasani, Mettupalayam Sivaselvan
- Runner-up: A static solver for hybrid fire simulation based on model reduction and dynamic relaxation - Patrick Covi, Giuseppe Abbiati, Nicola Tondini, Oreste Salvatore Bursi, Bozidar Stojadinovic

Best Paper Award

- 1st place: Experimental study on fire resistance of a full-scale composite floor assembly in a two-story steel framed building - Lisa Choe, Selvarajah Ramesh, Xu Dai, Matthew Hoehler, Matthew Bundy
- Runner-up: Fire fragility curves for steel pipe-racks exposed to localised fires - Jérôme Randaxhe, Olivier Vassart, Nicola Tondini

Best Student Presentation Award

- 1st place: A practical tool for evaluating fire induced failure probability of steel columns designed based on U.S. prescriptive standards - Ramla K Qureshi, Ruben Van Coile, Danny Hopkin, Thomas Gernay, Negar Elhami Khorasani
- Runner-up: Robust circle tracking for deflection measurements in structural fire experiments - Felix Wiesner and Luke Bisby

Best Presentation Award

- 1st place: Steel sheet piles exposed to fire experimental tests and numerical modelling - Jean-Marc Franssen and João Martins
- Runner-up: A simplified representation of travelling fire development in large compartment using CFD analyses - Marion Charlier, Olivier Vassart, Xu Dai, Stephen Welch, Johan Sjöström, Johan Anderson, Ali Nadjai

Signed: Cristian Maluk, Fire Safety Engineering group at The University of Queensland

News from Imperial College London

Hello! Welcome to another news update from Hazelab at Imperial College London.

For more follow us on twitter @ImperialHazelab, visit our website or watch our video.

New arrivals

We welcome our recent PhD student arrival, Rikesh Amin, who has joined us to study modern approaches to modelling fires in tall timber buildings. His research is co-funded by Arup and EPSRC. Also, Matthew Bonner, after submitting his thesis in December, has started on as a Postdoctoral staff and is now working on expanding his database of façade fire tests.

Watercolour of Queen's tower at Imperial College by Harry.

Welcome to Rikesh Amin, our newest PhD student!

We also welcome four new undergraduate students to Hazelab: Leonardo Caracci, Olivia Keatley, Nikolaos Kalogeropoulos and Hannah Nevill. Leonardo is working on analysing data from the London Fire Brigade in order to identify the fire risk to London citizens and how this has changed over time. Olivia is studying how different modelling techniques can be used to predict the thermal and mechanical response of mass timber buildings. Nikolaos and Hannah will be researching the coupling of wildfire spread, and pedestrian and vehicle evacuation models as part of the interdisciplinary and international NFPA WUI-NITY project.

Graduating Students

Eirik and Han passed their viva examinations in November and Matt passed his in February - congratulations, new doctors of fire! Eirik's thesis was intitled "Experimental Investigation of the Effects of Soil and Environmental Conditions on Smouldering Wildfires". His external examiner was Dr Nuria Prat from Pau Costa Foundation in Spain and his internal examiner Dr Ravii Vaidyanathan. Han thesis "Computational study of self-heating ignition and smouldering combustion of carbon-rich porous media" was examined by Dr Soraia Pimenta lecturer at Imperial College and Prof Ali Rangwala from WPI. Matt submitted his thesis "A Top-Down Approach to Understand the Fire Safety of Building Facades Using Standard Test Data" and was examined by Dr Juan Hidalgo from University Queensland and Dr Catrin Davis from ICL; this was a 6-hour examination that left Matt hungry for more. Agung has submitted his thesis 'Experimental study of smouldering wildfires, suppression and transition to flaming' and will be having his viva soon!

Departures

We bid goodbye to Eirik who joined the Arup fire team in London as a graduate engineer. Postdoc Fahid took a position as lecturer at the Teesside University, congrats on this important step! Postdoc Yuqi moved back to China

Eirik's viva examination.

Han's viva examination

and started a new job at the Sichuan Fire Research Institute of Ministry of Emergency Management. Han will be moving to Hong Kong in spring to start a fellowship at the Polytechnic University. They will be all truly missed.

Conferences

Dwi, Han, and Eirik presented their work at the Combustion Symposium. Matt presented a summary of his thesis at the SFPE Annual virtual Conference. Heidari presented the results from experiment X-Two at the SiF conference in December. Finally, in February, Guillermo gave two introductory courses during the Pyrolife ITN course on wildfires and smouldering fires, which are now both available on YouTube!

Awards

Guillermo has been elected Fellow of the Combustion Institute, class of 2021. This lifetime honorific title is for members of the international combustion community recognized by their peers as distinguished for outstanding contributions to research. The Combustion Institute is the largest international scientific society on combustion science and technology with over 5,200 members.

Matt received a SFPE Student Scholar Award during the SFPE Annual conference. He wrote a witty song for the occasion and sang it at the award ceremony. Watch the recording!

Matt giving his acceptance speech/song at the SFPE annual virtual conference.

Eirik was awarded the Dr Ashraf Ben El-Shanawany Memorial Prize. The prize is awarded for outstanding achievement in research, public outreach, and innovation with focus on safety. We are proud of Eirik and honoured for this medal.

Francesca was awarded a student research grant from the SFPE Foundation. The money will be used to partially fund large-scale experiments that will be running at ITB Poland in spring/summer 2021. These experiments will investigate the mechanical performance of curtain wall facades exposed to non-uniform heating from fire.

SFPE Greater London Student Chapter

The SFPE Greater London student chapter has announced the winner of Flash Points 2020 edition in November, Laura Schmidt won the competition with her video "Char fall-off and the Burning of Engineered Timber." Matt and Francesca received an honourable mention for their outstating videos. "Why Are Skyscrapers Burning More Frequently" by Matt, "Fire Safety of Glass Facades" by Francesca, and all the other video submissions are available on the chapters YouTube channel.

Flash Points competition logo

Francesca's video submission for Flash Points

Matt wrote a cover of Billy Joel's "We didn't start the fire" and it has become an anthem for the chapter which we play at the beginning of all our webinars. To listen to the song, visit our website, you won't regret it!

The chapter's monthly publicly available fire science webinars continue:

- Prof Carlos Fernandez-Pello of University of Berkley gave a talk on wildland fire spotting.
- Dr Antonio Cicione from Stellenbosch University presented on fire dynamics in informal settlements.
- Prof Yuji Nakamura from Toyohashi University of Tech gave a fascinating talk on fire in microgravity.
- Our dear friend Wojciech Węgrzyński from ITB Poland shared with us his knowledge about wind and fire modelling.
- Hazelab alumni Nils Roenner now working at BASF shared his work on digital transformation of R&D.

Virtual group meeting

Sign up to our mailing list by emailing sfpelondonstudentchapter@gmail.com for further updates!

Outreach

An article on WIRED explored peat land zombie fires and featured Dwi's cellular automata model that simulates smouldering fire flame spread. Guillermo gave a talk to friends of Imperial summarising Hazelab's most recent research. He also gave a talk to Hong Kong Polytechnic University (HKPU) and Oil, Petrochemical and Energy Risks Association (OPERA) about lithium ion batteries and their fire risks. Recordings of these talks are available on our website.

That's everything from us for now – we look forward to seeing you at the IAFSS virtual conference!

Signed: Francesca Lugares, Imperial College

News from the University of Cantabria

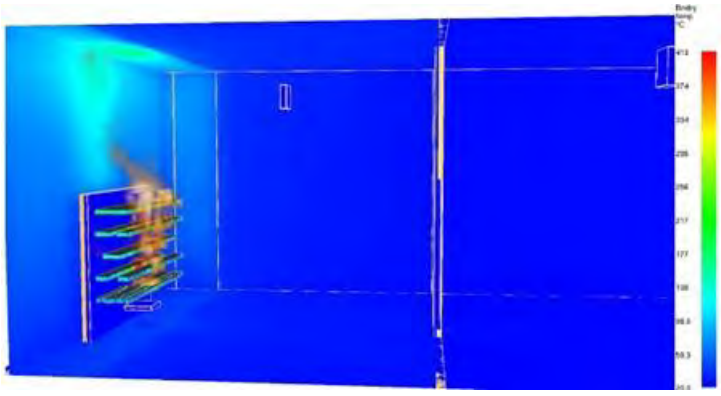
Participation in the workshop Community of Users for Secure, Safe and Resilient societies of the European Commission las 15th September 2020

Around 170 first responders and safety and security experts participated in the meeting organized by DG Home of the European Commission. The event had two objectives: 1) facilitating the dissemination of H2020 projects and 2) promoting the cooperation among academy, industry, and end-uses. Our lecture showed the main findings derived from the Societal Impact Assessment methodology that is being applied within the ASSISTANCE project (Grant Agreement number: 832576). It was divided into four parts: 1) intended/unintended potential/real societal outcomes of the project, 2) end-users vs new technological solutions, 3) citizens attitudes towards disasters and 4) gender dimension in disasters response.

New research collaboration project with the Spanish Nuclear Safety Council

We have signed an agreement with the Spanish Nuclear Safety Council (CSN) for the development over the next 4 years of a research project on "Advanced methodologies for analysis and simulation of fires in Nuclear Power Plants".

The project continues with the collaboration between both entities, which began in 2014, and will face several challenges such as supporting the Spanish participation in the PRISME phase III international research program (Propagation d'un Incendie pour des Scénarios Multi-locaux Élémentaires), promoted by the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development (OECD), in which experimental work and simulations of typical fire situations in nuclear power plants are developed. These works arise as a consequence of the growing importance of new approaches for the design of Fire Safety in nuclear power plants (NPPs), where computational simulation of fires play a prominent role. In addition, the monitoring of other international actions will be carried out, such as updating documents of the NUREG series. Likewise, this new Agreement aims to address new challenges in order to reinforce the actions of the CSN in the field of fire simulation and its application to the optimization of the NPPs design, and to improve, as far as possible, the good use and monitoring of current fire protection regulations (in Spain Instruction IS-30 revision 2 of the CSN) regarding risk-informed and performance-based design, as instruments for optimizing the design of fire protection systems in NPPs.



Kick off meeting of S4AllCities project

We are taking part of a recent H2020 project: S4AllCIties (GA 883522). This project aims to revolutionize the way smart cities become more protected and resilient to both physical and cyber-attacks on City soft targets, smart spaces and critical infrastructure networks, by greatly augmenting City Spaces Situation Awareness with intelligence, context and evaluated real-time cyber and physical security threat levels. The project, led by EXUS, involves 27 partners from 9 EU countries. Our tasks will focus on 1) societal impact assessment and 2) the development of simulation tools for supporting counterterrorist actions in case of IED and mass shooting attacks.

TRACES: a new research project

We have recently received funds from the Spanish Ministry of Research and Innovation to conduct a project entitled TRACES: undersTanding human BehaviouR in case of terrorism attaCks in mass gathErings buildingS (Ref. PID2019-106025RB-I00). The project focuses on the analysis of human behaviour under terrorist attacks through experimental analysis and the development of new simulation tools.

Paper on Self-preservation in toddlers

Safety Science has recently published our study entitled: "Assessing self-preservation capabilities in toddlers during evacuations". In this study, we investigated the performance of 94 children aged 0–3 during five evacuation trials. Overall, our findings contrasted with current age limits, namely 30–36 months, and provided new insights to be considered in safety design and practice. We believe that this paper has also provided an exciting opportunity to promote the importance and study of toddlers' evacuation.

Paper on Intelligent evacuation system

Safety Science has recently published our paper entitled "Testing a real-time intelligent evacuation guiding system for complex buildings". This research paper proposes and test a simple evacuation guiding system in operational conditions. The system is supported by ultrafast evacuation simulations and real-time decision support and used a simple dynamic signalling design. Overall, the results showed that evacuees performed better, and that evacuation timing was reduced with the system. Practical limitations are highlighted, and further research identified for the application of such guidance systems in the future.

Awards: Best presentation

Adriana Balboa, one of our PhD students, has received an award for the best presentation during CAMPUS FIT Congress 2020 that took place 24-26 June 2020. The presentation was related with SIGNAL project on the development of a decision support system for passenger trains in case of emergency. The system has been piloted in operational conditions and comprises hard and soft components (e.g. it is supported by real-time stochastic simulation models).

Signed: Mariano Lazaro Urrutia, University of Cantabria (GIDAI)

News from Universitat Politècnica de Catalunya

Outputs and expected impact of the WUIVIEW project

The European project WUIVIEW (https://wuiview.org/), funded by European Union's Civil Protection Mechanism (DG-ECHO) and coordinated by the research team CERTEC at UPC, has reached to its end after an exciting 2-year journey of research, innovation and demonstration activities focused on wildland-urban-interface fires.

WUIVIEW has been performed by an enthusiastic multidisciplinary consortium of six entities from five different European countries (Figure 1): ADAI (Association for the Development of Industrial Aerodynamics, Coimbra, Portugal), ARMINES (Laboratory of Industrial Environment Engineering, Alès, France), PCF (Pau Costa Foundation, Tivissa, Spain), RISE (Research Institutes of Sweden, Böras, Sweden), UNIBO (Università di Bologna, Bologna, Italy) and UPC (Universitat Politècnica de Catalunya, Barcelona, Spain).

Figure 1. Members of the WUIVIEW consortium in a general meeting held in Coimbra (January, 2020).

In line with the objectives of the Union's Civil Protection Mechanism, the WUIVIEW action has developed a fire risk analysis framework to be applied at the WUI home-owner level so to help WUI communities adapting to face the new generation of forest fires that have already arisen due to climate change. The first phase of the project has been devoted to understand factors and processes occurring at the WUI home-owner scale in real fires, by means of analysis of real incidents, laboratory experiments and CFD simulations (Figure 2). Based on observed problems and vulnerabilities, we have outlined an inventory of pattern scenarios typically responsible of home damage. We have particularly analysed the role of hedgerows as fire percolators through communities, the risk associated to domestic LPG tanks located in WUI properties, the level of fire impact in windows and glazing systems caused by residential fuels (either natural or non-natural) and the vulnerability that represents having fuels in semi-confined spaces leading to large heat accumulation in case of ignition.

