

# **FIRE SAFETY SCIENCE – PROCEEDINGS OF THE ELEVENTH INTERNATIONAL SYMPOSIUM**



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**INTERNATIONAL ASSOCIATION  
FOR FIRE SAFETY SCIENCE**

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The front image was taken by Charley Fleishmann and shows the participants of the 11<sup>th</sup> conference.

## Preface

The Eleventh International Symposium on Fire Safety Science was held at the University of Canterbury, Christchurch New Zealand from 9-14 February 2014. The symposium was organized by the International Association for Fire Safety Science (IAFSS) with the local organization by the University of Canterbury. Shortly before the conference Prof. Philip Thomas, the first chair of IAFSS, passed away and it was decided to contribute the symposium to his memory.

Around 240 delegates attended the three parallel sessions in which 112 fully peer review papers, including five invited papers, were presented. The presented papers were for the first time not printed but are available at the IAFSS bibliographic database site at <http://www.iafss.org/publications>. Also, two poster sessions were held at the symposium where around 82 posters and 48 images were presented. Additionally, five workshops were given at the start of the symposium on Wildfires and Climate Changes, Multi-Objective Fire Safety System Design, Education, Benchmarking/Data Sharing, Evacuation Modeling: Issues and Challenges. In total twenty-six countries were represented. A detailed report of the programme committee, organizing committee and awards committee is given in the preface of these proceedings.

The IAFSS would like to thank sponsors of the symposium and would like to extend its gratitude to all the organizations, committee members, and other volunteers that assisted in making this symposium so successful. A special thanks is given to Prof. Charley Fleishmann and the staff at the University of Canterbury, as well as the members of the local Symposium Arrangements Committee. They provided first class hospitality as well as an excellent forum for the exchange of ideas on fire safety science despite the difficult condition before the conference due to the earthquakes.

The work of Mr. Terry Fay and Prof. Michael Gollner, who set up the IAFSS bibliographic database site and assembled the web-based preprint versions of the papers presented at the symposium, is greatly appreciated. Finally, the editors of the Eleventh IAFSS Symposium Volume wishes to thank Dr. Michael Spearpoint, editor of the Tenth IAFSS Symposium Volume, for his valuable advice and suggestions in preparing this work.

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Editors, Eleventh IAFSS Symposium Volume  
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Sweden

# International Association for Fire Safety Science (2011-2014)

At the time of the Symposium, the IAFSS reached 700 members, including student members. We have become a large and diverse Association. The triennial Symposia of IAFSS and the resulting volumes of *Fire Safety Science* continue to be the centrepiece of the IAFSS activities. The page count in this volume exceeded by more than 50% the historic levels, making printed proceedings less convenient. Hence, for the first time, we will be publishing the *Fire Safety Science* only in an electronic format.

The 11<sup>th</sup> Symposium of the IAFSS was held at the University of Canterbury, New Zealand. The success of the Symposium represents the result of significant effort of many individuals and organisations. Special thanks are due to Professor W.K. Chow, Chair of the Symposium; Professor Charley Fleischmann, Chair of the Local Arrangements Committee; Dr Yaping He and Professor Arnaud Trouvé, Chair and Co-chair of the Program Committee; Professor Daniel Nilsson, Dr Robert Jansson and Professor Patrick van Hees, Volume Editors; Professor Bart Merci, Coordinator for the Workshops; Dr Piotr Tofilo, Coordinator of the Poster Session; Mr Terry Fay and Professor Michael Gollner, Co-ordinators of the Website and Symposium Papers/Posters; and Ms Carole Franks of the IAFSS Secretariat. Thanks are due to all Symposium sponsors.

I am grateful to Mr Terry Fay and Dr Amanda Robbins who, during 2011-2014, established the IAFSS Federated Search Facility. The Facility is accessible via <http://www.fire-information.net/wiki/tiki-index.php>. Dr Guillermo Rein has put tremendous effort into our Newsletter, taking it to new heights. I would like to take this opportunity to thank Guillermo sincerely. In the second part of 2014, Dr Rita Fahy will take over as the Editor of the Newsletter. The Association also operates the website and the LinkedIn Group thanks to Professor Michael Gollner and Dr Guillermo Rein.

Unfortunately, during 2011-2014, several of our colleagues, who had laid the foundation of our Association and who actively participated in the early life of the IAFSS, have passed away. Amongst them are Dr Ray Friedman, Professor Toshisuke Hirano, Professor Sven Erik Magnusson and Professor Philip Thomas. They had moulded IAFSS into what we are today.

The Committee elected during the 10<sup>th</sup> International Symposium on Fire Safety Science in Maryland, served from 2011 to 2014. Its membership was as follows:

## **IAFSS COMMITTEE**

### **Chairman**

Professor Bogdan Dlugogorski, Australia

### **Vice-Chairmen**

Americas: Dr Anthony Hamins, USA

Europe and Africa: Professor José Torero, UK (until 2012)

Professor Patrick van Hees, Sweden (from 2012)

Asia/Oceania: Professor Ai Sekizawa, Japan

### **Secretary**

Dr Margaret Simonson McNamee, Sweden

### **Treasurer**

Dr Christopher Wieczorek, USA

### **Immediate Past Chairman**

Dr Craig Beyler

### **Executive Members**

Professor Arnaud Trouvé, USA

Professor Charley Fleischmann, New Zealand

## **Other Members**

Dr Vytenis Babrauskas, USA  
Mr Dieter Brein, Germany  
Professor W.K. Chow, Hong Kong, China  
Professor Nicholas Dembsey, USA  
Dr Rita Fahy, USA  
Ms Carole Franks, UK (co-opted)  
Professor Ed Galea, UK  
Professor George Hadjisophocleous, Canada  
Dr Tuula Hakkarainen, Finland  
Professor Yuji Hasemi, Japan  
Professor Patrick van Hees, Sweden (until 2012, then Vice-Chairman, Europe and Africa)  
Dr Yaping He, Australia  
Dr Björn Karlsson, Iceland  
Professor Bart Merci, Belgium  
Dr Guilermo Rein (co-opted)  
Professor Jinhua Sun, China  
Professor Takeyoshi Tanaka, Japan  
Professor José Torero, UK (until 2012) then Australia

The IAFSS would like to express their appreciation to Committee Members who left the Committee at the time of the 10<sup>th</sup> Symposium, after years of service to the Association

Professor Pierre Joulain, France  
Professor Dougal Drysdale, Scotland, UK  
Dr Suresh Kumar, UK

During the 2011-2014 term, the Committee met at the Symposia in 2011 and 2014, as well as it held meetings in 2012 in Poland (International Symposium on Combustion), China (Asia-Oceania Symposium on Fire Science and Technology) and in 2013 in the UK (Interflam). The three interim meetings assured maximum participation of Committee members, from around the world, in the affairs of the Association.