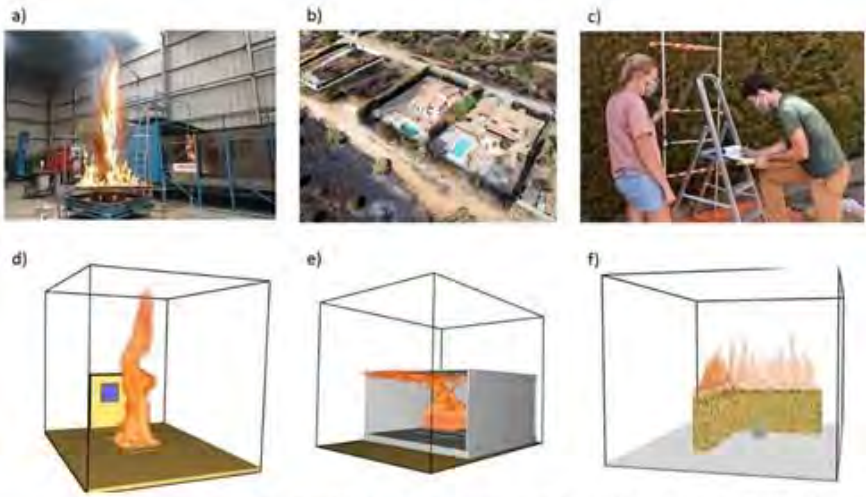


Figure 2. Activities to understand factors and processes at the WUI home-owner level; a) experimental burns at ADAI premises; b) Analysis of WUI accidents; c) Analysis of fuel load in hedgerows; FDS simulations of fire impact in d) glazing systems, e) semi-confined spaces, f) LPG tanks.

A thorough understanding of these vulnerabilities together with lessons learnt from other WUI fire risk mitigation programs and literature available, has enabled us to develop a user-friendly basic tool (in the form of check-list) for self-assessment of structure vulnerabilities (Figure 3).

We've come up with two versions of it: one to be applied in Mediterranean WUI properties[1] and the other to be used in Scandinavia[2], as the WUI context is significantly different in both areas. In addition, we have developed a PBD (performance-based design) engineering framework for an in-depth analysis of fire impact in properties, adapting PBD principles to the WUI problem and the wildland-urban environment. We have successfully tested this methodology in three different case studies: a Spanish property, a Swedish property and a community shelter in Portugal (Figure 4).

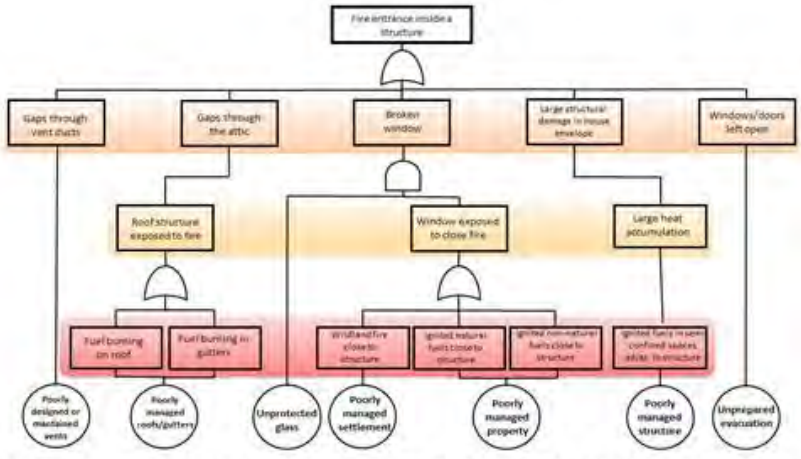


Figure 3. Rationale of the Vulnerability Assessment Tool developed in WUIVIEW. Adapted from Vacca et al. , J. Saf. Sci and Res. (2020)

Our wish is that, after two years of hard work, we generate real impact in our WUI communities in the not-too-distant future. To achieve so, there is further work to do to upgrade our tools so that they can cover all types of WUI communities (rural, touristic, and even metropolitan communities) and all types of assets and infrastructure (particularly focussing on critical infrastructure). We will have to make a step forward and do demonstrations of improved tools integrated into wider fire risk prevention and preparedness programs with the help and engagement of different fire actors: local civil protection and fire prevention authorities, fire risk managers, municipalities and, of course, residents at the WUI.

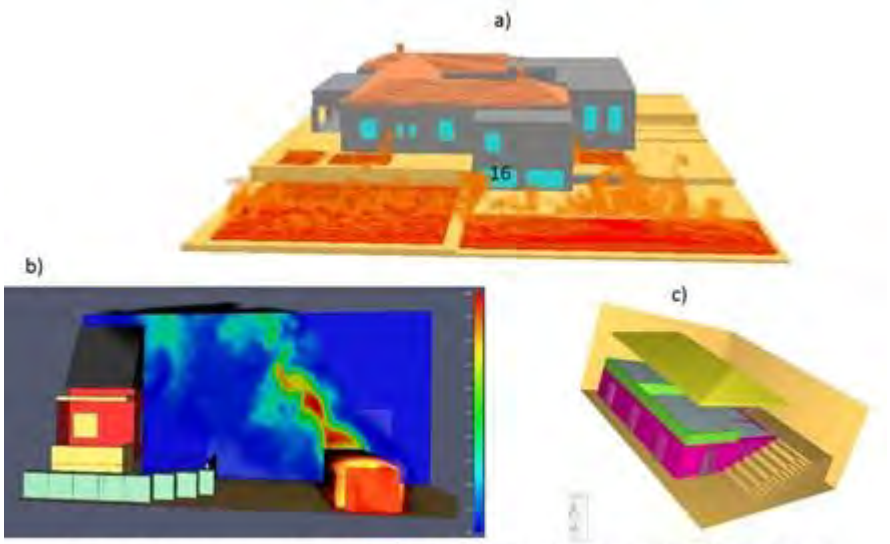


Figure 4. Study cases of the WUIVIEW project. PBD methodology testing in a) Spanish property; b) Swedish property; c) community shelter in Portugal.

Indeed, Europe needs to push the WUI fire safety agenda to empower all stakeholders and foster WUI community resilience in the face of wildland fires. We need to build the bespoke EU platform for fire-adapted communities to join collaborative efforts across WUI residents, fire agencies, fire practitioners and fire researchers. We require a common framework to develop science-based programs and resources to mitigate fire risk in WUI communities and we modestly believe that, with the WUIVIEW effort, we have contributed to sow the seeds to make this happen.

To the DG-ECHO agency and in particular to Project Officers, thank you all for your support!

Footnotes:

1. https://forms.gle/cga9EM2LGsdMXXG66
2. https://docs.google.com/forms/d/e/1FAIpQLSdBizP4UqxTMASxMYrSToitGOmTaNkrOglNmoaxeX8YF80YLw/viewform?usp=sf_link

Signed: by Elsa Pastor, Universitat Politècnica de Catalunya, Coordinator of the WUIVIEW Project - elsa.pastor@upc.edu

News from Universiti Putra Malaysia

Introducing the Fire Safety Division, Safety Engineering Interest Group (SEIG) from Universiti Putra Malaysia.

Greetings from us!

The Fire Safety Division is a focus research group within the Safety Engineering Interest Group (SEIG) which was established in 2020 under the auspices of the Department of Chemical and Environmental Engineering, Faculty of Engineering, Universiti Putra Malaysia. The group's primary focus is to facilitate research work within the field of fire science, fire engineering and other fire safety engineering-related research. We aspire to become the national leader as well as to be internationally renowned in the sector of fire safety engineering research.

Our group comprises of members with unique expertise, extensive experience, and diverse engineering background who have active involvement with the industry at the present or in the past, supported by strong analytical, computational, and experimental facilities. With variety of research interest within our group, though pandemics remain at a threatening level in the country, our members continuously reach out to each other remotely and have been working endlessly to the fullest to accomplish progress milestones in each research work.

Being new to the IAFSS community, we look to expand our networking reach throughout the globe, and we are always open for any research collaboration from any of IAFSS members. We are taking this opportunity to also introduce our graduate members and their respective research to the world.

Regards,
Zahirasri Tohir, Head, Fire Safety Division, Safety Engineering Interest Group (SEIG)
Email : zahirasri@upm.edu.my
Twitter : @SEIG_my

Our members

Abdelmoutaleb Noumeur's primary research for his PhD's degree is related to evaluation of the evacuation and pre-movement time components, specifically a study case for Malaysia. The study is based on the assessment of the effectiveness of fire alarm audibility inside buildings and the influence of the pre-movement time on the evacuation time in general.

Abderrahim Zermane**,** coming from Algeria, is one of our PhD candidates, his primary research is related to managing work at heights activities and Fatal Falls from Heights (FFFH). He is focusing on the work at heights activities pertaining the installation of PV solar panels on rooftops. While his research might not be directly related to fire safety, the contribution of his work is towards the safety of installers from fire hazards during the installation of solar panels. Being from Algeria, Abdelmoutaleb and Abderrahim are both fellow countrymen.

Nur Aliah Fatin Nizam Ong**,** as one of our PhD candidates, her previous research entitled "Investigation of the Effects of Photovoltaic (PV) System Component Aging on Fire Properties for Residential Rooftop Applications" is a profound finding contributing a chapter of renewable energy in solar PV to the team. Currently, she is investigating fire safety of PV systems with a particular emphasis on aged systems and components. By investigating the thermal properties of the material, additional safety elements can be considered in the design phase to reduce the frequency and severity of fire incidents caused by PV electrical systems installed on residential rooftops.

Dayang Nur Sakinah Musa**,** our PhD candidate, is focusing on a project related to study on the effectiveness of fire suppression on smouldering peat fire. Hence her research aims to understand the extinction mechanism of smouldering peat fire using water as a medium of suppression in a forest reserves area.

Some of our members during the recent online meetup.

Mohd Rashid Ramali is on his route to accomplish his master's degree developing a set of best practices of safety guidelines for responders during PV fire. He discovered a significant correlation between fire safety and photovoltaic (PV) application and the need to advance research about the safety guidelines when encountering PV-related fire scene.

Michael Chong Vui San**,** an outstanding undergraduate student spearheads a research entitled "Assessment of Thermal Radiation Models Performance for Different Fuel Variants". He intends to contribute in showing the limitation of different radiation models while subsequently providing supporting data for the selection of the best suited radiation models in predicting radiant heat flux.

Iffah Umairah Zulmajdi**,** as a top undergraduate student, is leading a research entitled "Apriori benchmarking simulation of B-RISK Software for single item burning experiments". The project is conducted to benchmark the prediction capability of B-RISK model when performing a priori simulations of incident radiation of single item using room size experiments. The project is in collaboration with Dr. Greg Baker from Fire Research Group Limited (FRG), New Zealand.

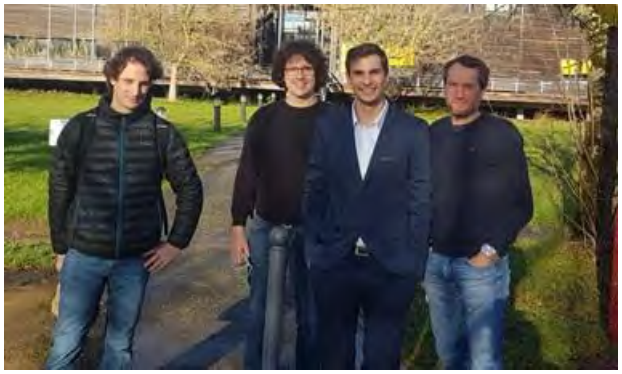
Signed: Zahirasri Tohir, Universiti Putra Malaysia

News from Pprime Institute – Poitiers – France

PhD defense of Jeremy Colombiano on "Multi-scale approach of the fire reaction of wood, development of the methodology of fire safety engineering"

Jeremy has realized his PhD in Pprime Institute with the financial support of EFECTIS society and the French ministry.

The 5th of December 2020, Jeremy has presented its PhD defense to an international jury composed of: Jose Luis Torero from university College London and Bernard Porterie from Marseille university as reviewers, and Bart Merci (Ghent university), Pascal Boulet (University of Lorraine), Virginie Dréan and Eric Guillaume from Efectis France as jury members, as well as its supervisors, Benjamin Batiot, Franck Richard and Thomas Rogaume from Pprime Institute – university of Poitiers.



During its PhD, Jeremy has developed a rigorous and complex multi-scale experimental methodology in order to:

- Understand the phenomenon of thermal decomposition, of ignition and of flame propagation, both it is vertical, horizontal, co-flow or counter-flow of wood samples.
- Determine the thermal, physical and chemical properties required from the modelling approach.
- Furnish the data necessaries for the model development and validation.

To do this, Jeremy has used the TGA, DSC, cone calorimeter apparatus coupled with detailed analytical apparatus. A specific medium scale apparatus, based on a radiant panel has also been developed and used and finally, large scale experiments have been conducted.

The experimental results have permitted to develop and validate with an up-scaling approach the modelling of the processes of thermal decomposition, ignition, flame propagation with FDS. Recommendations have finally been formulated in order to better describe the flame propagation and the interaction Flame-Solid.

The members of the jury have unanimously underlined the quantity and quality of the enormous work realized by Jeremy and the major scientific contribution of its study.

Now, Jeremy is a permanent research Engineer in Efectis France society. Congratulations to him and many happiness and fulfillment.

PhD Defense of Xiaowen Qin on "Modeling study of pyrolysis of composite materials-Application to wood and carbon/epoxy composite"

Xiaowen Qin has supported his PhD defense on the 4th of February 2021. Its jury was composed of Alexis Coppalle (Rouen) and Bernard Porterie (Marseille) as reviewers, Pascal Boulet (Nancy), Jean Lachaud (Bordeaux) and Virginie Dréan (Efectis France) as jury members, and finally, Benjamin Batiot, Franck Richard and Thomas Rogaume, its supervisors.

With a financial support of the Chinese government, Xiaowen has studied the application of the PATO model (Porous material Analysis Toolbox) based on OpenFOAM to the thermal decomposition of composite fuels. PATO model has been initially developed for the description of the phenomenon of ablation in the context of spacial application. The challenge was then to modify and to apply this model to the thermal decomposition of solid fuel in the context of fire.

The numerical approach used by Xiaowen is based on detailed experiments in order to obtain the properties and the data required by the model development, application and validation of the model. TGA and modified controlled atmosphere cone calorimeter experiments under inert atmosphere have been conducted. The bench-scales have been modified in order to control the desired parameters and to study separately different important phenomenon such as: heat transfer, water evaporation, mass transfer, char front propagation, etc.

Based on those experiments, PATO model has been modified, completed and the experiments have been modelled. A very special attention has been focused on the water evaporation, the char formation and the coupling between heat and mass transfers in order to well understand and to describe the dominant processes implicated.

The study has concerned two different composites: one natural, wood, and one synthetic, a resin epoxy/carbon fibers. The results obtained are very promising and show the capacity of PATO Model to represent the pyrolysis of solid fuels in the context of Fire science. The perspectives concern notably its coupling with Firefoam model in order to describe the gaseous aspects.

The jury has particularly appreciated the large effort and the major contribution of the PhD of Xiaowen on the study of both heat and mass transfers during thermal decomposition, based on a very detailed analysis of the scientific aspects involved. Congratulations to Xiaowen and many pleasure, happiness and fulfillment in its future!!

New PhD Student: Rita Nohra, concerning the effects of under-ventilated fires on the reaction-to-fire of materials

My name is Rita Nohra, and I am a Mechanical Engineer from Lebanon holding a Master degree in energy management from the University of Poitiers.

Throughout my years of education, I developed a particular interest in energy engineering and in risk management, and I am thrilled to have recently started (in January 2021) a related Ph.D. at the Pprime Institute in collaboration with the LNE, under the supervision of Prof. Thomas Rogaume, Dr. Benjamin Batiot and Dr. Damien Marquis.

The purpose of this thesis is to study fire in confined and under-ventilated spaces, and to simulate it using adequate pyrolysis and combustion models. Precisely, the aim is to comprehend the effect of under-ventilation on the reaction-to-fire of materials. Additionally, with an experimental phase on different scales, we will quantify the concentration of dioxygen and air flux on the reaction.

New experimental bench-scale and collaboration with FIRE EVOLUTION society in order to improve the training of firefighters.

Fire Evolution is a young society created by professional Firemen of SDIS85. They develop innovative and successful tools for the training of firefighters. Notably, they have performed the Fire Evolution Box which is dedicated to the understanding and to the study of thermal accidents, as the ignition of cold smoke. The Box is very innovative and permits to study different scenario and kinds of accidents. It is a tool for understanding the fire system, its development, the occurrence of thermal phenomena or accidents. The Fire Evolution Box is economical, ecological, scalable, adaptable and safe. It is composed by three modular parts: the first one corresponds to the main cubic volume, the second to the interchangeable facade allowing to modify the scenarios and the third to the removable door.

In last November, a new collaboration has been developed between Fire Evolution and Pprime Institute. A Fire Evolution Box has been delivered and installed in Pprime Institute.

This one will be equipped with different scientific instrumentation in order to characterize the phenomena implicated during thermal accidents and the conditions associated. Notably, gas analyzers, thermocouples, heat flux gauge will be installed. Non-intrusive equipment's as thermal camera and rapid camera will also be installed.

Different experimental investigations will then be conducted together in few months…

Project OPTIFUM and its state of advance

One of the objectives of the project OPTIFUM is to resolve the problematic of chimney fires. Chimney fires can have many causes. A fire can be caused by the buildup and the inflammation of the creosote deposits within the flue. The real creosote deposits have been characterized in a previous work [1]. The experimental campaigns showed significant heterogeneity among deposits [1]. Depending on their source and their generation conditions, the deposits differ in terms of structure, porosity, composition and thermo-physical parameters. These elements imply differences in thermal decomposition and ignition. For this reason, it seems difficult to predict one single pyrolysis and combustion model that can be suitable for all the types of deposits. Therefore, we are currently still working on the same problematic, but differently.

A PhD student (Safae KELLALI) joined the team under the supervision of Prof. Thomas ROGAUME, Dr. Franck RICHARD, Dr. Benjamin BATIOT and Dr. Pierre CREMONA. After noticing the heterogeneity among the real deposits. For the current research, we have chosen to accomplish the study using one kind of material. The coal chosen to replace the real creosote is lignite. This choice has been decided firstly after an initial observation that showed similarities between the two materials. This first observation has then been experimentally validated. At first, the behaviour of lignite and creosote were compared at the material scale through TGA experiments. After that, cone calorimeter tests were carried out in order to compare their behaviour at the small scale. After the validation of the material choice, to discern the pyrolysis phenomenon under Nitrogen, thermal decomposition has been studied through TGA experiments. The drying behaviour has firstly been analysed, then pyrolysis of lignite has been studied under different heating conditions. The results were exploited to validate the pyrolysis mechanisms proposed during this work. The use of two different software (DAKOTA and MATLAB) allowed us to find the kinetic parameters for the pyrolysis reactions. The optimization with DAKOTA has been performed by the coupling of DAKOTA and PATO (Porous material Analysis Toolbox based on OpenFOAM). The first mechanism proposed is parallel, while the second one is competitive. Once both mechanisms have been validated. A comparison was necessary to assess the ability of the mechanisms to model the mass loss at a large range of heating rates. In addition to this first pyrolysis kinetic study (TGA scale). We have accomplished extra tests at the small scale (cone calorimeter), under nitrogen and air, using different sizes of lignite particles to study the effect of porosity on pyrolysis behaviour. Experimental results have then been modelled using PATO (Openfoam). Besides the thermal experiments that have been performed (TGA and cone calorimeter). As it is shown in the picture, a new experimental bench at semi-real scale has been developed at the CERIC Laboratory (Poujoulat). This bench will be exploited to study the conditions of ignition in a real chimney duct.

Reference:

[1] Caractérisation expérimentale et numérique des scenarios de feu impliquant un conduit de fumée d'appareils de combustion bois, Doctorat de Pierre Cremona

Fire REsistaNce of External Thermal Insulation Composite Systems - FRENETICS Project

As we know the current scenario is to improve the insulation of the building in order to reduce energy waste. To achieve that external thermal insulation (ETI) of buildings has been developed (with two types: ventilated cladding and composite exterior thermal insulation systems, called ETIC). This results in an increase in the mass of fuel and the probability of fire spreading on the facades. The primary aim of this project is to study the impact on fire safety on these new building insulation products and solutions. This project has 4 collaborators out of which, 3 research laboratories are Coria Complexe De Recherche Interprofessionnel En Aerothermochimie, Umet Unité Matériaux Et Transformations, and Pprime Institut P': Recherche et Ingénierie en Matériaux, Mécanique et Energétique, 1 industrial partner is EFECTIS France. In this project, the role Pprime institute is to perform experimental study on these new insulating materials and solutions at two scales i.e. small and intermediate scale.

At small scale the reaction to fire properties of materials will be studied on small samples using analytical methods: Thermogravimetric analysis with coupled Fourier transform infrared spectrometry (FTIR), differential scanning calorimetry (DSC), cone calorimeter (CC). New materials will be developed using a multi-scale approach (intumescent, fireproof materials). The properties of current materials and flame-retardant materials will then be compared. The experimental data will be used to analyze the flammability and fire behavior of materials as well as to characterize the kinetics of thermal decomposition. The pyrolysis models developed will be introduced into CFD simulations carried out on a larger scale.

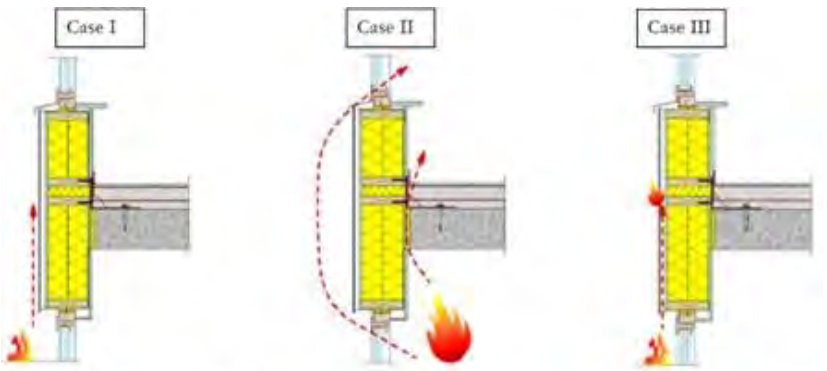


Fig. 1 Illustration of the three main classes of scenario of ignition and propagation of a facade fire.

On intermediate scale a Research Engineer Hussain NAJMI is working under the supervision of Prof Thomas ROGAUME and Benjamin BATIOT at Pprime Institut (Poitiers, France). His aim is to develop and validate a new test bench in order to test the panels up to 1 m in size for three different fire scenarios (see Fig. 1).

The risk of ignition and propagation of fire to the facade takes place mainly according to the three scenarios: by the external surface of the insulating system (case I), by a flame exit of a generalized fire in a room or by deformation of the structure (case II) and finally within the same insulating system (case III). It is also possible that a fire on a nearby building can also be the cause of the facade ignition. Case III corresponds to a fire propagation within the insulation system, in particular for the case of ventilated cladding, for which an air layer between the cladding and the insulation material exists. The test bench should allow studying the above three different fire cases in details and to do so and a new innovative test bench being developed at Pprime institute (see Fig. 2).

In this test bench the hood, the exhaust duct and probe section is based on ISO 9705 norm because this norm is already validated for the HRR measurements of range 0 to 1.5 MW. In order to study the above described test

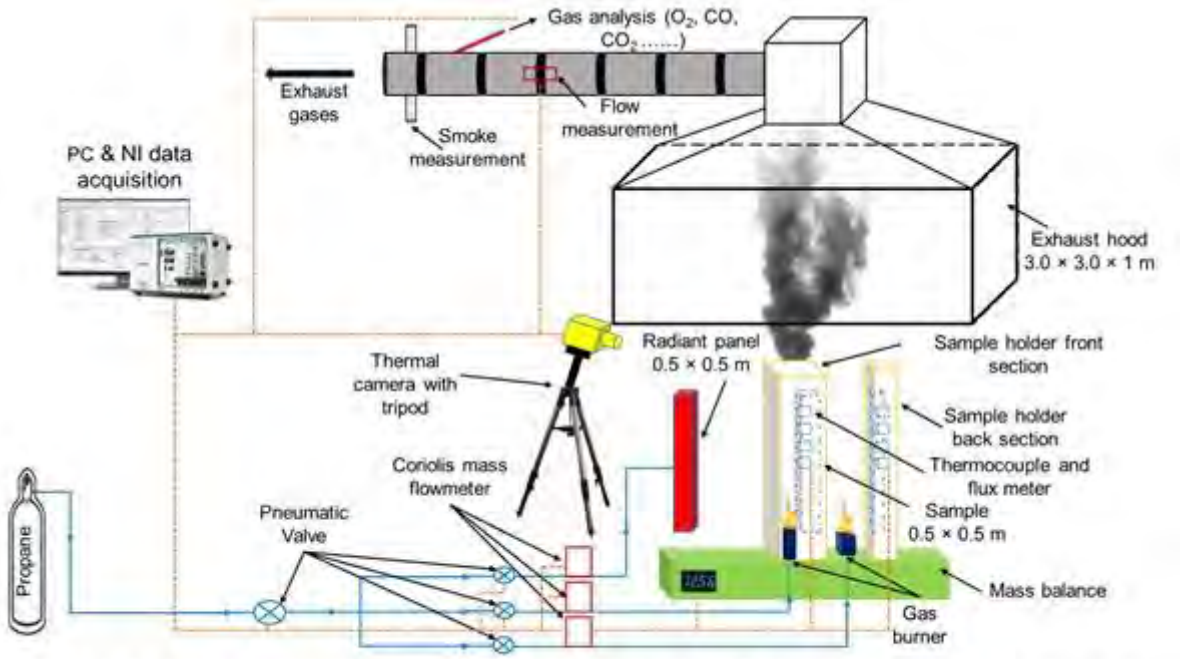


Figure 2: A schematic of new test bench under development at institute Pprime to study thermal decomposition, combustion and flame propagation on ETI setup.

cases, a unique sample holder is designed and validated using Catia and Solidworks. The sample holder is a very important part of this test bench it consists of two sections (i.e. Front and Back section) and both the sections are made up in metal (Aluminium alloy) and as well as in insulated material (Calsium silicate). The metal frame acts as a cage for the insulated part (see Fig. 3). The advantage of this sample holder design is that the dimensions of insulated and metal part can be varied depending upon the size of the sample and its thickness. This sample holder assembly is placed on a digital mass balance to estimate the mass loss during the test.

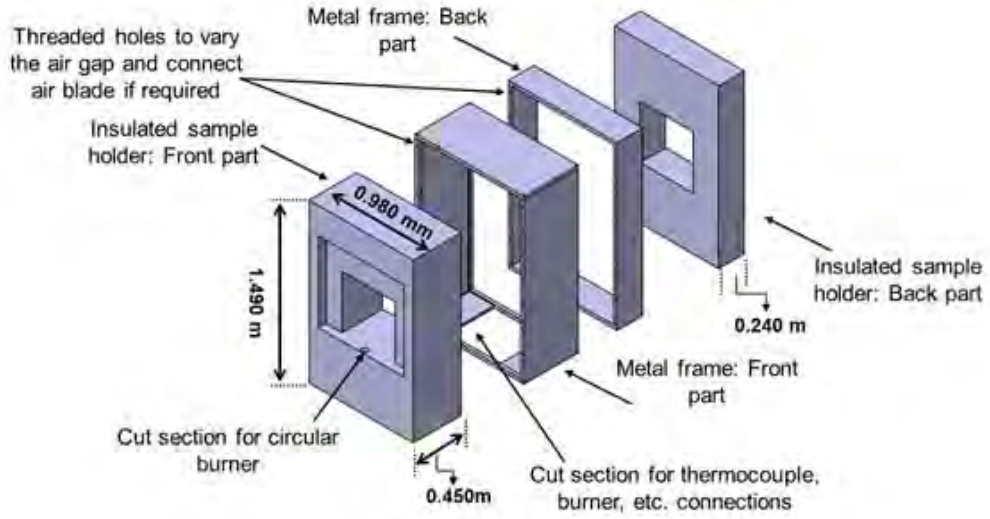


Figure 3: A 3D model of sample holder assembly.

There are two different types of fire sources are used first is a radiant panel and the second is burner (cf. Fig. 2). One radiant panel of size 500 × 500 mm is placed at the front sample with a

provision to vary the angle of incident flux with respect to the sample as well. While two burners are placed at the base of the sample out of which one is circular of diameter 50mm and second is rectangular of length 500 mm and width 20 mm. All the burners are feed with the propane gas and its mass flow rate is controlled by a dedicated Bronkhorst mass flow controller as per the heat flux requirement. In view of safety reasons a pneumatic valve is connected before each mass flow controller and one master valve is connected before these 3 valves. These valves allow cutting the supply of propane in case of emergency. To study in detail the properties of flames and fumes, the heat flux on vertical samples. The test bench will be equipped with exhaustive measurement means: thermocouple, flux meter, IR and visible cameras, laser diagnostics (PIV) and heat flow sensors on the sample. The toxicity of the fumes will be analyzed using gas analyzers and an FTIR spectrometer.

All the sensors are connected to a NI data acquisition system (Chasis PXIe-1073 NI PXI-6229: 48 I/O Numerical, 16 I/O Analog, PXIe-4353: 32 Thermocouples input channels 16 analog I/O). LabVIEW program is developed not only to store all the data from different sensors, but it also helps in real-time monitoring (exhaust gas concentration, temperature, mass loss, thermal image and heat flux) and controlling of all the input parameters (mass flow rate, opening-closing of pneumatic valve and heat flux) and control them during the experiments.