With its 2012 Symposium in Hefei China, the Asia-Oceania Association for Fire Science and Technology (AOAFST) continues to be a vibrant regional association operating under the auspices of the IAFSS. The local Arrangement Chairs were Professors Weicheng Fan, Naian Liu and Heping Zhang, all from the University of Science and Technology of China. Professor Takeyoshi Tanaka, Kyoto University, chaired the Technical Committee and Professor Naian Liu the Programme Committee. The current Chair of the Asia-Oceania Association for Fire Science and Technology is Professor W.K. Chow of the Hong Kong Polytechnic University.

Carole Franks has continued to operate the Secretariat, providing invaluable service to the IAFSS.

The next Symposium will be held in 2017 at the University of Lund, Sweden. The University of Waterloo, Canada will host the subsequent Symposium. The IAFSS Committee will soon deliberate on whether to move to a two-year cycle of holding the Symposia.

As of this writing, I have completed my service as the Chairman. It has been an eventful three years and there is much more to do to continue to enhance the service that IAFSS provides to the fire science community and the membership. The on-going goal is to make membership in IAFSS more valuable and to enhance the contributions of the IAFSS to the fire science community and to fire safety around the world. I wish well Professor Patrick van Hees who has taken over from me as the Chairman of our Association.

Professor Bogdan Dlugogorski, Immediate Past Chairman  
Murdoch University, Perth, Australia

## Report from the Local Organising Committee

We would like to open this report by thanking all of the delegates who travelled so far to visit our corner of the world. All of us on the organizing committee can empathize with those of you who came to Canterbury to participate in the 11th Symposium. With our recent natural events, we were heartened by the number of you that came to experience all that New Zealand has to offer. We had a total of 240 delegates from 26 different countries, which exceeded our expectations.

The technical program was expertly arranged by the program committee chaired by Yaping He and Arnaud Trouvé which simplified the local arrangements. It is acknowledged that the delegates attend the Symposium for the technical program but it is often during the social events where the real work gets done. From the welcome reception on campus Sunday evening to our final banquet in the Transitional Cathedral made from cardboard, all of the events were well attended and enjoyed by all. The Maori welcome at the opening ceremony on Monday and at the banquet gave the delegates a snapshot of New Zealand culture.

The optional events were well attended and received very positive comments from many delegates. Participants enjoyed the educational experience and the cold of Antarctic Centre. Not surprising, it was the wine tasting in the staff club at the Ilam Homestead which received the most positive feedback from the delegates. Apart from a few misguided buses, all the arrangements seemed to go as planned. The success of the event was the result of the efforts of many people at the university. Most notably Assoc Prof Michael Spearpoint, Dr Tony Abu and all of the fire engineering students who worked so hard doing anything and everything they were asked.

Prof. Charley Fleishmann

# Report from the Program Committee

It is with great pleasure that we attended the 11<sup>th</sup> International Symposium on Fire Safety Science in Christchurch, New Zealand, earlier this year. This was also the time to see the work of the Program Committee being brought to what we think was a successful conclusion. We would like to present below a brief report on the structure of the Program for the 11<sup>th</sup> IAFSS Symposium, the paper selection process as well as some statistical information on papers submitted and accepted.

## Symposium Topics

A few changes were introduced in the list of featured topical areas that was included in the Call for Papers. Some traditional topics in previous symposia were combined and merged; and the following new topics were introduced: Forest (Wildland) Fires; Explosions and Industrial Fires; and Fire Safety and Sustainable Design. The full list of topics included in the Call for Papers is presented in Table 1 below.

Table 1. Track number and topic areas for the 11<sup>th</sup> IAFSS Symposium.

Track Number	Topic
1	Ignition, Flame Spread
2	Compartment Fire Dynamics
3	Fire Chemistry and Toxic Hazards
4	Flame Retardants and Advanced Materials
5	Structural Fire Performance
6	Smoke Control and Detection
7	Suppression
8	Forest (Wildland) Fires
9	Explosions and Industrial Fires
10	Fire Risk Analysis and Statistics
11	Evacuation and Human Behavior
12	Fire Safety and Sustainable Design
13	Special Applications (Codes and Standards; Fire Safety Management; Fire Safety and Security; Fire Forensics)

## Composition of the Program Committee

The Program Committee of the 11<sup>th</sup> IAFSS Symposium consisted of 45 members including a Chair (Yaping He) and a Co-Chair (Arnaud Trouvé), two Workshop Chairs (Bart Merci, Jorge Capote), a Poster Chair (Piotr Tofilo), an English Language Mentoring Chair (Ron Alpert), and 39 Track/Topic Chair and Co-Chairs (for a complete list, visit <http://www.iafss.org/symposium/11th-symposium/>).

## Selection of Invited Plenary Speakers

The selection of invited plenary speakers started with initial nominations by members of the Program Committee subject to a set of criteria. In total, 14 nominations were received. The nominations underwent a ballot by members of the Program Committee. The nominees were then ranked according to the outcome of the ballot. The first six nominees were finally recommended to the IAFSS Executive Committee and Symposium Chair for a decision. Consideration was also given to the relevance and diversity of topics in the selection process.

## Paper Review Process

The paper review process at the 11<sup>th</sup> IAFSS Symposium was managed using a free web-based platform called *EasyChair*. Thirteen tracks were established in the platform corresponding to the 13 topical areas listed in Table 1. In addition, a special track was created for submissions of conflicted papers authored/co-authored by members of the Program Committee. (Conflicted papers are defined as papers submitted by members of the Program Committee to the Track where they have oversight responsibilities.) The special track was administrated by the Program Committee Chair and Co-Chair.

The Program Committee was assisted by a pool of 263 reviewers. All submitted papers were reviewed by at least two reviewers; most submitted papers were reviewed by three reviewers; a small number of papers

were reviewed by four or even five reviewers. The paper review process was a two-stage process. After the initial stage of review by reviewers, the authors were notified of a conditional acceptance or rejection. The conditionally accepted papers were then revised by the authors in response to the reviewers' comments and re-submitted for further evaluation. The second review stage was handled by the members of the Program Committee and ended with notifications of a final decision by the Program Committee Chair and Co-Chair.

### Submission Statistics

The 11<sup>th</sup> IAFSS Symposium generated great interest from the fire safety science community and received 205 regular paper submissions. (This number is comparable to the number of submissions at the 10<sup>th</sup> IAFSS Symposium.)

Table 2 below gives an overview of the submission statistics.

Table 2. Submission statistics for the 11<sup>th</sup> IAFSS Symposium.

Submission Category	Number
Invited Plenary Paper	5
Regular Paper	205
Poster	82
Image	48
Invited Plenary (without a paper)	1
Invited Session Presentation (without a paper)	1
<i>Total</i>	342

The invited plenary papers and regular papers were subjected to a peer review process, as described above. After the initial review stage, 110 regular papers were conditionally accepted and after the second review stage, 107 regular papers (plus five plenary papers) were accepted for both presentation at the Symposium and publication in the Proceedings. Figure 1 presents the geographical distribution of submitted and accepted papers based on the origin of the first author affiliation over three major regions, namely America (AM), Asia-Oceania (AO) and Europe (EU, including Africa).

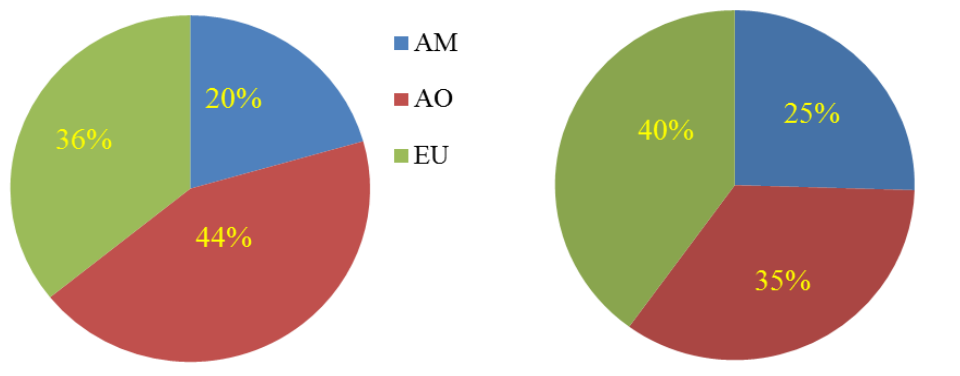


Figure 1. Geographical distribution of (a) submitted papers and (b) accepted papers.

Geographical statistics on acceptance rates are presented in Figure 2. The total number of accepted regular papers was 107; the acceptance rate was 52%. (These numbers are comparable to those obtained at the 10<sup>th</sup> IAFSS Symposium, for which 111 regular papers were accepted and the acceptance rate was 53%.)



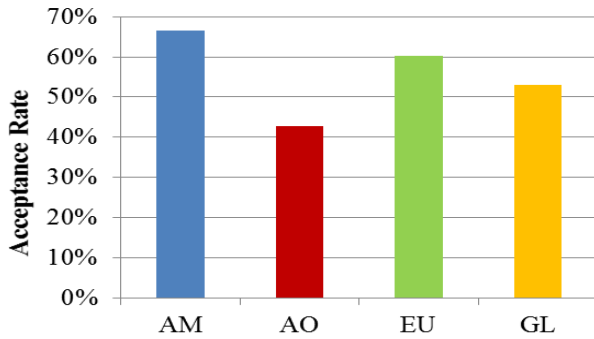


Figure 2. Geographical distribution of paper acceptance rate (GL = Global.)

Figure 3 presents the track/topic distribution of submitted and accepted papers. The topics with the larger number of accepted papers were: Compartment Fire Dynamics; Structural Fire Performance; Ignition and Flame Spread; Flame Retardants and Advanced Materials; Forest (Wildland) Fires; Suppression; Evacuation and Human Behavior; and Fire Risk Analysis and Statistics. In the final program of the Symposium, some papers were re-grouped for a special series of two sessions on Post-Earthquake Fires.

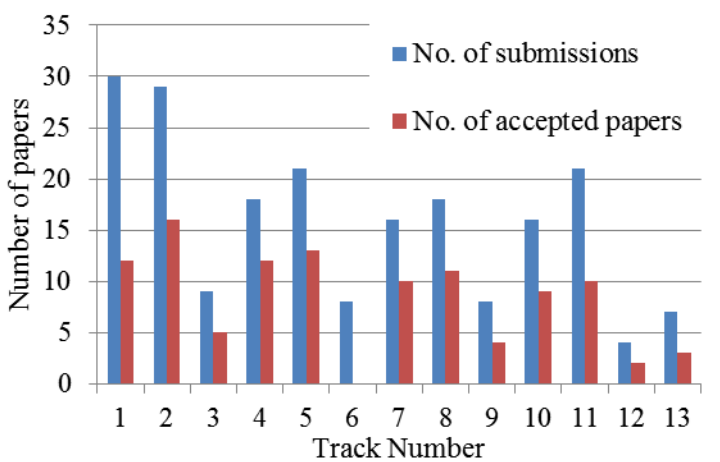


Figure 3. Track distribution of submitted and accepted papers.

Legend for Figure 3:

Track names:

1. Ignition, Flame Spread
2. Compartment Fire Dynamics
3. Fire Chemistry and Toxic Hazards
4. Flame Retardants and Advanced Materials
5. Structural Fire Performance
6. Smoke Control and Detection
7. Suppression
8. Forest (wildland) fires
9. Explosions and Industrial Fires
10. Fire Risk Analysis and Statistics
11. Evacuation and Human Behaviour
12. Fire Safety and Sustainable Design
13. Special Applications

## **Summary**

The quality of the program of the International Symposium on Fire Safety Science depends on many factors, including the quality of the Program Committee, the relevance and diversity in featured topical areas, the number of paper submissions, the quality and rigor of the peer review process, and the quality of the accepted papers (both oral presentations and final manuscripts).

Some observation can be made from the geographical distribution of submitted and accepted papers. It is apparent that research activities in fire safety science are growing in the Asia-Oceania region, as shown by a large number of submitted papers. On the other hand, the paper quality remains high in the America region, as shown by a high acceptance rate. The EU-Africa region struck a balance and contributed the largest number of accepted papers.

Forest (Wildland) Fires is a new emerging topic for IAFSS that enjoyed significant interest and participation at the 11<sup>th</sup> Symposium. The interest in wildland fires was comparable or even larger to that in more traditionally dominant IAFSS topics. This trend may be explained by growing worldwide concerns on the effects of climate change.

## **Acknowledgements**

We would like to acknowledge the contributions of all authors of papers submitted to the 11<sup>th</sup> IAFSS Symposium, whether accepted or rejected. We thank you for your interest and contributions and hope to see your work featured at the 12<sup>th</sup> IAFSS Symposium in 2017. We also would like to acknowledge the efforts of the Program Committee members and of the reviewers. The program of the Symposium is a community-wide effort and its successes (and occasional failures) are the result of our collective efforts. Finally, we would like to acknowledge the efforts of the IAFSS Executive Committee (chaired by Bogdan Dlugogorski), the Symposium Host Committee (chaired by Charley Fleischmann), the Symposium Awards Committee, the Symposium Proceedings Editors, the 10<sup>th</sup> Symposium Chair (Anthony Hamins) and the secretariat at Interscience Communications (Carole Franks).