Signed: Thomas Rogaume, University of Poitiers

News from Department of Fire Protection Engineering, Worcester Polytechnic Institute (WPI), MA, USA

New Members:
The Department of Fire Protection Engineering at WPI welcomes the new post-doctoral fellow and graduate students.

Reza Ziazi is a post-doctoral fellow in Fire Protection Engineering Department at Worcester Polytechnic Institute (WPI) working in in the area of wildland fire behavior in Prof. Simeone's group, particularly on the multi-scale physics of the interactions between fire, wind and vegetation. Prior to joining WPI, Dr. Ziazi has been a lead technical engineer at Alden Research Laboratories where he supervised, designed, and conducted several projects for the industries in the general area of fluid system performance. He received his PhD from Oregon State University in the general area of turbulent flows in porous media. He is a member of IAFSS, NFPA, SFPE, IAWF, ASME, APS, and AGU.

Abhinandan Singh is a Ph.D. student in the Department of Fire Protection Engineering at Worcester Polytechnic Institute (WPI). He received his master's degree from the Department of Aerospace Engineering at the Indian Institute of Technology Kanpur, India. 'Prescribed burns' is one possible solution to the severe wildland fire problem our world is currently facing. Apart from the many benefits this solution has some demerits, including the fact that it impacts the local air quality. My research as a Ph.D. student under Professor Albert Simeoni will focus on establishing a general relationship between fuel-fire-emissions by conducting controlled burns at various scales. This work will provide a detailed insight into the physics of vegetative burning and help the fire managers conduct more controlled and less polluting prescribed burns.

Weixuan Gong is a master student in the Department of Fire Protection Engineering at Worcester Polytechnic Institute (WPI). She received her bachelor's degree in Fire Protection Engineering from Central South University, China in 2019. Her current research, advised by Professor Albert Simeoni and Professor James Urban, focuses on the flammability of vegetative fuels based on bench scale experiments mainly by measuring HRR, concentration and the temperature of pyrolysis gases and combustion products, and time to ignition.

Research:

Developing an Assessment Framework for Flame Spread on Facades of High-Rise Buildings

Ahmed O. Said and Albert Simeoni

A high-rise building is deemed as one of the signatures of modern urban designs and luxurious lifestyle. While the high-rise buildings contribute positively to modern cities, several incidents have demonstrated that the façade systems of these buildings are highly vulnerable to catastrophic fires. Available statistics and reports showed that the frequency of these fires has dramatically increased since 1990 all over the world. Therefore, as the number of high-rise buildings is soaring, the fire safety criteria of these buildings become of paramount importance to outline and characterize.

At WPI, a new project is being conducted to study the phenomenon of fire spread on façade systems. The objectives of the study include reviewing the literature and available information on structural designs and fire incidents of façade systems and Identifying critical parameters controlling fire spread on vertical façade systems. The identified parameters are analyzed to better understand the behavior of an entire façade system (not only individual components). Based on the identified parameters, a set of medium scale experiments are conducted in accordance with the ISO13785:2002-Part 1 protocol to help better understand the mechanisms controlling fire spread on different facade system constructions.

The Effect of Fuel Characteristics and Fire Dynamics on Emissions from Prescribed Forest Burns: Wind Tunnel Testing at WPI

Reza Ziazi, Abhinandan Singh, Ahmed O. Said, and Albert Simeoni

This work responds to the Strategic Environment Research and Development Program (SERDP) RCSON-20-C3 call for understanding the linkages between fuel characteristics, fire dynamics, and air quality, which is essential to develop and validate risk-reducing fire models. The objective for the first steps of this project is to determine through laboratory scale combustion experiments at the WPI wind tunnel the effects of fuel type, fuel load, area density, volume density, fuel moisture, and wind velocity on fire dynamics (e.g., mass loss rate, smoldering times), emission composition, and emission quantity. A first series of experiments has been conducted at WPI with the Environmental Protection Agency (PI Institution) and field experiments are currently conducted at Tall Timber Research Station in Florida.

ICME approach to design Novel safe Lithium electrode

Ahmed O. Said, James L. Urban, Milosh T. Puchovsky, and Albert Simeoni

This project is sponsored by Underwriters Laboratories (UL). Our team had the opportunity to collaborate with material science teams from the Department of Mechanical Engineering at WPI to design a novel electrode with high voltage and a thermally-stable performance. The material science teams designed and manufactured lithium ion and solid-state batteries with a 2023-form factor (coin cells). The results of this project will enable comparing the thermal stability of liquid versus solid electrolytes. The long-term goal of the study is to produce a high energy density battery with high thermally-stable performance and understand the toxicity of any released gases during failure.

Media:

1. Professor Albert Simeoni contributes to United Nations Disaster Risk Reduction Report: Professor Albert Simeoni Contributes to United Nations Disaster Risk Reduction Report | Announcements | News | WPI
2. Professor Albert Simeoni speaks on wildland fires: A Look at Why the West Coast is Burning (shondaland.com)
3. Professor Ali Rangwala speaks on the new law that requires portable fuel containers to include flame mitigation devices to prevent explosions: New law requires portable gas containers to add devices to protect against explosions (nbcnews.com)
4. Follow our latest news and announcements on:
   Fire Protection Engineering | Academics | WPI
   (2) Department of Fire Protection Engineering at WPI | Facebook,
   https://twitter.com/fpewpi, https://www.linkedin.com/company/71129086/admin/, and
   https://www.instagram.com/challenge/?next=/fpe_wpi/

Signed: Ahmed O Said, Worcester Polytechnic Institute

News from the University of Maryland (USA)

UL and The International Fire Safety Consortium Collaborate to Address Global Fire Safety Challenges
UMD, in collaboration with the International Fire Safety Consortium (IFSC) and Underwriters Laboratories (UL), is working to address unresolved fire safety problems worldwide by advancing fire safety engineering and scientific research, while encouraging information exchange and facilitating global collaboration. This establishes UL as a non-profit partner of the IFSC. The IFSC was launched in 2019 by UMD, University of Edinburgh, University of Melbourne, Lund University, and University of Queensland. All five of the founding partner universities are members of the Universitas 21 Global Network. Ghent University joined as an academic research partner.

Research Team Receives DOE Grant to Develop Heat-Flux Sensors
A research team has received funding from the U.S. Department of Energy to study Robust Heat-Flux Sensors for Coal-Fired Boiler Extreme Environments. Oded Rabin, in the Department of Materials Science and Engineering and Peter Sunderland, in FPE, will develop heat flux measurement systems capable of operating in high-temperature, corrosive environments such as fires and coal-fired power plants. The team will investigate new thermoelectric materials and new sensor designs to address the yet-unanswered challenges of these high-temperature environments. The 3-year, $500K grant is supported by the DOE NETL (National Energy Technology Lab) University Training and Research program. The project will also support the training of graduate and undergraduate students in STEM disciplines.

Massive Computer Power Performs High Resolution Simulations of Turbulent Pool Fires
A computational study of a methanol-fueled turbulent pool flame provides new insight into the unstable structure of the flame, and into the convective and radiative heat transfer processes that determine the intensity of the gas-to-liquid thermal feedback. The study uses FireFOAM and was funded by FM Global and by the National Science Foundation (NSF). High spatial resolution (millimeter-scale) was utilized to capture the thin boundary layer flames that repeatedly form at the burner rim above the liquid pool surface and the small plume-like structures – called "thermals" – that grow along the flame surface as a result of buoyancy-driven Rayleigh-Taylor instabilities. The study, led by Arnaud Trouvé, was published in 2020 in Combustion and Flame (https://doi.org/10.1016/j.combustflame.2020.10.055). Mohamed Ahmed, a PhD student advised by Trouvé, is the first author.

Chaffer Receives UMD 2020/21 Outstanding Graduate Assistant Award
Ryan Chaffer, an M.S. student in the Department of Fire Protection Engineering, has received UMD's Outstanding Research Assistant Award for the 2020/21 academic year. Over 4,000 UMD graduate students serve the campus as administrative, research and/or teaching assistants and are eligible. Chaffer is developing his thesis, "A Redesign of the Fire Propagation Apparatus to Simplify Manufacturing and Increase Measuring Capabilities." According to Chaffer, there is only one company that produces commercial FPAs that are up to code with the FPA scientific testing standards, and that company charges a premium for them. "My ultimate goal is to demonstrate that in a strictly research environment, you can make one yourself and hopefully yield comparable results, for a fraction of the cost," he said. Chaffer is a graduate research assistant for FireTec - managed by Drs. Stanislav Stoliarov and Fernando Raffan-Montoya. His research advisor is Dr. Stoliarov.

Baldwin Named a Philip Merrill Presidential Scholar
The Philip Merrill Presidential Scholars program recognizes the University of Maryland's top graduating seniors and their accomplishments, prestigious internships, impressive grades, and mentoring experiences. FPE senior James Baldwin has received this award for 2021.

Bellamy and Harris Receive 2020 UL FSRI Fellowship
Grayson Bellamy and Matthew Harris, FPE MS students, are the 2020 recipients of the UL Firefighter Safety Research Institute Fellowship. The UL FSRI Fellowship has supported one FPE graduate research assistant from UMD each year since 2017. This is the first year there will be two new fellows.

Hamburger Awarded 2021 Federal Engineer of the Year Award
Alum Kenneth Hamburger (BS 2012, MS 2013), a fire protection engineer in the U.S. Office of Nuclear Regulatory Research, will be the NRC Representative in the National Society of Professional Engineers (NSPE) 2021 Federal Engineer of the Year program. Hamburger was selected for this award for leading innovative research activities associated with advancing nuclear power plant fire safety, risk assessment and hazard mitigation, and high energy arcing faults.

di Marzo Retires
Professor Marino di Marzo retired in December after nearly 40 years of service to the Departments of Fire Protection and Mechanical Engineering. Di Marzo received his Dr.-Ing. in chemical engineering from Naples University in 1976 followed by a Ph.D. from Catholic University in 1982. He joined UMD in 1981. He served as the department chair of FPE for over ten years. Dr. di Marzo's research expertise covers multiple areas across fire, heat transfer, multi-phase flow, and nuclear safety. Di Marzo collaborated extensively with NIST and served as a

consultant for the U.S. Nuclear Regulatory Commission. He is a fellow of the American Institute of Chemical Engineers and the American Society of Mechanical Engineers. We wish him all the best in retirement!

Signed: Peter Sunderland, University of Maryland

News from Royal Melbourne Institute of Technology - RMIT (Australia)

Arrivals

Dr Erica Kuligowski joined RMIT University as a Vice-Chancellor's Senior Research Fellow in October 2020. Erica will be working within the STEM College (Civil and Infrastructure Engineering) as well as with colleagues within RMIT's Centre for Urban Research. During her fellowship, she will conduct research on evacuation and emergency communications during bushfire, building fires, and other hazards.
https://www.rmit.edu.au/contact/staff-contacts/academic-staff/k/kuligowski-dr-erica

Research at the Innovative Fire and Façade Engineering (IFFE) Group

The group currently has three PhD students working on Artificial Intelligence and Façade Fire (funded by the Australian Research Council), fire performance of aerated geopolymer concrete and fire performance of concrete from recycled materials (funded by Cooperative Research Centres Projects Grants). Hoang Nguyen recently completed his PhD confirmation and published a review paper on the use of Artificial Intelligence to predict fire performance of construction materials and their flame retardancy.

IFFE has two ARC DECRA Fellows, Dr Kate Nguyen and Dr Long Shi, who currently work on façade fires and thermal efficiency of buildings. Kate also started her L'Oreal-UNESCO For Women in Science Fellowship in early 2021 on a low carbon coating manufactured from industry wastes for bushfire-prone areas.

IFFE has been taking the research leading role in the CRC-Project on Upcycling hazardous claddings which investigates the "greener" transformation of non-compliant claddings removed from buildings into commodities of higher value. This project received $2.95 mil funding from the Australian government.

IFFE has been conducting a pilot project with the Australian Building Code Board to enhance the training on fire risk assessment. This project is in collaboration with SFPE US, the University of Melbourne and Basic Expert Pty Ltd.

Dr Erica Kuligowski is invited as one of the five invited speakers for the 13th IAFSS Symposium, where she will present on the following topic: "Evacuation Decision-making and Behavior in Wildfires: Past Research, Current Challenges, and a Future Research Agenda".

Congratulations to our researchers.

- Dr Erica Kuligowski's new research grants: Erica is part of two international research teams funded by the National Institute of Standards and Technology focused on analysing bushfire evacuation behaviour with GPS data (grant led by the University of Florida) and on the integration, verification and validation of the wildfire evacuation platform WUINITY (grant led by the Fire Protection Research Foundation).
- Erica was awarded the 2020 Arthur B. Guise Medal for eminent achievement in the advancement of the science and technology of fire protection engineering, awarded by SFPE.
- Dr Kate Nguyen has been recently awarded the 2020 RMIT Award for Research Excellence (ECR-Enterprise).

Education

Our group is assisting the Australian Education Committee on Fire Safety Engineering to design and run a survey on industry need for education in this field in both immediate and long terms.

The first semester of 2021 has just commenced with Capstone final year research projects kicking off. The topics this year focus on evacuation strategies in bushfires, sustainable construction materials for fire safety of informal settlements and post-bushfire reconstruction.

Signed: Kate Nguyen, RMIT University

News from York University (Canada)

Research news

Its been awhile since we have updated the community on our progress at York University. You can follow our research activities at YorkUFire.com ; @galesfiresafety on twitter and yorkufire on Instagram.

When lab restrictions came into place back in March, a number of data collection initiatives were concluding in our group. We had also initiated planning for several research frameworks for the coming years. These, combined, have kept our group very operational despite the struggles in Toronto and globally. This communication serves to update the field of our groups' activities since we last reported late 2019.