Yaping He and Arnaud Trouvé

## Award Recipients

### Howard W. Emmons Invited Plenary Lectureship Award for Distinguished Achievement in Fire Safety Science

1984	J. de Ris (NBS-CFR Award)
1985	E.E. Zukoski
1986	J.G. Quintiere (NBS-CFR Award)
1988	K. Kawagoe
1991	P.H. Thomas
1994	O. Pettersson
1997	T. Jin
1999	Y. Hasemi
2002	P.J. Pagni
2005	H.R. Baum
2008	V. Babrauskas
2011	T. Tanaka
2014	M. Delichatsios

### Kunio Kawagoe Gold Medal for Outstanding Lifelong Contributions to Fire Safety Science

1994	A. Robertson
1997	P.H. Thomas
1999	H.E. Nelson
2002	D. Drysdale
2005	S. Yokoi
2008	G. Cox
2011	J.G. Quintiere
2014	I. Thomas

### Philip Thomas Silver Medal of Excellence for the Best Paper of the Previous Symposium

1988	Y. Hasemi
1991	H.R. Baum and B.J. McCaffrey
1994	A. Atreya and M. Abu-Zaid
1997	B.Z. Dlugogorski, J.R. Mawhinney and V.H. Duc
1999	R.G. Rehm, K.B. McGrattan, H.R. Baum and K.W. Cassel
2002	J.P. Garo, P. Gillard, V.P. Vantelon and A.C. Fernandez-Pello
2005	D.W. Weinert, T.G. Cleary, G.W. Mulholland and P.F. Beever
2008	T. Korhonen, S. Hostikka and O. Keski-Rahkonen
2011	N. Ren, A. Blum, Y.-H. Zheng, C. Do and A. Marshall
2014	H.-Z. Yu.

### IAFSS Best Thesis Award “Excellence in Research” for the Best Masters and PhD Theses

2005	S. Lamont (Europe and Africa), A. Bar-Ilan (Americas) and W. Wenguo (Asia and Oceania)
2008	M. Knobloch (Europe and Africa), A. Rangwala (Americas) and J. Dimyadi (Asia and Oceania)
2011	A. Law (Europe and Africa), C. Lautenberger (Americas) and K. Chen (Asia and Oceania).
2014	T. Gernay (Europe and Africa), J. Overholt (Americas) and Chao Zhang (Asia and Oceania)

*Honorable Mentions: J. Gales, M. Rochoux, S. Verstockt*

## **Dougal Drysdale Award for Extraordinary Service to the IAFSS**

- A. Robbins: “for the Development of the federated search engine of the fire research collections of institutions around the world ”
- R. Alpert: “for his invaluable support to numerous authors of recent IAFSS Symposia to improve the English language of submitted and accepted papers ”
- C. Beyler: “for successfully leading the Association through a period of rapid change, especially for spearheading open access to the Association’s publications, expanding the membership, and developing guidelines for the nominating processes”.”

## **FORUM Sjölin Awards for Outstanding Contribution to the Science of Fire Safety**

**Sponsored by: the International FORUM of Fire Research Directors**

- 1994 Lund University, Science University of Tokyo, the University of Edinburgh, the University of Maryland, and Worcester Polytechnic Institute
- 1999 P.H. Thomas, K. Kawagoe, H.W. Emmons, D. Rasbash and the eight organizations to which they were connected: Harvard University, NIST, FMRC, WPI, BRI, Science University of Tokyo, FRSS, and the University of Edinburgh
- 2002 V. Babrauskas, P.F. Beever and J.G. Quintiere
- 2005 D. Drysdale
- 2006 G. Cox
- 2007 R. Gann
- 2008 A. Buchanan
- 2009 G. Heskestad
- 2010 T. Tanaka
- 2011 Y. Hasemi
- 2012 FDS Development Team: K. McGrattan, H. Baum, G. Forney, R. McDermott, R. Rehm, J. Floyd, S. Hostikka, T. Korhonen, W. Mell.
- 2013 J. deRis.
- 2014 J. Hall.

## **FORUM Mid-Career Researcher Award**

**Sponsored by: the International FORUM of Fire Research Directors**

- 2014 P. van Hees

## **FORUM Student Travel Awards for the Best Student Papers Accepted for the Symposium - The Sheldon Tieszen Student Award**

**Sponsored by: the International FORUM of Fire Research Directors**

- 2008 S. Ukleja and S.-H. Koo
- 2011 Z. Chen, Y.Z. Li, T. Nishino and S. Summoogum
- 2014 F. Evengren, F. Vermina Lundström, P. Summers, M. C. Rochoux

## **The FORUM Student Travel Award**

**Sponsored by: the recipients of the 2012 Sjölin Award and the International FORUM of Fire Research Directors**

- 2012 N. Brogaard and M. X. Sørensen

## 11<sup>th</sup> Symposium Poster and Image Awards

### *Best Poster Awards:*

S. Kim, J. Kim and D. Myeong Ha for “An Experimental and Numerical Study of the Effect of Flow Angle on the Probe Constant of Bi-Directional Velocity Probe for Fire Testing”

S. Morlon, E. Blanchard, C. Rebuffat, G. Parent, Z. Acem, A. Collin and P. Boulet for “On real radiative shielding effect when applying water mist in case of fire.

### *Best Student Poster Awards:*

X. Huang and G. Rein for “Computational Modelling of Smouldering Peat Fires: Predicting the Role of Moisture and Inert Contents”

C. Maluk, L. Bisby and J. Torero for H-TRIS: Quantified, reproducible and rational thermal exposures for fire testing

### *Best Fire Science Image Awards:*

E. Rackauskaite, X. Huang and G. Rein for the image entitled “Fire Watch Constellation.”

J- White, E- Link, T. Myers, A. Marshall and P. Sunderland for the image entitled “Oxidizer Dilution Quenching of a Turbulent, Methane Line Flame.”

In addition, a set of letters of appreciation from the IAFSS chairman was presented to several IAFSS members for their long-term services to the community: D. Brein, Y. Hasemi, N. Dembsey, C. Beyler, C. Franks.

# In Memoriam

## Harold "Bud" Nelson (1929–2011)



Harold "Bud" Nelson, 82, a primary force in the definition of modern fire protection engineering (FPE), died July 21, 2011 in Fairfax, Virginia. More than anyone else, Bud championed modern FPE as a discipline based upon quantitative hazard and risk assessment, rooted in fire safety science. Nelson was one of those rare individuals in fire protection who could relate both with the fire scientist creating the technology and also with the fire protection engineer who applies that technology. Bud was born on February 9, 1929 and grew up in and around Chicago, Illinois. In 1950, he graduated from the Illinois Institute of Technology with a bachelor's degree in Fire Protection and Safety Engineering. After graduating, he was drafted into the army and served during the Korean War at Fort Aberdeen Proving Ground.

In 1952, Bud moved with his wife, Theresa, to Wilmington, Delaware, where he worked as an engineer for E.I. DuPont Co. In 1956, Bud and his family moved to Washington, DC as he began to work with the U.S. Government Naval Yard. In 1958, he began a 17-year stint with the General Services Administration (GSA), where he served as Director of Accident and Fire Prevention Division. There, his leadership was integral in establishing GSA's international reputation as a leader in fire safety for high-rise buildings. As has often been the case in fire safety, a tragedy led to the cornerstone for a leap forward. In February 1971, a fire occurred above the 30th floor of the office building at One New York Plaza in New York City. The difficulty encountered by the fire department in combating this fire highlighted growing concerns for fire safety in modern high-rise office buildings. The GSA convened an international conference to develop solutions to the fire problem in high-rise buildings, with Bud as the conference organizer and coordinator. The conferees concluded that fire protection for high-rise buildings was not keeping pace with high-rise building design. They established the basic fire protection design parameters for high-rise buildings and endorsed the need for a total systems concepts approach for high-rise fire safety.

Bud had been pioneering such an approach. Under his direction, GSA implemented his system and many of the conference recommendations into the final design of the 32-story Seattle Federal Building. This building became a model for high-rise fire protection design around the world. The GSA design approach, Bud's brainchild, led to the formal development and use of event logic trees for risk assessment and the formation of the National Fire Protection Association (NFPA) Committee on Systems Concepts for Fire Protection that formalized the practice. It has been in use ever since.

In 1975, Bud joined the new Center for Fire Research at the National Bureau of Standards. As Chief of the Design Concepts Section, he and his team conducted groundbreaking research in the areas of fire risk appraisal, human behavior in fires, applied fire growth and smoke transport modeling, fire safety for handicapped persons, and the application of personal computers to fire safety problems. He created the Fire Safety Evaluation System (FSES), a process in which experts' grading of fire protection technologies enabled minimizing the cost of providing a degree of fire safety equivalent to that provided by the fire code. Today, this is an integral part of the national fire codes and became the basis for the computer-based performance-based design that is spreading worldwide. Bud was one of the first in his profession to

recognize the value of the emerging computer technology to practitioners. He organized a group of scientists and engineers who developed many of the early FPE software tools, including FSES tools for various occupancies. Bud was known to go to fire meetings and hand out floppy disks and, later, CDs by the hundreds.

Bud had such a unique influence on the Fire Research Program at NIST that his colleagues developed a preliminary expert system, ASKBUDJr, to attempt to capture how Bud approached fire safety analysis. It is likely that he was the only engineer in the history of NBS/NIST whose mind was thus encoded.

Bud's singular contributions while at NIST were recognized in 1982 when he received the U.S. Department of Commerce Silver Medal and again in 1989 when he received the Department's Gold Medal.

Bud retired from the Federal government in 1992, but remained affiliated with NIST throughout the rest of his life. His picture hangs in the NIST hall of distinguished alumni.

Early in the 1990s Bud was diagnosed with Parkinson's disease, but he never let his condition stop him. After his "retirement," Bud joined Hughes Associates, Inc., a global fire science and engineering consulting firm, where he continued to contribute for 10 years (1992-2002) by advancing computer based engineering tools used in modeling fire growth and fire hazards development, in smoke management analysis and design, and in fire investigation.

In 2002, Bud was again called upon by the Federal government. On September 11, 2001, in an unprecedented attack on the U.S. homeland, terrorists had destroyed the World Trade Center buildings in New York City. Counter to all expectations, three tall buildings had collapsed, killing nearly 3,000 people. The country wanted to know how this could have happened. Bud was a central figure on the 2002 expert committee assembled by the Federal Emergency Management Agency to appraise the response of the buildings to the attack. When NIST's National Construction Safety Team conducted the scientific reconstruction of the collapse of these buildings, Bud was a prized member of the team.

Throughout his career, Bud's devotion to his profession was legendary. He was a Fellow of the Society of Fire Protection Engineers and was awarded their John J. Ahern President's Award and their John L. Bryan Mentor Award. In 1987, the Society surprised him by creating the Harold E. Nelson Service Award and making him the first recipient.

Bud was a member and leader of many NFPA Technical Committees, including Safety to Life Correlating Committee; Board & Care Facilities; Means of Egress (Building Code/Safety to Life); Health Care Occupancies (Building Code/Safety to Life); Alternative Approaches to Life Safety (Chair); Fire Investigations; Building Construction (Chair), Records Protection (Chair), Smoke Management Systems (Chair). In 1990, NFPA awarded Bud their Standards Medal in recognition of his outstanding contribution to fire safety in the development of fire safety standards.

On a broader stage, Bud was a member of the committee that created the International Association for Fire Safety Science in 1985. He was adamant that "science" be in the organization's name and that it be a cornerstone of its function. In 1999, he received their prestigious Kunio Kawagoe Gold Medal in recognition of his life-long contributions and career achievements in fire science and engineering.

In 2005, the American Association of Engineering Societies recognized Bud with National Engineering Award. This award recognizes inspirational leadership and tireless devotion to the improvement of engineering education and to the advancement of the engineering profession, as well as to the development of sound public policies as an engineer-statesman. He is the only fire protection engineer to ever receive the award.

Bud was an avid student of history, with interests ranging from ancient Europe to the U.S. Civil War to modern days. He combined this with his love for his profession as a major contributor to the History of Fire Protection Engineering, which was jointly published by NFPA and SFPE.

In all, Bud led the application of the advances in fire safety science to practical engineering problems and building fire investigations, and in the process developed and disseminated new engineering methodologies for broad use by practicing professionals. He earned worldwide recognition as the father of modern fire protection engineering.

And yet, even with this unparalleled professionalism, Bud's prime passion was always for his family.

During 58 years of marriage, he was devoted to his wife Theresa, his four children, eight grandchildren, and three great-grandchildren. He was always there for his family as husband, father, friend, advisor, general handyman and always as practical engineer. He shared with each of them his passions for science, history, technology, fire science (of course) and above all marriage and family.

Bud lived fully the passions of his life and left an enduring legacy, both personally and professionally. His loss deeply moves us all and he will be deeply missed, but even more we will celebrate, cherish, and benefit always from his presence in our lives.

*Signed: Craig Beyler, Hughes Associates, and Richard G. Gann, National Institute of Standards and Technology.*



## In Memoriam

### Nora Helen Jason (1936-2012)



Of Gaithersburg, MD, retired director of Fire Research Information Services at the National Institute of Standards and Technology passed away on January 23, 2012 as the result of complications from a perforated gastric ulcer. Ms. Jason was born in Schenectady, NY.

*Source: www.legacy.com. Published in The Washington Post, February 26, 2012*

Nora's recent article in *Fire Technology* "**inFIRE Revisited**" ([dx.doi.org/10.1007/s10694-010-0163-z](https://dx.doi.org/10.1007/s10694-010-0163-z)) was freely accessible online by everyone (Open Access) from Feb 1st to April 1st as a token memorial.

*Signed: Jack Watts, Editor of Fire Technology*

After receiving her master's degree, Nora accepted a position as cataloger, Sacramento State College, California. Areas of responsibility were: music, American history, psychology.

In 1967 she was selected as an Administrative Librarian with the Special Services Libraries, Germany. Two medium sized libraries in the Stuttgart area serving the service men and women and dependents provided managerial challenges with the American and German staff, library collection building, public relations, and programs for the troops, including non-reading adults. In 1969 Ms. Jason was promoted to Head Librarian, Special Services Libraries at McGraw Kaserne (Munich), Hospital Library and Dachau Library. With an Assistant Librarian and Larger staff it was possible to offer many more of the same activities except for a more diverse user population which also included University of Maryland students and retirees. In 1971 Ms. Jason joined the Office of Fire Research and Safety staff to build a fire safety database for the National Aeronautics and Space Administration, Aerospace Safety Research and Data Institute (ASRDI). In a short time she was made the ASRDI Project Leader and successfully built the database which is now part of NASA RECON (their bibliographic database). The NASA work stimulated the beginning of the Fire Research Information Services and the building of the fire research collection. The collection has grown from zero to over 60,000 items during this time period. Access to the collection has been automated and national and international users can access the database, FIREDOC, from their home or office via modem, Web or Internet. FIREDOC contains the bibliographic reference, keywords, identifiers and (where possible) abstracts to the items in the collection.