Stay Cable Fire Tests

York University has recently been the recipient of equipment funding to enable fire testing, and the first test programs have recently reached the end of their first phases in March of 2020. This began with the commissioning and testing of various heating capabilities and environmental system assessment. This then allowed us to perform a comprehensive analysis of gypsum board performance using narrow spectrum illumination technologies (developed with our friends from NIST), as well as the investigation of stay bridge cables (pictured). We have worked quite closely with our friends and collaborators at the University of Waterloo to see these projects to success. Both of these projects were led by graduate students: Ben Nicoletta, Chloe Jeanneret, and Bronwyn Chorlton, with supported by members of our undergraduate team. The bridge cable experiment research programme is supported through a partnership with Arup UK Fire Engineering. The Gypsum research was supported by the Canadian Government. The recently accepted peer reviewed papers at the time of writing this news can be found here:

- Nicoletta, B., Gales, J., Kotsovinos, P, and Weckman, E. (2021) Experimental Thermal Performance of Unloaded Spiral Strand and Locked Coil Cables Subject to Pool Fires. Structural Engineering International (IABSE).
- Jeanneret, C., Nicoletta, B, Gales, J. Robertson, L., and Kotsovinos P. (2021) Guidance for the Post-Fire Structural Assessment of Prestressed Bridges. Engineering Structures (Elsevier).
- Chorlton, B., Forrest, B., Weckman, W., and Gales, J. (2020) Performance of Type X Gypsum Board on Timber to Non-standard Fire Exposure. Fire and Materials (John Wiley).

Did you know that YorkU fire has a transportation skills research team? Combining resources from transportation teams in Ottawa and at York, we have developed multiple research projects. We are currently investigating accessibility in transportation terminals, including lesser-considered mobility impairments. Pedestrian dynamics, required actions and decision making are being evaluated to identify considerations for the flow of occupants within transportation facilities. Multiple technologies are being tested to help collect data to inform and validate pedestrian models, including AI tracking from camera footage. Early results appeared last summer at the human factors sessions of the International Conference on Applied Human Factors and Ergonomics conference series, led by team members Seth Gatien and Tim Young. This data analysis work will continue over the next year. We are also investigating human factors in wildland urban interface community evacuation. You can find reference to our recent paper here:

- Yerushalami, A., Folk, L., Carton, H., Gales, J., Khan A., Weckman, B. (2021) Fire Evacuation Modelling of a Canadian Wildland Urban Interface Community. Canadian Journal of Civil Engineering (NRC Research Press)

Related, we received funding from the SPFE foundation to undertake the construction of a movement parameters database for human behaviors in emergencies, and to analyze our existing video database for new parameters over 2020. The research project was a joint collaboration with Arup North Americas (Specifically William CK Wong and Jarred Stock). The database will be publicly available once our Eastern Canada Student Chapter for SFPE is finalized in the coming months (a joint initiative with Waterloo and ETS in Montreal). The final SFPE report is now publicly available. The student chapter's initiatives are focused on developing educational based materials in the french language for greater accessibility of fire engineering teaching resources in Canada.

Our team's paper "The Historical Narrative of the Standard Temperature-time Heating Curve for Structures" was recently published in the Springer-Nature journal *Fire Technology*. This research began 9 years ago as part of from team lead, Dr. Gales' first ever research grant he received as a PI. The grant was to archive and digitize various difficult to find papers which would be obtained from antique dealers like the one you see here. That project began by also digitizing meeting minutes, books, and papers not previously accessible to the greater community and buried in stacks of musty library halls.

The Queen's University Engineering and Science Library in Canada was relied upon heavily for obtaining these articles. For example, this library houses all early ASTM meeting minutes from the conception of the curve to present, definitively establishing elements of the narrative. These were digitized for this project in 2014. This new paper in *Fire Technology* now presents these firsthand accounts (pictured), meeting minutes, and literature to really explore origins as well as contemporary discussions to the future.

It has been a fascinating hobby to study since, and a joy to work with my co-authors and share with the greater community (finally). The full reference of this paper, including a supporting paper that covers the 18th century fire testing technologies can be found here:

- Gales, J., Chorlton, B., and Jeanneret, C. (2020) The Historical Narrative of the Standard Time and Temperature Heating Curve. Fire Technology (Springer-Nature).
- Chorlton, B., and Gales, J. (2020) Fire Performance of Heritage and Contemporary Timber Encapsulation Materials. Journal of Building Engineering (Elsevier). 201(15).

Henry Holland's 1793 research on fire experiments on timber structures

Future Research Projects

Our upcoming research work includes various institutional collaborations, including Queen's University Canada and ETS in Montreal. Sponsored by the Canadian Institute of Steel Construction we have multi-year funding for a study of steel connectors. Our team was very fortunate to have also procured funding for pedestrian modelling technology and structural fire tests with our colleagues from Arup UK Fire Engineering and the local Toronto office. Lastly, we will be undertaking a large-scale wood technology related research program. These projects have resulted in funding support for 12 new graduate student projects over the next 3 years.

Team Growth

The Canadian Standards Association Group has awarded Chloe Jeanneret with its first Graduate Scholarship to help her studies in the area of steel construction. Team members were very successful in scholarship generation and our team received its 60th large scholarship for our members in the last 5 years. Our team welcomes seven graduate level students this year (many continuing from our undergrad research program): Danielle Alberga, Sara Arce, Hannah Carton, Anne Davidson, Seth Gatien, Luming Huang, and Ethan Phillion. Anne, Danielle and Ethan will work on our structure research project portfolios while Hannah, Luming, Seth and Sara will work on our Human Behaviour in Emergency and Transportation research portfolios. Chloe Jeanneret and Tim Young begin their doctoral studies with us this year. Ben Nicoletta and Bronwyn Chorlton will have graduated from their studies. Dr. Kotsovinos and Dr. Genikomsou have also joined us as visiting professors to support our research team.

Team members will present photos and posters at the IAFSS conference.

Recent Workshops

Team members Bronwyn Chorlton and Neir (Natalie) Mazur, and collaborators at Waterloo Jennifer Ellingham, presented their research with their second organized Equity Diversity and Inclusion workshop. This one was on "Gender Differences in Graduate Engineering Student Experiences", which followed an earlier workshop they organized on industry and academic experiences. Team members have been investigating the leaky career pipeline and following their study of undergraduate experiences last year. They are now considering those experiences of graduate students (not just fire students). Team members surveyed graduate students at multiple universities in Canada between 2019 and 2020. The key findings indicate issues pertaining to funding resources for graduate students and very significant disparity in supervisory support between genders. In the coming months, more of their work will be made available.

Course Offerings and Development

In education, we are also pleased to convey that we (with help from team members Danielle Alberga and Ben Nicoletta) are working with the Canadian Wood Council to produce a national curriculum and requisite resources for undergraduate students in Canada. This course will include detailing for fire safety engineering to help facilitate this topic area into more universities in Canada. These lecture modules and resources should be available by the end of 2021 and should greatly support those undertaking designs in this subject in Canada.

An original painting of York University's timber experiments by Danielle Alberga

Team lead Dr. John Gales will be offering his 6th version of Human Behaviour in Fire at the University of Waterloo and York University in October of 2021. The course will be taught via online video series once again. The course was also offered at WPI in the US last fall. In all, total yearly enrollment has been steady with approximately 20-30 participants on average each year with the majority of students coming from industry. The curriculum used was originally developed by the late Guylène Proulx and modernized with contemporary findings and research. The course focus is on industry

applicability. Therefore, the course conveys fundamental and important psychological and sociological concepts in a format that can be accessible and applied by engineers and practitioners within their designs assuming this is their first exposure to the topic area. The course has directly led to the establishment of this discipline as a service in multiple Canadian based consultancies in the last few years. We are quite excited to continue offering this class to grow this important field in North America.

Signed: John Gales, York University

News from Victoria University (Australia)

Victoria University's Fire Safety Group (VUFSG) has been active in fire research and education since 1991. The corp of the group is formed by Prof Khalid Moinuddin, Prof Vasily Novozhilov, Associate Professor Paul Joseph and Associate Professor Maurice Guerrieri. There are currently three postdoctoral fellows and seven PhD students conducting research in this group. Wildland fire, fire suppression by water mist and fire risk analysis research are led by Prof Moinuddin, Associate Professor Guerrieri leads concrete behaviour in fire research and Associate Professor Paul Joseph is in charge of fire safety engineering courses and fire retardance research.

Wildland Fire Research
Prof Moinuddin has been the Project Leader of the Bushfire and Natural Hazard CRC (BNHCRC) project entitled "Fire spread prediction across fuel types" since 2014 which involves modifying and applying WFDS to simulate firebrand transport, grassfire propagations under various atmospheric and fuel conditions as well as over slope, fire transitioning from grassfire to a forest canopy fire and sub-canopy wind flow. In recent years, we are focussing on utilizations.

From modelling of wind flow through homogenous and heterogeneous (horzonatally and vertically) tree canopies, we found that simple mathematical model gives similar wind-profile as given by FDS/WFDS in a homogenous (under neutral atmospheric condition) tree canopy on a flat ground. We went on to implement this simple model (known as Harman and Finnigan model) to generate dynamic wind reduction factor (WRF) in an operational model Spark (developed by CSIRO Data61). Using six real-fire case studies, we have demonstrated that a dynamic WRF generally provides better fire propagation prediction than a fixed WRF. Postdoctoral research fellow Dr Mahmood Rashid is currently working in these area for further improvement.

We modelled transport of non-burning firebrands (cubical, cylindrical, and disc shaped particles, representing idealised firebrands) and their landing distribution with view to develop operational models of ember attack for quantification in Australian Building Standard in wildfire-prone areas, AS3959. We have extended the simulation work to study the transport of ember particles and landing on buildings with forest clearings. We aim to evaluate heat load and ember load on structures to map vulnerability. Postdoctoral research fellow Dr Nazmul Khan and two PhD students are working in this area.

We have a strong international collaboration with Aix-Marseille University and University of Toulon in France and Lebanese University, Lebanon. We also collaborate with Dr Ruddy Mell at US Forest Department. We are forming a collaboration with Oregon State University in relation to firebrand generation.

Fire Risk Analysis Research
In recent years, we have focussed on determining reliability of fire safety systems in buildings of various occupancy (such as shopping centres, office buildings etc). We are seeking funding to estimate reliability of fire safety measures in low-rise multi-storied residential buildings as these buildings often *fly under the radar*, but poses significant risk to human lives. In addition, our PhD student Mr Samson Tan has developed a dynamic probabilistic fire risk model incorporating technical, human and organizational risks for high-rise residential buildings. Human and organizational errors (HoEs) can significantly increase the fire risk. He has employed Bayesian Network to include HoEs and System Dynamics to account for dynamic realiability in a probabilistic fire risk model.

Fire Suppression by Water-mist Research
Dr Mohammadmahdi Ghiji (VU industry postdoctoral research fellow) in addition to his experimental work of testing a novel technique to suppress lithium-ion battery fire using the water mist system, carried out CFD analyses. He used FireFoam to simulate combustion and fire suppression process. Currently, we are seeking suitable funding from the Australian Research Council and in collaboration with our industrial stake-holders to extend the use of water mist systems to actively suppress fires involving hydrocarbon-based fuels in maritime vessels. In this context, we will be also exploring the efficacies of water foams obtained through the use of environmentally-benign and electrically neutral surfactant formulations. We collaborate with Associate Professor Futoshi Tanaka at University of Fukui in water mist research.

Fire Retardance Research
We had two PhD completions in 2020 in this area. Dr Ananya Thomas' thesis entitled "Thermal and calorimetric evaluations of some bio-inspired fire-resistant coatings for ligno-cellulosic materials". In this study the passive

fire protection efficiency of some bio-inspired substrates was investigated, which included: β-cyclodextrin, dextran, potato starch, agar agar, tamarind, chitosan, rice bran and fish gelatin. Formulations of these were prepared with both inorganic and organic compounds, the latter included some phosphorus-containing compounds with the phosphorus atom in different chemical environments and oxidation states. Both *reactive* and *additive* routes were employed to bring about the desired modification reaction. Overall, the modified systems containing phosphorus were found to be less combustible than the parent substrates, and thus can be considered as promising base matrices for environmentally-benign fire resistant coatings. The results indicated that formulations based on fish gelatin endowed with the best fire protection property as a fire-resistant coating on wood-based construction elements, followed by chitosan.

Dr. Malavika Arun's thesis entitled "Thermal and calorimetric investigations of some phosphorus-modified polymeric materials." In this study novel ways of passively fire protecting polymeric materials, both synthetic and natural, were explored. Whilst the synthetic methodology (employing phosphorus-containing compounds) employed to prepare step-growth polymers was found to be successful, and resulted in materials that exhibited superior thermal properties and combustion characteristics, all of them failed to produce uniform and coherent coatings onto mild steel and some common polymeric surfaces. Furthermore, preliminary investigations were conducted with a view to gauging the corrosion inhibiting attributes of some of the modified-acrylic systems.

We are also actively seeking laboratory-scale synthetic methodologies for making fire resistant polymeric components for use as insulation materials and as the internal core components for Aluminium Composite Panels (ACPs) for high rise buildings. Here we propose to adopt suspension polymerization route to obtain precursors for foamed polystyrene, and bulk polymerization technique to obtain compression- mouldable plaques for making the internal core layer of the ACPs. We have also performed preliminary investigations to recycle white and card-board based lingo-cellulosic materials, with sufficient fire proofing attributes, as alternative materials for imparting thermal insulation in buildings.

Signed: Khalid Moinuddin, Victoria University

News from Technical University of Denmark (DTU)

Master in Fire Safety

Since 1999, the Civil Engineering Department of the Technical University of Denmark (DTU-BYG) runs a Master education in Fire Safety (MiB) that starts every two years and offer an advanced and research-based continuing education within the area of fire safety to professionals and students with practical working experience.

The new course of study started at the end of January 2021 and counts 40 students. The number of students have increased regularly over the past years, signaling an increased need of fire education among Danish Engineers, as well as the success of the past courses of study.

More information on the Master are found at: https://www.brand.dtu.dk/english

NFSN: Nordic Fire & Safety Network

The Nordic Fire & Safety Network (NFSN) is a newly established research network, which unites the major Nordic Universities and Research Institutes dealing with fire safety and risk management:

- Research Institutes of Sweden (RISE)
- The Technical University of Denmark (DTU);
- Norwegian University of Science and Technology (NTNU);
- Lund University (LU);
- Aalto University (A?);
- Luleå University (LTU);
- University of Stavanger (UIS);
- Western Norway University of Applied Sciences (HVL);
- Iceland University (HI);
- Technical Research Centre of Finland Ltd (VTT);
- Danish Institute of Fire and Security Technology (DBI).

In 2015 a core group of the NFSN was formed with the Nordic Fire and Safety Days (NFSD), a conference which was run annually and since 2019 is run biannually. Together, we have been shaping this Nordic platform for scientists, students and professionals interested in and working with different aspects of fire and safety. The success of the NFSD has been used as a model for expanding the collaboration to a broader network and apply for research project. In particular, the previous NFSD workshops and research roadmap exercises have identified the questions of safety of bioenergy storage, new energy transport systems, energy storage and energy saving building design in green buildings as well as digitalization, which are focus research topics of the NFSN.