In her capacity as Supervisor of the Fire Research Information Services, Ms. Jason has established national and international document exchange programs with her counterparts. As one of the driving forces of inFIRE (international network of Fire Information and Reference Exchange) she has been instrumental in developing products, e.g., a Union List of Serials, for use by the fire information community. Special projects also have been done for government agencies; for example, NASA, Minerals Management Service. Ms. Jason was an observer at the Federal Pre-White House Conference on Libraries and Information Services held at the National Library of Medicine in November 1990 and the White House Conference on Libraries and Information Service, 1991. Ms. Jason was awarded the US Department of Commerce Bronze Medal in 1977 and 1999. She was awarded the Society of Fire Protection Engineers Director's Award for the 1992 Outstanding Committee Chair, as the Chair of the inFIRE Advisory Committee. She is a member of the Special Libraries Association, inFIRE, and the Textile Information Users Council.

As a Guest Researcher, Ms. Jason was the Associated Editor of FIRE.GOV. It is an electronic newsletter for the fire service worldwide, bringing news of current international research to them. Technical reports, photographs, videos, and websites provide greater insight to the reader.

*Source: NIST [http://www.nist.gov/el/fire\\_research/gnjson.cfm](http://www.nist.gov/el/fire_research/gnjson.cfm)*

# In Memoriam

## Phil DiNenno (1953-2013)



It is with great sadness that the Society of Fire Protection Engineers (SFPE) announces the passing of Philip DiNenno, P.E., FSFPE. Phil was an unparalleled leader and visionary in the fire protection engineering community.

In the mid-1980s, Phil DiNenno, Jack Watts, Doug Walton, Craig Beyler and Dick Custer had an idea to create a collection of calculation methods for fire protection engineering. From this idea emerged the SFPE Handbook of Fire Protection Engineering, of which Phil was the Editor-in-Chief for all four editions. *“I doubt that there is anyone else who could have turned a vision of creating a handbook of fire protection engineering into reality, and do it entirely using volunteer authors and editors,”* said Morgan Hurley, Technical Director of the Society of Fire Protection Engineers.

The passage of the Montreal Protocol on Substances that Deplete the Ozone Layer limited the manufacture of fire suppressants known as “halons,” which created a huge vacuum for the protection of special hazards. Phil worked internationally with organizations like the United Nations Environment Program, the US EPA, the U.S. Navy, and the National Fire Protection Association to develop test standards and criteria to identify suitable replacements.

DiNenno was a past-president of the Society of Fire Protection Engineers. In recognition of his accomplishments, stature, and service to SFPE and the fire protection engineering profession, Phil received almost every one of SFPE's awards, including the membership grade of Fellow (1996), the Harold E. Nelson Service Award (1998), the President's Award (1989 and 2002), the Arthur B. Guise Medal (2005), and the D. Peter Lund Award (2009). DiNenno was a graduate of the University of Maryland, from which he received a degree in fire protection engineering. He was the president of Hughes Associates, a fire protection engineering research and consulting firm.

In lieu of flowers, memorial contributions may be made in Phil's memory to the Carroll Hospital Center Foundation for the development of their new Cancer Center, 200 Memorial Avenue, Westminster, MD 21157 or to the Ivymount School for Autism, 11614 Seven Locks Road, Rockville, MD 20854.

*With permission from SFPE. This article was first published in the Blog of SFPE at <http://blog.sfpe.org/2013/08/sfpe-mourns-loss-of-fellow-and-past.html>*

# In Memoriam

## Professor Philip H. Thomas (1927-2014)



It is with the great sadness that we have learnt of the sudden death on 14th January 2014 of Professor Philip Thomas, aged 87. Philip was the founding father of the IAFSS.

It was he, along with like-minded researchers from across the world, who made the first moves in 1983 to establish a new international association for fire researchers. They had recognised that, whilst there were several organisations then in existence that embraced some special aspects of fire there was no single institution that covered the full diversity of topics that constituted fire safety science.

Phil drove the initiative forward, establishing the IAFSS at the very successful First International Symposium on Fire Safety Science hosted in the US in 1985 by NIST (then the National Bureau of Standards). At that Symposium he was elected the Association's first Chairman and served in that capacity from 1985 to 1991. Phil was uniquely positioned to achieve this objective because of the authority and enormous respect he enjoyed throughout the world. In addition to this new role as first Chairman of the IAFSS, he was also Chairman of the International Standards body ISO TC92 from 1976 to 1995 and Co-ordinator of CIB W14 from 1974-1994, which he used to establish research agendas in support of standards development. In the early 1980's the world was far more fragmented than it is now but Phil's insistence on a truly international body ensured the continuing success of the Association. His appetite for international cooperation had been particularly strengthened by a year's sabbatical spent at the Japanese Building Research Institute in 1966 following Professor Kunio Kawagoe's stay at the Fire Research Station. He enjoyed Visiting Professor status at the University of California, Berkeley in 1980, the Science University of Tokyo in 1982 and the Technical University of Denmark in 1987 and for six years from 1984 to 1990 at the University of Lund in Sweden. Philip had graduated with First Class Honours in Mechanical Engineering from Cambridge University in 1945 obtaining in 1950 a PhD from research on Rubbing Solids in the Physical Chemistry Department.

After a year as a special research trainee at the Metropolitan Vickers Company in Manchester he joined the Fire Research Station (FRS) in 1951.

Throughout a long career at the Fire Research Station he published much of the key seminal scientific research that has provided us with our understanding of fire. Ranging through contributions on selfheating, thermal explosion theory, through fire extinction and buoyant diffusion flame theory to the modelling of forest and building fires, his name is dominant in author citation indexes in the field. He continued to contribute well after his retirement from FRS in 1986 and was still publishing in the Fire Safety Journal as late as 2010. He was particularly animated about the need for high standards in fire research and it is particularly fitting that the IAFSS now names its award for best paper at its Symposia as the Philip Thomas award. Phil will be sadly missed by many friends and colleagues from across the world not only for his unique contribution to our field but for his warmth, wisdom and his analytical insight.

*Signed: Geoff Cox*

# In Memoriam

## Professor Toshisuke Hirano (1939-2014)



It is with great sadness that we have learned of the death on February 13, 2014 of Professor Toshisuke Hirano, aged 74. Prof. Hirano, Emeritus Professor at the University of Tokyo, passed away after 2 months of medical treatment at Tokyo Metropolitan Neurological Hospital in Tokyo, Japan. He has made enormous contributions to IAFSS continuing from the time of its founding. He has served as a secretary (1985-1991), vice chairman (1991-1997), and chairman (1997-2002) of IAFSS. He has increased the activities of the Association and especially put emphasis on the globalization of fire science. He worked as a bridge to areas of Asia, Oceania, and Russia, and expanded the IAFSS into a true international audience. He established Asia-Oceania Association for Fire Science and Technology as a branch of IAFSS in 1992 to promote the exchange of fire safety science within the Asia-Oceania section, and beyond.