NFSNergy Project: Nordic Fire and Safety Network focus on Energy

In 2020 the Nordic Fire & Safety Network got funding from the Nordic Energy Research for a research project named "The Nordic Fire and Safety Network Focus on Energy" (NFSNergy).

The project aims at strengthening research collaborations for mutual projects and publications. Multidisciplinary teams are brought together working on important energy -related initiatives promoting the fire safety of new bioenergy systems, energy storage systems in green buildings, improved digitalization through Building Information Models in construction and the fire safety of new energy carriers in green transport systems. Due to the common theme of fire safety, this project is particularly suited to consider several of the research areas identified in the call based on on-going research at the partner organizations.

In particular, the project enables the networking and exchange of PhD students and researchers in the field of safety of buildings and energy infrastructures. Summer schools for PhD students are going to be arranged as part of the project. Further, the project addresses professionals within safety and fire safety, by means of webinars and teaching for professionals, to be arranged four times yearly.

Signed: Luisa Giuliani, DTU

News from the National Research Council of Canada

Total Cost of Fire Dialogue Series – Invitation to May 2021 Sessions
Following hot on the heels of the IAFSS 13th Symposium, the next public engagement sessions will be held to spur dialog around the topics of end user needs, input data and analysis methods for estimating the total cost of fire. These dialogues are part of the initial phase of a research project spearheaded by researchers at the NRC to reassess the total cost of fire in Canada, which was last updated in 1995.

The dialogues will be held virtually, spanning across different time zones on Wednesday 5 May 2021 and Thursday 6 May 2021 (click here for details). The focus of the discussions will include areas for strategic alignment with current and previous efforts by other research groups, and sharing lessons learned and other experiences during the development of cost of fire estimation tools.

The outcomes of these dialogues will help inform the basis for the scope and overall approach of the larger research project while supporting ongoing engagement of stakeholders and potential collaborators. If you would like to be involved, please contact Cecilia Lam for further information (Cecilia.Lam@nrc-cnrc.gc.ca).

Signed: Cecilia Lam, NRCC

News from the Commonwealth Scientific Industrial Research Organisation (CSIRO) Australia

Our last update in this newsletter was 2017 edition and so over the last few years the following has occurred alongside the two major building façade fires and extensive bushfires the country has experienced.

Bushfire
Australia's 2019-2020 bushfire season burned more than 10 million hectares of land and caused more than AUD$2.3 billion in insurance losses. It became known as "Black Summer"

As Australia's national science agency, CSIRO is an authority in Australia on fire management, behaviour and prediction. After Black Summer the Australian government asked us for a report on how we could improve our climate and disaster resilience and better protect homes, our environment, industries and infrastructure.

CSIRO and AFAC, Australia's National Council for Fire and Emergency Services, are also developing a nationally consistent bushfire modelling and prediction capability that's based on CSIRO's 'Spark' fire prediction platform. It combines current fire behaviour knowledge with state-of-the-art simulation science to produce predictions, statistics and visualisations of bushfire spread, as well as simulating hours of fire spread across a landscape in a matter of seconds.

Bushfire research at the bushfire burnover simulator facility at Mogo, NSW.

Further research work has been carried out on the burnover protection of fire fighting vehicles on the bushfire burnover simulator facility at Mogo, NSW.

Awards

Keith Nicholls (Team Leader - Fire Assessments) won the Fire Protection Association A V Viscogliosi Award in 2018. recognises "Excellence for Outstanding Service to Fire Protection.

The CSIRO Impact from Science medal was awarded to the Infrastructure Technologies - Fire Science Team and their industry partner: Fire and Rescue NSW for the experimental design and completion of fourteen full-scale fire tests to evaluate the performance of sprinkler designs for residential apartments. The research project provided the evidence base that supported changes to Australia's National Construction Code for the mandatory installation of fire sprinklers in low rise residential apartment buildings, significantly contributing to improved life safety for occupants and firefighters.

Education

Dr Mark Burgess completed his PhD, with a thesis in the area of societal participation in the decision-making processes that set Australia's building regulations.

Facilities

The Infrastructure Technologies North Ryde laboratories constructed the BS 8414 building cladding test rig which has been utilised testing façade systems for evaluation to BR135 and the AS 5113. The test rig located in the SAFE building allowing for protection from weather and wind and treatment of the smoke produced.

The CSIRO Land and Water Bushfire Behaviour and Risks team (Dr Andrew Sullivan and Stu Sadler) is having a new laboratory constructed at the CSIRO Black Mountain site in Canberra, Australia. Along with office, working and equipment storage space, the new laboratory will also house both the CSIRO Pyrotron and Vertical Wind Tunnel. The Pyrotron, a 2-m by 2-m cross-section fire-proof wind tunnel used for studying combustion and flame propagation mechanisms of free-burning fires in natural wildland

BS 8414 test rig located at North Ryde (Sydney) testing to AS 5113 and the advisory report.

Computer renderings of the completed Bushfire Behaviour and Risks laboratory currently under construction.

fuels. It is also being straightened and the working section extended from the current 4.8 m length to 7.2 m. The total length of the modified Pyrotron will be 29 m, improving the quality of the tunnel's air flow and allowing fires to burn longer to reach an equilibrium spread rate. The CSIRO Vertical Wind Tunnel a 12-m-tall tunnel for studying the aerodynamic characteristics of free-falling burning firebrands and embers. A new data acquisition system will enhance the recording capability of the tunnels.

The CSIRO Fire Systems Laboratory has fully transitioned its test capability to support the wide range of (AS) ISO 7240 / EN54 series of Standards related to fire detection, control and emergency warning systems. The capability also covers AS 3786 / EN 14604 standards for residential smoke alarms, and also Australian-specific standards such as AS 4428.16 (similar to EN54-16), and AS 4428.4 (Emergency Intercom Systems). As part of the capability development to support these standards, the laboratory has significantly upgraded its vibration test capability to accommodate the larger items including cabinets in use for control and indicating, and power supply, equipment.

Projects

The majority of CSIRO projects are client-in-confidence however the teams have been involved in CLT construction, building cladding rectification, passenger rail vehicles and tunnel commissioning via hot smoke tests. In the bushfire space we have developed mapping technology that identified bushfire prone areas in Queensland down to a 25 metre square area and this tool is now utilised mapping regions all over the world that have conditions susceptible to fire events. This latest global tool is a valuable resource for hazard analysts, financers, developers and even the general public, seeking bushfire information online. Our bushfire urban design researchers have developed the bushfire hazard module for the World Bank's ThinkHazard! website . It identifies areas that may be subject to natural disasters in a proposed development project area and makes recommendations on ways to reduce their impact.

Publications

CSIRO publishes in several journals with the major reports having impact summarised below.

The fire engineer team, sponsored by the Victorian Building Authority and Department of Environment, Land, water and Planning, has published several publicly available reports to support the façade construction industry. The reports on fire safety of rendered expanded polystyrene (EPS) in Exterior Insulation Finishing Systems (EIFS) are available via the VBA. The report on fire performance and test methods for ACP external wall cladding is available via DELWP.

The land and water team partnered with QLD government and published a " bushfire resilient building guidance for Queensland homes" for existing and new homes.

CSIRO continues to publish the International Journal of Wildland fire.

Signed: Alex Webb, CSIRO Infrastructure Technologies

News from LEMTA – OS Feux, University of Lorraine

Twitter: LEMTA (@Labo_Lemta) / LEMTA-OS Feux (@FeuxOs)
Web site: https://lemta.univ-lorraine.fr

Events. The research group on *Fires* in Nancy recently held the 28th meeting of the French research network on Fire Safety ("GDR Feux" / 3 – 4 December 2020). This network affiliated to the CNRS (National Center for Scientific Research in France) allows senior researchers from universities, from technical centers or companies, students and firefighters to present their latest works or encountered problems. The meeting was held as a web conference, but it allowed for constructive and friendly exchanges. Up to 90 simultaneous participants were able to discuss during technical sessions dedicated to confined fires, forest fires, materials, smoke management and evacuation. A special session was devoted to fire safety on board ships. In spite of the remote meeting conditions, this meeting was a great success and enabled contact to be re-established with all the French colleagues.

The GDR assembly last December, held by LEMTA

Research . The LASHFIRE project for improvement of fire safety aboard ro-ro ships (with funding from the European Union's Horizon 2020 research and innovation program under grant agreement no 814975) is actively ongoing. More than 100 experiments have been conducted between October and January on a model setup of a ro-ro ship deck with a scale of 1 to 12.5, considering a wide range of fire scenarios. The objective has been to evaluate the radiative and smoke shielding capability of water mist and fabric curtains. This work will be consolidated with numerical simulations carried out both at the model-scale and at the real-scale, providing insight into the usefulness of CFD for the prediction of fire containment using water and fabric curtains.

The ro-ro space model of the LASHFIRE project, with blocs featuring vehicles.

Gaspard Trohel did an internship within the LEMTA with the aim of studying the effect of wood species on auto-ignition, degradation and self-extinction in vertical conditions. This work was based on the thesis work of Lucas Terrei with in particular an experimental device composed of two calorimeter cones placed on a sliding table as well as a dedicated metrology (fine embedded thermocouples - see https://doi.org/10.1016/j.ijthermalsci.2020.106686 - infrared camera, high speed camera). The double cone makes it possible to switch from a high heat flux (causing the appearance of the flame) to a lower heat flux than the first while continuously measuring the surface temperature as well as the loss in mass. It therefore enables the self-ignition, degradation and self-extinction of wood to be studied simultaneously during the same test. The 530 tests carried out with 5 different wood species made it possible to demonstrate that the rate of loss in mass (MLRPUA) on extinction or for which the flame is maintained evolves linearly with the initial density of the samples. This result shows that from a large number of tests, simple correlations concerning auto-ignition and self-extinction can be demonstrated regardless of the experimental conditions. The results are being more deeply analysed and will be submitted in an international scientific journal.

Prof. Chengan Wang (Visiting LEMTA from the Harbin Institute of Technology of China). Prof. Chengan Wang who is a researcher at the Harbin Institute of Technology at Weihai, China, spent 6 months in our group for a

research stay. As a specialist in radiative transfer and numerical simulation, he participated in our work on radiation attenuation by using water curtains. He has developed a virtual infrared camera concept, reproducing the image of a high temperature source seen by a camera through a suspension of water droplets, based on a reverse Monte Carlo modeling approach. The work currently being validated is promising and should pave the way for a collaboration between LEMTA and the Harbin Institute of Technology at Weihai.

Arrival. Hassan Flitty joined LEMTA in October 2020 to carry out a thesis on the fire behavior of wood. Hassan has an MEng in Civil Engineering from the Lebanese University and the Claude Bernard University (France). He has worked on the characterization of the hydrothermal properties of wood fiber, cardboard and extruded polystyrene by using inverse methods (like Bayesian inference) during a research internship at CETHIL laboratory. His PhD works is a continuation of Lucas Terrei's thesis (defended in October 2020). The main goal of this thesis is to use the large amount of experimental data acquired during this previous thesis as a basis to develop a model as complete as possible, coupling heat transfer, chemical reactions and mass transfer to describe the reaction to wood fire (mass loss, char front progress, self-extinguishing conditions). The double cone calorimeter developed during Lucas Terrei's thesis, as well as the specific metrology implemented, will be used to obtain additional data if necessary. He is under the supervision of Prof. Gilles Parent and Dr Zoubir Acem.

Hassan Flitty

Signed: Prof. Gilles Parent, Prof. Pascal Boulet, Prof. Anthony Collin, and Dr. Davood Zeinali, at LEMTA laboratory, University of Lorraine and CNRS.

News from INERIS

Revisiting fire and explosion safety of 4th generation of refrigerants

Since this seems of major interest for the scientific community to whom this newsletter is addressed, we would like to remind of the following significant changes that to a greater extent is due to worldwide progressive ban of refrigerant substances having a GWP over 500. Used from nearly 2 centuries at industrial scale, innovation-driven evolution of refrigerants has successively put on the market 4 generations of such materials to meet societal demands or comply with more stringent regulations (see figure 1).

1G refrigerants	2G refrigerants	3G refrigerants	4G refrigerants
"Whatever worked"	"Better Safety and stability"	"Ozone layer Protection"	"Global Warming response"
1830's – 1930's	1930's-1990's	1990's-2010's	2010 - ??
• Limited application • many industrial	• Exponential societal improvement, innovation driven	Preserved 2G innovations, improved safety, stability, and efficiency	Fewer optimal choices Safety and design challenges
• NH3 • CO2 • various hydrocarbons (ex. R290 – propane) • H20 • SO2 • chlorinated HCs (such as methyl chloride – R40)	• NH3 • CFC's & HCFC's o R11 o R12 o R22 o R502 o …	• NH3 • HCFC's and HFC's o R123 o R134a o R410A o R404A o Lots of blends	• NH3 • Low GWP HFCs and HFO's o R1130(E) o R1233zd(E) o R1234yf & R1234ze(E) o HFC/HFO blends Revival (?) of old (natural) substances • CO2 • hydrocarbons

adapted from S. Kujak (2016)

Figure 1: historical move from early use of old refrigerants according to societal expectations

Interestingly, if environmental protection has been historically the main motivation to move to more environment-friendly chemical substances or blends, apart from the search of more stability and better functional

performance, safety issues, including flammability and toxicity have always constituted an underpinning hot topic. As a matter of fact, introducing halogen elements, such as chlorine or fluorine , in substitution of one or several hydrogen atoms in a HC structure generally reduce the ability of oxidation reaction to propagate and maintain flammable conditions (which in former times led to the development of well-known flame retardants and halons). However, the emergence of the 4th generations of fluids, setting on focus so called HFO's in particular, reintroduced some flammability issue -which was no longer a matter of concern since the 3rd generation of fluids- as a trade-off aspect to meet progressively enforced environmental performance as a result of the Montreal protocol (such as by the so-called F gas (EU) Regulation n° 717/2014 applicable since 2015). This is notably due to the introduction of a C=C double bond in the innovating structures of those HFOs (see fig.2).

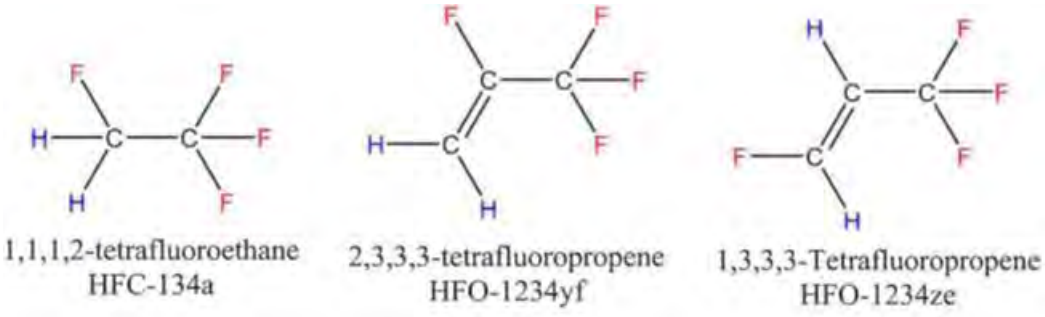


Figure 2: chemical structures of well known (non flammable) HFC-134a (3rd gen) under progressive ban, compared to modern competitors or fast growing commercial importance of HFO class (4th gen) HFO-1234yf and HFO1234ze, now recognized as mildly flammable (rated 2L by ASHRAE 34)

Some difficulty arises to appraise the actual flammability of these chemicals, for a number of reasons. One of those comes from the fact that conventional flammability hazard can be assessed by various standards or regulatory schemes that do not consider the same environmental parameters such as temperature or relative humidity. As an example, while flammability of gases shall normally be evaluated by use of legally binding regulations worldwide transposed from the GHS (Globally harmonized system for the classification of and labeling of chemicals (in the EU, the applicable regulation is the CLP) flammability of HFO's is generally examined according to ASHRAE 34 (2016-2019) in the context of their use as refrigerants. Other difficulties may arise by the facts that modern classes of refrigerants may have other important commercial uses, such as substances used as propellant of active materials in aerosols dispensers, for which aerosol flammability has to be evaluated for the whole system constituting the aerosol generator (gas propellant + active mixture + dispenser device) with again other testing systems and (nearly) whatever the flammability rating of the gas propellant component is).

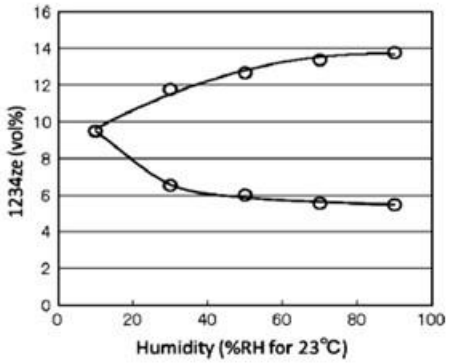


Figure 3: influence of air moisture in testing flammability limits of HFOs: the example of HFO-1234ze (reproduced from cited Kondo et al paper)

For some time, INERIS has been committed in a number of studies aiming at better evaluate flammability of a number of those substances as well as their relating behavior under abuse thermal conditions of such substances in various existing or potential applications (use as cooling media in car HVAC systems, as foam gas dispensers, as heat exchange medium in heat pumps and as propellants in spray cans, and many more. The key role of humidity and to a lower extent of reference temperature both in terms of flammability range of HFO's (as discovered by the pioneering work from Kondo et al: see *Journal of Fluorine Chemistry 144 (2012) 130–136*) as well as regarding the fate of the fluorine element and the relative toxicity of produced gases (CF4, HF, COF2?) in case of thermal degradation or combustion have been and still are within the scope of INERIS current investigations.

Signed: G. Marlair, B. Tribouilloy, G. Binotto and B. Truchot, INERIS

News from FM Global (USA)

Post-doc opportunities
We are excited to announce that FM Global is now offering post-doc positions for fire research scientists. This role provides up to 3 years of support at a highly competitive salary and the opportunity to work on a wide range of fundamental and applied topics. Applicants are welcomed from experimental, theoretical, and computational disciplines.

Applicants for positions in the fields of Fire Dynamics and Wildland Fire: https://jobs.fmglobalcareers.com/job/norwood/post-doctoral-fellowship-fire-dynamics/3467/3343962784

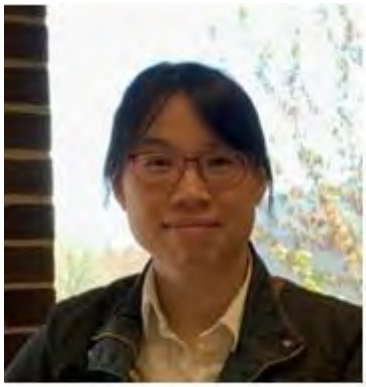
Applicants for positions in the field of Fire and Explosion Protection: https://jobs.fmglobalcareers.com/job/norwood/post-doctoral-fellowship-for-fire-and-explosion-protection-research/3467/4784221968

New Staff
We warmly welcome three new members to our research group, Dr. Bifen Wu, Dr. M. Sitki Ulcay, and Dr. Hamed Farmahini Farahani.

Bifen comes to FM Global from The University of Connecticut, where she completed her Ph.D. Thesis "*High-Fidelity Modeling of Buoyancy-Driven Diffusion Flames Towards Fire Suppression*" under the supervision of Dr Xinyu Zhao. Bifen is the first member of our post-doc program and is applying her numerical modeling expertise to diverse topics including façade fires, wildland fires, and pool fires.

Sitki joins us from Purdue University , where he completed his Ph.D. thesis titled "*Experimental Investigation and Modeling of Minimum Hot Surface Ignition Temperatures for Aviation Fluids*" under the supervision of Prof. Jay P. Gore. He is bringing his experience to the Large-Scale Fire Testing Team to find innovative and cost-effective solutions to mitigate fire exposure and hazards.

Hamed is formerly from Worcester Polytechnic Institute (WPI), where he worked as a research engineer. Hamed was awarded his Ph.D. from WPI on the topic of "*Melting of Ice and Formation of Lateral Cavity during In Situ Burning in Ice-infested Waters*" under the supervision of Prof. Ali S. Rangwala, followed by a post-doc appointment at University of Maryland. He is working in the Large-Scale Fire Testing Team with focus on the development of


Dr. Bifen Wu


Dr. M. Sitki Ulcay


Dr. Hamed Farmahini Farahani

protection options for a variety of structures exposed to large fires.

Signed: Alex Krisman, FM Global (USA)

Building Research Institute (ITB) – Poland

In the troubling times of the COVID pandemic, ITB continues the work focused on experimental fire science. Through ambitious large scale fire experiments performed (and ones in preparation), we hope to impact our discipline significantly.

In summer 2020, dr Paweł Sulik performed a large scale experiment on the fire behaviour of encapsulated wooden structure under natural fire loads. In this project, three large fire experiments were performed in small and large size compartments. The fuel used was wood cribs, representing fire loads representative for offices and residential buildings. The building had a wooden structure, and plasterboards covered the walls. This experiment's specific condition was the excellent quality of the craftsmanship and high precision of connections between elements, specific to pre-fabricated structures. This precision possibly had a large impact on the performance of the fire protection of the structure. Each of the tests lasted for over an hour, after which the fires were extinguished. The summary of the experiments is already available in Polish, and the papers are in preparation. The experiment

videos can be found at the ITB YouTube channel or by searching the polish phrase: "*Bezpieczny pozarowo szkieletowy dom drewniany*".

Dr Sulik commenting the experiment live on national television (left) and the interior of the largest tested compartment (right)

The second large experimental project was lead by dr Grzegorz Kimbar and focused on the mechanical response of flat-bottom grain silo to asymmetric fire. Three full-scale silos were burned, with varying size and infill. This project aims to create a scientific basis for new law regulations for agricultural buildings in Poland. This follows our previous experience with funnel-type silo, which was published this year in Fire Safety Journal.

View of the Pionki Material Survey samples on the ceilina of the furnace

Dr Wojciech Węgrzyński has performed three rounds of '*Pionki Material Survey*' experiment, a collaborative effort with prof. G. Rein of Imperial College London and dr F. Richter of UC Berkeley. This project aimed at testing the material response and heat transfer at different heat exposure scenarios. The exposures included: a standard fire-temperature curve (ISO834, 90 minutes), Eurocode parametric fire (so-called "short-hot") and a travelling fire scenario with a late peak. A varied representation of building materials was chosen, including concrete, gypsum plasterboards, certified fire protection solutions for steel, fire-resistant glass and wood. The experiments have generated a rich dataset on heat transfer and fire behaviour of these materials, and the data is currently being processed. We are thrilled with the data set from the solid wood samples, as due to the exquisite craftsmanship of the measurement system, we were able to capture the charring process within the blocks of wood with excellent resolution, for all three exposure scenarios.

Charring remains of wood blocks, with visible thermocouples inside (left), a sample of mortar fire protection system after the ISO834 exposure (90 minutes)

The research team at ITB had two promotions in late 2020. Dr Wojciech Węgrzyński was awarded a Habilitation from Łódź Technical University, which is a Polish State recognized tenure. He was soon promoted to the Professor of ITB. The recognized work of dr Węgrzyński was on the removal of smoke from buildings under environmental

conditions, which includes his long record of research on wind and fires and fundamentals of smoke entrainment in buoyant plumes. Dr Węgrzyński was also awarded with a large grant NCN OPUS 19 for furher research on wind and fire dynamics, in which in he will apply risk evaluation framework and multiparametric coupled wind-fire CFD analyses, to determine the conditions at which the wind starts to have an impact over smoke dynamics.

In November, our Katarzyna Kaczorek-Chrobak has defended her PhD on the flammability of cables. By introducing a novel parameter to characterize cable structure, she hopes to create a new generation of testing framework for the design of cables in buildings. The papers from this PhD are being published at this moment and should be available soon. The research of Kasia is the starting point for future developments in the field of cable fire safety, and we hope to be able to share more exciting news from this field in the next Newsletter.

Two SFPE Student grants were awarded, for students who wish to perform their research at ITB. Mrs Francesca Lugaresi of Imperial College London will perform here experiments on the mechanical response of facades to localized fires, and Mr Diego Álvarez Coedo of Universidad Pontificia Comillas will research multiscale modelling of tunnel fires. We are thrilled to host these brilliant students in our labs in the summer 2021.

We are looking forward to 2021, for which we have planned a large number of excellent fire experiments, including fire behaviour of facades, cables and the use of wood in buildings. We hope that the new normal can be achieved soon, and the disturbance to the laboratory caused by the COVID will be soon mitigated.

We are also looking forward to the virtual edition of the IAFSS conference and hope to see you all in the virtual lobby!

Signed: Wojciech Węgrzyński, Building Research Institute

News from NFPA and the Fire Protection Research Foundation

Notice of New Fire Protection Research Foundation Reports

- *Proceedings: Public Safety sUAS Compliance Training Workshop* - This Research Foundation workshop was part of a project to develop training materials to support the safe implementation and utilization of small Unmanned Aerial Systems (sUAS) for public safety operations and this workshop was an effort to address the needs for the first responder community. The Proceedings summarize proposed methodologies, identified perceived gaps, prioritized actionable needs, and generated recommended enhancements for the overall project deliverables. This also include identifying and reviewing other issues related to implementing a compliant UAS program in public safety organizations. The proceedings can be found here.
- *Variables Impacting the Probability and Severity of Dust Explosions in Dust Collectors* - The primary objective of this study was to identify the key variables leading to dust explosions in dust collectors through a literature review, and analysis of information collected from dust explosion incidents. The report can be found here.
- *Carbon Monoxide Detection and Alarm Requirements: Literature Review* - This report summarizes the current requirements for installation of Carbon Monoxide (CO) detectors in various occupancies through a literature review of applicable Codes and Standards, and State regulations. Non-fire CO incident injury and death data from available sources are also presented. The report can be found here.
- *Fire Damage and Loss Assessment of Recreational Vehicles (RVs)* - This report examines the recreational vehicle fire experience and highlights the importance of working smoke alarms in RV fire safety. The report can be found here.
- *Protection of Storage Under Sloped Ceilings Phase III: Large Scale Testing Summary and Guidance* - The new report contains new guidance for protection of storage under sloped ceilings. The report can be found here.

Recent and upcoming webinars

You can register for upcoming webinars or watch any of our archived webinars free on demand at this link: https://www.nfpa.org/training-and-events/by-type/webinars

Fire Safety Challenges of 'Green' Buildings and Attributes - Wednesday, April 14, 12:30 p.m. ET

Brian Meacham, PhD, PE, Meacham Associates, Margaret McNamee, PhD, Lund University

This webinar will present highlights from a comprehensive information review of how the landscape of fire safety challenges of 'green' attributes of buildings has developed since 2012. It is based on a global information search into: fire events involving 'green' and/or sustainable building materials, systems and features; emerging 'green' building materials, systems and features; and research, regulatory changes, engineering approaches, risk mitigation strategies, and firefighting tactics associated with fire challenges with 'green' and/or sustainable building materials, systems and features.

Addressing Fire Safety Challenges During Construction - Thursday, April 15, 1 - 2:30 p.m. ET

Nicholas Dawe, Cobb County Fire and Emergency Services, Division Chief/Fire Marshal; Dick Davis, PE, FM Global, AVP, Sr Engineeering Technical Specialist; Jim Begley, PE, FSFPE, CFM, TERPconsulting, Principal; Matthew Bourque, PE, WS Development, Director of Fire Protection and Construction Operations

Join NFPA as we discuss with a panel of industry experts some of the key considerations for construction site fire safety. Topics will include the fire risks present during construction, the importance of proper training, and the role of the Fire Prevention Program Manager. There will also be plenty of opportunity for Q&A with our panel members. This is a webinar that you do not want to miss!

Recently archived webinars include:

- Combustible Gas Dispersion and Detector location Analysis in Residential Occupancies
- Obstructions and Early Suppression Fast-Response Sprinklers
- Holistic Protection Method of Top-Loading Automatic Storage and Retrieval Systems
- Engaging Local Officials to Bring Sustainability to Local Wildfire Risk Reduction
- Using Data to Inform Crowd Management
- Considerations for Warehouse Fire Safety

Reports from the Applied Research Group
Several reports on aspects of the U.S. fire problem have been completed recently and posted on our website. The topics include home structure fires, home heating fires, smoke alarms in home fires and Christmas tree fires. They can all be found at https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem.

News from OFR Consultants

Even with all of the upheaval of 2020 OFR has managed to maintain its research output and the links with a wide range of academic institutions.

OFR are part of the initiative being led by Matt Linegar from Stora Enso through the Structural Timber Association (STA) supporting best practice for fire safety when constructing with mass timber, inclusive of CLT. This year the STA published its compliance roadmap and also released a literature review of large-scale fire experiments on cross-laminated timber. Both of these were as the result of work undertaken by OFR, and copies are available from the STA website. For those interested, OFR has its own 'Lab' on ResearchGate that collates much of the research output.

We also have several large research projects that were started in 2020 in which we are collaborating with leading research partners across various areas of work. The outcomes of the projects will likely impact statutory guidance in England and further afield, and this will keep many of us busy for the coming year and beyond.