Prof. Hirano was born in Shizuoka, Japan, on February 25, 1939. In 1970, he earned the Doctor of Engineering degree from research on ionization in flame in the University of Tokyo. After working for Ibaraki University, he made his way to the University of Tokyo as an associate professor in the department of reaction chemistry and was promoted to full professor in 1985. After he retired from the University of Tokyo in 1999, he served for National Research Institute of Fire and Disaster as a president from 2001 to 2004. He managed the researches at the National Research Institute of Fire and Disaster, which is a leading research institute on fire safety science in Japan. He also served for Chiba Institute of Science as a president from 2004 to 2010. Chiba Institute of Science was founded in 2004 and he was the first president.

Prof. Hirano has performed pioneering researches in fire safety science and engineering. For example, he has studied flame spread phenomena above combustible solid and liquid. He examined airflow near the flame carefully and succeeded in describing the flame structure exactly as a diffusion flame in boundary layer. Also he has studied flame propagation phenomena in the combustible particle clouds and flammable gas mixtures (dust explosion and gas explosion). The propagation mechanisms were analyzed by using aero-thermo dynamics. These fundamental studies present how the phenomena of flame spread and propagation are governed by mass and heat transfer, combustion reaction, and flow behavior. The results contribute to the scientific understanding of flame spread and propagation in fire and explosion. The results of this research were presented in more than 170 original papers, 65 review papers, and 27 books. By these achievements, he was presented with the Award for the Outstanding Paper (Japan Society for Safety Engineering, 1981), the Komo Prize (Tanikawa Fund Promotion of Thermal Technology, 1987), and other noted awards. His achievements in research are of great importance for the promotion of fire safety science and engineering, and also have had great impact on the other academic areas such as combustion science, transport phenomena, and energy engineering.

Prof. Hirano was an active person and his leadership was exceptional. He served not only for IAFSS, but also for the Combustion Institute (Executive Committee member, Secretary for Foreign Affairs, Board of Directors), Asia-Oceania Association for Fire Science and Technology (President), and Japan Association

for Fire Science and Engineering (President). He has also served as a member of editorial board for Journal of Loss Prevention in the Process Industries, Journal of Japan Society for Safety Engineering, and Combustion and Flame. By these great contributions, he was awarded Bernard Lewis Gold Medal (Combustion Institute, 2004), Award for Prominent Contribution (Japan Association for Fire Science and Engineering, 1985), Dionizy Smolenski Medal (Polish Academy of Sciences, 1997), Award for Prominent Contribution in Sci. (Japan Institute of Energy, 1999), and International Science and Technological Cooperation Award of the People's Republic of China (2003).

Prof. Hirano made considerable efforts to bring up young generations. He was known as a strict teacher; however, he trained them with warm heart. Many of his pupils have played important roles in the research of fire safety science. He was an attractive person loving sports (association football) and flowers (especially roses). We believe his legacy will endure in many ways. He is survived by his wife, Kazuko, two daughters and a son.

*Signed: Ritsu Dobashi, The University of Tokyo*

# In Memoriam

## Professor John L. Bryan (1926-2014)



Dr John L. Bryan (1926-2014) was the founding Professor and Chair of the Department of Fire Protection Engineering (FPE) at the University of Maryland, from the department's initiation in 1956 until 1993. Following his retirement on August 1, 1993, he was granted the rank of Professor Emeritus, with 37 years of service in the department and 39 years of service with the University.

Under Dr Bryan's leadership, the Department of Fire Protection Engineering at the University of Maryland College Park evolved from a modest, one-person operation to a mature and vital program serving the fire protection needs of the nation.

Dr Bryan was not just a professor and chair, but was also a mentor to the FPE students. Known as "Prof" to the students and alumni, he knew each one by name. In fact, at an alumni gathering on campus in 1989, where usually guests provide self-introductions, he introduced virtually every one of the 200 alumni in attendance! He was known by students for his dry wit, which served to liven up class discussions. Also, anyone who was late for class or dozed off would be identified, usually resulting in the individual (and the rest of class) being on time and awake for several subsequent class meetings. His 'snowmen' were legendary among students. He would draw a snowman on exam answers when he sensed that the student's response included extraneous information (usually by students hoping to have captured the desired answer somewhere in the essay).

Serving as a mentor for the students, he always made time to talk to them, and would show a personal interest in their concerns. In many cases, he'd intercede with various campus offices in support of the students. As a result of this connection, the allegiance of alumni to Prof is extraordinary. Signs of this allegiance are indicated by initiating a tradition of holding annual alumni dinners at the NFPA conferences, which continues today, and in the strong support for an endowed scholarship in the name of his wife, Sarah. His legacy is recognized through the endowed John L. Bryan Chair of Fire Protection Engineering, a named fire protection engineering laboratory and the student dormitory at the College Park fire station, which is in his honour.

For any of us who had a chance to work with him, he was the ultimate team player. He sought to develop a consensus for strategic initiatives and genuinely welcomed input from everyone in the department. He treated each faculty member with respect and went out of his way to introduce us to key individuals in the field and provide numerous opportunities for us to excel. One of the most memorable aspects of working with him was that he treated me as an equal, though I clearly was not.

*Signed: Jim Milke, Ph.D., P.E., Professor and Chair, Department of Fire Protection Engineering, University of Maryland*

# In Memoriam

## Dr. Raymond Friedman (1922–2014)



Impressive in his work, inspiring to others and dedicated to his profession, Dr. Ray Friedman leaves a legacy of devotion to fire research.

With a background as a research chemist, Dr. Friedman held positions in research and management at Westinghouse Research Laboratories, Atlantic Research Corporation (ARC) and Factory Mutual Research Corporation (FMRC). As vice president and general manager of the research division of ARC, he directed fundamental studies on various kinetics and combustion problems, particularly in solid propellants combustion, flame extinguishment, flame structure and ionized combustion gases.

In 1969, he joined FMRC as scientific director and manager of the basic research department. In 1975, he became vice president and manager of the research division (now part of Factory Mutual Insurance Company [FM Global]), a position from which he retired in 1987. He was, at the time, an internationally known scientist prominent in the Combustion Institute and other professional associations. His presence brought renown to FMRC as a leading institution for research on combustion and fires. Soon after he arrived, his reputation was the determining factor in drawing the famous combustion scientist Dr. George H. Markstein to join FMRC to work with him.

Ray devoted much time to the training of young scientists, and his inquisitive and inventive mind was instrumental in driving many of the early advances in the understanding of fire phenomena. While at FMRC, Ray wrote many papers reviewing the state of the art in the field of fire research, which were intended to guide further research. But, by far his most significant contribution was that of enhancing FMRC's scientific reputation and creating an environment that inspired other scientific researchers. His leadership established the foundation of an enduring legacy that is still felt at FM Global.