OFR staff continue to contribute to various fire engineering degree programmes include those at the University of Edinburgh, Sheffield University, Stellenbosch University, and the IMFSE programme. This includes lecturing and seminars, course assessment, co-supervision of student research projects. OFR have recently donated funds to Ghent University to support research on structural reliability and fire safety which will include assisting a PhD student's work under the supervision of Dr Ruben van Coile. In addition, through Danny Hopkin, we have joined up with academic staff at Sheffield University to sponsor part of a new PhD research project on sustainable steel-timber hybrid structures in fire.

Finally, Mike Spearpoint has been helping the Institution of Fire Engineers (IFE) to develop ways in which they could revise the technical assessment of Chartered Engineer applications and how that could dovetail with the accreditation of existing and new fire engineering degree programmes.

Signed: Michael Spearpoint, OFR Consultants

UPCOMING CONFERENCES

International Conference on Electrical Fires (ICEF) – 15-16 April 2021, Porto Alegre (Brazil)

ICEF 2021 is an international conference for exchanging knowledge and new developments on electrical fires research and prevention. A significant number of fires has origin on faults and malfunctions in electrical installations. This can be mitigated by appropriate fire detection systems, use of improved fire behaviour materials, efficient building evacuation techniques, among others. In spite of this, a few has been done on reducing the fire risk of electrical installations. This Conference provides a unique opportunity to discuss how to prevent electrical fires ignitions and potential fire hazard on equipment and installations.

Conference topics include:

- Electrical fire hazard and risk assessment
- Electrical fires investigation
- Firefighting on energized installations
- Nuclear power plants
- Certification of electrical installations

- Electrical installations, equipment and materials
- Education on electrical fires

For any query, please do not hesitate to contact the Organizing Committee at the following e-mail address: ICEF.organizing@gmail.com (or organisational questions) or ICEF.scientific@gmail.com (for papers and scientific related questions). Register at https://www.sympla.com.br/international-conference-on-electrical-fires_835123.

NFSD 2021: Nordic Fire & Safety Days, 15th &16th June 2021, Virtual

The "Nordic Fire & Safety Days" is a biannual event supported and led by RISE Research Institutes of Sweden with the collaboration of "The Nordic Fire and Safety Network", which comprises several Nordic Universities and Research Institutes involved in risk and fire safety. The conference has become a meeting point for professionals from industry, municipalities (including the fire service and other local government professionals), research institutes and universities.

The next edition of the conference will be held on 15th and 16th June 2021 and, due to corona, it will be a digital event. NFSD 2021 will 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, but are not limited to:

- 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

More information can be found on the conference web site: www.ri.se/en/nfsd

2nd International Symposium on Lithium Battery Fire Safety – 25-28 August 2021, Heifi (China)

The 2nd International Symposium on Lithium Battery Fire Safety (2nd ISLBFS) will be hosted by the University of Science and Technology of China, from 25 to 28 August 2021, Hefei, China. It is aimed to provide an opportunity for scholars and others who are interested in fire safety science of lithium-based battery to discuss and share knowledge.

You can visit the webpage (http://liion2.csp.escience.cn/dct/page/1) to get more information about the symposium. Some selected papers presented will be invited by the Guest Editors to submit to the special issue of Fire Technology for peer review, or potential to Loss Prevention in the Process Industries. The topic areas include, but not limited to:

- Heat generation of lithium-based battery
- Thermal management for lithium-based battery
- Gas generation of lithium-based battery
- Thermal runaway and propagation of lithium-based batteries
- Fire and explosive dynamics of lithium-based battery
- Fire detection and suppression of lithium-based battery
- Safer materials for lithium-based battery
- Fire assessment in production, transportation, storage and usage

If you are not available to prepare a paper, posters and oral presentation are also selected, we sincerely welcome you to attend the symposium to discuss ideas and share knowledge.

The 1st International Symposium on Lithium Battery Fire Safety (July 18-20, 2019, Hefei, China) was a great success with the help of colleagues. On the following link, you'll find the news report: http://en.sklfs.ustc.edu.cn/2020/0109/c5778a411476/page.htm.

AUBE '21 / SUPDET® 2021 – 21-23 September 2021, Duisberg (Germany)

AUBE '21/SUPDET 2021, a joint conference of the 17th International Conference on Automatic Fire Detection (AUBE '21) and the Suppression, Detection and Signaling Research and Applications Symposium (SUPDET 2021) will be jointly hosted by the Department of Communication Systems NTS at the University of Duisburg-Essen, Germany and the Fire Protection Research Foundation. The combination of these two international conferences

continues the tradition of presenting the latest developments in research, technology and applications for the fire protection community. The joint conference will be held September 21-23, 2021 in Duisberg, Germany.

Registration information is available on the conference website: http://nts.uni-duisburg-essen.de/aube/aube21/aube21.html.

20th International Water Mist Conference (IWMC) – 27-28 October 2021, Warsaw (Poland)

IWMC 2021 will take place in Warsaw, Poland, on 27th and 28th October 2021. The conference hotel will be the Regent Warsaw. IWMA will offer reduced prices up to 30th July 2021. Day One of the conference will be Applications Day and can be booked separately. Day Two will primarily focus on the scientific side of the technology.

Deadline for submissions for the IWMA Young Talent Award is 30th April 2021. In 2021 this award will go to the author of the best master thesis dealing with water mist.

See details on the website at www.iwma.net.

12th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) – 7-9 December 2021 - Virtual

The 12th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) will be hosted by the Fire Safety Engineering Research Group at The University of Queensland. The conference is organised in collaboration with Charles Darwin University, Griffith University, Monash University, Victoria University, The University of Melbourne, Queensland University of Technology, RMIT University, University of New South Wales, University of Canterbury, and Massey University. AOSFST 2021 will take place between the 7 and 9 December 2021.

For details and registration, see https://aosfst2021.com/.

Symposium on Obtaining Data for Fire Growth Models – 9-10 December – Atlanta (USA)

A Symposium on Obtaining Data for Fire Growth Models will be held December 9-10, 2021. Sponsored by ASTM Committee E05 on Fire Standards, the symposium will be held in Atlanta, GA, in conjunction with the December standards development meetings of the committee.

Note: Considering the uncertainties with travel restrictions due to the COVID-19 pandemic, it is not clear at this time whether it would be possible to hold the symposium as an in-person event, a virtual one, or a combination of both. The Symposium Chairs and ASTM will continue to monitor the situation and provide you with updates on this matter as soon as they become available.

For details, see:
https://www.astm.org/SYMPOSIA/filtrexx40.cgi?+-P+EVENT_ID+4208+callforpapers.frm#anchor1

SEMC 2022: 8th Int. Conf. on Structural Engineering, Mechanics, and Computation – 5-7 September 2022, Cape Town (South Africa)

SEMC is a renewed structural conference indexed in Scopus and Web of Science, dealing with broad engineering problems, also of interest for the fire engineering community, such as: Structural Analysis and Design, Design for Fire Resistance, Design for Blast and Impact, Structural Failures, Structural Optimisation, Structural Foundations and Tunnels, Structural Safety and Reliability, Structural Risk Analysis, Life-Cycle Performance of Structures.

The next edition of the conference SEMC 2022, which will be held in Cape Town, South Africa, from 5 to 7 September 2022, also envisages ***a special session on the Behaviour of Structures in Fire (SS05)***, organized by Prof. Mario Fontana (Swiss Federal Institute of Technology, Switzerland) and by Prof. Markus Knobloch (Ruhr-Universität Bochum, Germany).

This special session aims at reviewing progress in the area of structural fire safety and providing a forum for the dissemination of knowledge and exchange of ideas to make use of innovations and advances gained in the field of structural fire safety. Amongst others, the session will address the following topics: Constitutive modelling of building materials in fire; Behaviour of single members in fire; Global behaviour of structures in fire; Fire tests; Numerical simulations.

More information on the conference can be found at: http://www.semc.uct.ac.za/

CALLS FOR PAPERS/ABSTRACTS

12th Asia-Oceania Symposium on Fire Science and Technology (AOSFST)

The call for abstracts can be found **here**. Extended abstract (up to two pages) describing recent innovative work in the field of fire safety engineering or science, aligned with the conference themes listed below. The new abstracts submission deadline is Friday 16 April 2021. Notification of Abstract Acceptance will be made on Friday 28 May 2021.

The focus of the Asia-Oceania Symposium on Fire Science and Technology is on research and developments in fire safety science and engineering. The themes below cover what the organising committee considers relevant to the conference attendees; any other topics related to the art, science and practice of fire safety engineering are welcome.

- Material fire behaviour or fire chemistry
- Fire dynamics
- Fire detection or suppression
- Structures in fire
  - Evacuation and human behaviour
  - Fire risk assessment and probabilistic analysis
  - Tunnel fires
  - Wildland and Wildland-Urban-Interface fires
- Explosion hazards
- Applications in fire safety engineering practice
- Any other fire science or engineering topic

The link to the EasyChair abstract submission is available **here**.

20th International Water Mist Conference (IWMC)

The conference will inform those responsible for selecting fire protection as well as researchers / scientists who wish to be updated on the current state of the water mist technology for fire protection. The target audience includes safety engineers, consultants, manufacturers, fire brigades, researchers, government bodies, insurance companies, authorities having jurisdiction, and end customers.

Those wishing to give a presentation, may submit an abstract no later than 31st May 2021. Abstracts may under certain circumstances and by request be accepted at a later date. Please send all abstracts to mcdowell@iwma.net. According to the template, abstracts should not exceed 2 pages and should include the title of the paper, the name(s) of the author(s), the person(s) presenting (including bios) and the affiliation, including the address, telephone, fax number and e-mail address. Please ask IWMA HQ for the template!

Topics include:

- **System Applications:** solutions for mass transport systems, traffic tunnels, office buildings, hotels, archives and galleries, storage and sales areas, health care facilities, industrial processes and other new applications where water mist has been found to be a cost effective replacement for halon and sprinkler systems.

- **Regulations, Standards and Codes:** assessment of currently available regulations, planned standards and changes to standards, including gaps in regulations and further needs

- **Research & Testing:** small and large scale testing, suppression technologies, spray characteristics, advantages / disadvantages of water mist systems, comparison to other firefighting methods, CFP Modelling and research needs in the future

- **Environmental and Health/Safety Issues:** environmental effects of water mist and other agents (chemical gases etc.) as well as discussions on health issues.

- **Detection, Innovation Technologies**

The notification of acceptance will be mailed by **30th June 2021.** Final versions of presentations are **due on 13th October 2021!**

Special Edition of *Applied Science* on Combustion and Fluid Mechanics, Advance in Fire Safety Science

A planned Special Issue aims to address the recent efforts and advances in fire safety science. The topics of interest for this Special Issue include but are not limited to the following topics, both bringing together experimental investigations and numerical model development:

- Thermal decomposition of solid fuel, thermophysical properties, and model of pyrolysis
- Flaming ignition process
- Fluid mechanics in fire, diffusion and aerolic phenomenon
- Gaseous combustion, finite and non-finite chemistry
- Solid / gas interactions and couplings
- Flame propagation and characteristics

- Wall / Flame interaction and description, convective models
  - Gaseous emissions and their impact
  - Influence of the ventilation on the fire characteristics
  - Radiative thermal exchange and radiation models
- Extinction process and its description
- Specific case of charring material thermal decomposition and combustion
- Smoldering combustion and its characteristics
- Advance in facade fire
- Advance in timber combustion

See https://www.mdpi.com/journal/applsci/special_issues/Combustion_Fluid_Mechanics_Fire_Safety_Science
The deadline for full manuscript submission is 10 September 2021.

UPCOMING EVENTS –2021-2022

2021

Apr 15-16	International Conference on Electrical Fires (ICEF) – Porto Alegre (Brazil) - https://www.sympla.com.br/international-conference-on-electrical-fires__835123
June 15-16	Nordic Fire & Safety Days (NFSD 2021) – virtual - www.ri.se/en/nfsd
Aug 25-28	2nd International Symposium on Lithium Battery Fire Safety (2nd ISLBFS) - University of Science and Technology of China, Hefei (China) - http://liion2.csp.escience.cn/dct/page/1
Sep 21-23	Suppression, Detection and Signaling Research and Applications Symposium (SUPDET 2021) and 17th International Conference on Automatic Fire Detection (AUBE '21) - Duisburg (Germany) - https://www.nfpa.org/supdet
Oct 27-28	20th International Water Mist Conference (IWMC) – Warsaw (Poland) - www.iwma.net
Dec 7-9	12th Asia-Oceania Symposium on Fire Science and Technology (AOSFST) – virtual - https://aosfst2021.com/
Dec 9-10	Symposium on Obtaining Data for Fire Growth Models – Atlanta (USA) - https://www.astm.org/SYMPOSIA/filtrexx40.cgi?+-P+EVENT_ID+4208+callforpapers.frm#anchor1

2022

Sep 5-7	8th International Conference on Structural Engineering, Mechanics and Computation – Cape Town (South Africa) - http://www.semc.uct.ac.za/

JOB POSTINGS ON THE IAFSS WEBSITE

You can find the current job postings at the bottom of the front page of the IAFSS website – www.iafss.org.

Symposium on Obtaining Data for Fire Growth Models

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. 47), the deadline for submissions is September, 2021.

http://www.iafss.org

2017-2021
OFFICERS AND COMMITTEE MEMBERS OF THE IAFSS

EXECUTIVE COMMITTEE
Chair:
Prof Patrick Van Hees, Sweden
patrick.van_hees@brand.lth.se

Vice-Chairs:
Prof Edwin Galea, UK
Prof Longhua Hu, China
Prof Arnaud Trouvé, USA

Secretary:
Prof Brian Meacham, USA
brian@meachamassociates.com

Treasurer:
Dr Margaret Simonson McNamee, Sweden

Immediate Past Chairman:
Prof Bogdan Dlugogorski, Australia

Executive Members:
Prof Beth Weckman, Canada
Prof Bart Merci, Belgium

IAFSS COMMITTEE:
Prof Luke Bisby, UK
Prof W-K Chow, Hong Kong, China
Prof Alexis Copalle, France
Prof Ritsu Dobashi, Japan
Prof Bogdan Dlugogorski, Australia
Dr Rita Fahy, USA
Dr Charles Fleischmann, New Zealand
Dr Jason Floyd, USA
Prof Michael Gollner, USA
Dr Tuula Hakkarainen, Finland
Dr Anthony Hamins, USA
Peter Johnson, Australia
Dr Bjorn Karlsson, Iceland
Prof Yoshifumi Ohmiya, Japan
Prof Guillermo Rein, UK
Dr Yi Wang, USA