He devoted much effort to the formation of the International Association for Fire Safety Science, and he received many professional and academic honors. They included positions of leadership with the Combustion Institute (president, 1978-82), the American Chemical Society's Division of Fuel Chemistry (chairman, 1964), the National Aeronautics and Space Administration (NASA) and the National Academy of Science (NAS). Ray was also a member of the Cosmos Club.

Known for his keen wit and analytical mind, Ray enjoyed classical music at the Society of the Four Arts in Palm Beach and at Tanglewood in the Berkshires. The eclectic nature of Ray's intellect is reflected in the wide range of his publications. He is the author of the definitive text on fire prevention, *Principles of Fire Protection Chemistry and Physics*, and several other publications. Ray leaves his adored best friend and wife of 68 years, Myra. He is missed by those who had the privilege to know him and work with him.

*Franco Tamanini, FM Global*



# In Memoriam

## Prof. Sven Erik Magnusson (1938–2014)



Professor Emeritus Sven Erik Magnusson passed away on December 15 2014, leaving family, friends and colleagues in sorrow and grief. Professor Magnusson has been invaluable in the development of both research and education in fire science, fire safety engineering and risk management and societal safety at Lund University.

In the fire science world he will be remembered as a pioneer and visionary in the area of parametric fires and for the introduction of risk management for fire safety design. Related to fire engineering education he will be remembered as one of the authors of the first curriculum for fire safety engineering published in the Fire Safety Journal in 1995. Together with the late Prof. em. Ove Petterson he was one of the driving forces during the start-up of the IAFSS (International Association of Fire Safety Science). He was a principal figure in the start-up of the MSc program in Risk Management and Safety Engineering at Lund University and in initiating and leading Lund University Centre for Risk Assessment and Management (LUCRAM) together with Prof. Roland Akselsson.

Prof. Sven Erik Magnusson was born on January 3<sup>rd</sup> 1938 and he grew up near Lönsboda, in the northeast part of Skåne. He started his university career as PhD student with Prof. Ove Petterson and defended his PhD thesis in a joint session with Prof. em. Sven Thelandersson. Together they had 3 opponents for the discussion forum. The work of Magnusson and Thelandersson was later used as the basis for parametric fires in the Eurocodes and was considered a pioneering work. He was also active as a researcher in the area of fire development where he was involved in a number of research projects dealing with early room fires in cooperation with SP in Borås. In the start up phase of standardisation of the room corner test, he was chairman of the working group on ISO TC92 SC1. After the retirement of Prof. Ove Petterson, he was appointed professor at the Department of Fire Safety Engineering. In the beginning of his academic career he became heavily involved in the development of courses for the BSc program in fire protection engineering, together with Robert Jönsson and the staff at the department of fire safety engineering.

In the mid-nineties the focus of his research moved to the area of risk management and societal safety. He started activities such as LUCRAM and introduced multidisciplinary research in the department. Around the same time, he initiated and led the development of the MSc program in Risk Management and Safety Engineering. Furthermore, he led numerous research activities in this area that generated continuous growth of risk-related research at the university. At the end of his career, he always supported the younger generation by leading the development of larger research projects and serving as a mentor for many of the PhD students in risk research.

After his retirement, he still kept close links with the late Prof. Philip Thomas, also a founding member of the IAFSS, and felt a deep sorrow when Philip passed away earlier in 2014.

In addition to being a distinguished academic, Sven Erik was very interested in society and was keen on keeping up with current affairs as well as understanding history. His cultural interests included theatre and classical music, and he was keen on exercising not only the mind but also the body, mainly through

spinning classes. He was very passionate about spending time in his country house with his closest family, his beloved wife Lisbeth, their children and grandchildren, and friends.

We will remember Sven Erik as a great researcher as well as a warm and caring person whom many of us have to thank for very much today. Many friends and colleagues from across the world will sadly miss Sven Erik.

*Signed: Marcus Abrahamson and Patrick van Hees, with help from Lisbeth, Sven Eriks' wife*

# Symposium Committees

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*Editors D. Nilsson, P. van Hees, R. Jansson*

## **11<sup>th</sup> Symposium Awards Committee**

*Chair D. Brein*

### *Members*

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M. Spearpoint  
T. Tanaka

The Awards Committee was cordially supported by B. Dlugogorski and numerous scientists, They helped the Awards Committee in choosing the awardees for the Philip Thomas Silver Medal, for the IAFSS Best Thesis Award and the 11<sup>th</sup> Symposium Poster and Image Awards. The latter were decided upon both by P. Tofilo and J. Torero during the conference, while every other awardee was chosen in front of the symposium.

The Dougal Drysdale Awards were decided upon by the Chairman (B. Dlugogorski), while the FORUM Awards were decided upon by the FORUM chairperson (M. Janssens) and an internal FORUM awards committee.

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Joshua Sheffel  
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Michael Spearpoint  
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### **COMPARTMENT FIRE DYNAMICS**

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### **EVACUATION AND HUMAN BEHAVIOR**

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Weiguo Song

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### **STRUCTURAL FIRE PERFORMANCE**

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### **FIRE HAZARDS IN ELECTRICAL EQUIPMENT**

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### **POST-EARTHQUAKE FIRES**

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### **WILDLAND FIRES**

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### **FLAME RETARDANTS AND ADVANCED MATERIALS**

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### **FIRE RISK ANALYSIS AND STATISTICS**

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### **LARGE-SCALE FIRE HAZARDS**

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### **Wildfires and Climate Change**

Workshop Panlists:

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Mark A. Finney (USDA Forest Service, USA),  
Samuel L. Manzello (National Institute of Standards and Technology, USA),  
Hiroshi Hayasaka (Hokkaido University, Japan),  
Dominique Morvan (Aix-Marseille University, France)  
Albert Simeoni (University of Edinburgh, UK).

### **Benchmarking/Data Sharing**

Workshop Panelists:

Michael Spearpoint (University of Canterbury, New Zealand),  
Assaad Masri (University of Sydney, Australia),  
Anthony Hamins (National Institute of Standards and Technology, USA),  
Sergey Dorofeev (FM Global, USA),  
Kevin McGrattan (National Institute of Standards and Technology, USA),  
Ed Galea (University of Greenwich, UK)

### **Multi-Objective Fire Safety System Design – Economy, Sustainability and Aesthetics**

Workshop Panelists:

David Barber (Arup, Australia),  
Margaret Simonson McNamee (SP Technical Research Institute of Sweden, Sweden)  
Brian Meacham (Worcester Polytechnic Institute, USA)

### **Evacuation Modeling – Issues and Challenges**

Workshop Panelists:

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Rita Fahy (National Fire Protection Association, USA),  
Ed Galea (University of Greenwich, UK),  
Enrico Ronchi (Lund University, Sweden),  
Weiguo Song (University of Science and Technology of China, China).

### **Education**

Workshop Panelists:

Patrick van Hees (Lund University, Sweden),  
Jose Torero (University of Queensland, Australia)  
Kathy Notarianni (Worcester Polytechnic Institute, USA)

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