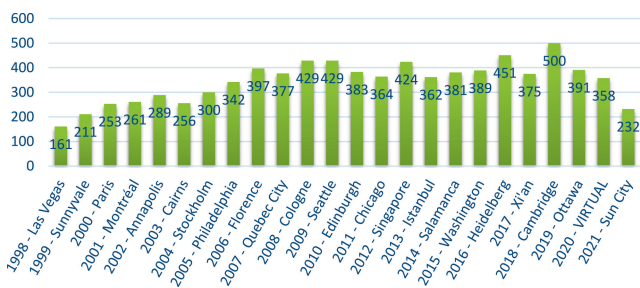


# 25 YEARS OF FUSION CONFERENCES: COLLECTION OF MEMORIES

## INTRODUCTION

### CHEE-YEE CHONG, ISIF TREASURER, 1998–2022

**F**USION 1998 was held in Las Vegas, NV, a city known for its casinos. It was an appropriate location because without an established community in information fusion, organizing the first international conference was a gamble. As it turned out, FUSION 1998 was not a financial success. However, the conference provided an opportunity for information fusion researchers from all over the world to meet and share their research. The need to continue the conference was recognized by a group of attendees, who formed the International Society of Information Fusion (ISIF) in September 1998 to be the primary sponsor of future conferences.



FUSION conference attendance.

papers in recent years. The conference proceedings, available on the ISIF website and Institute of Electrical and Electronics Engineers (IEEE) Xplore, are arguably the best sources of publications on information fusion research.

We have invited the organizers of the past FUSION conferences to share their memories in this paper. They share how FUSION 1998 led to the formation of ISIF, how Paris was chosen to be the first location outside North America, how ISIF built up its financial reserve, that coronavirus disease 2019 (COVID-19) is not the first pandemic for the FUSION conferences, and how one organizing committee had to organize two conferences. Although reports of some conferences have been published previously, e.g., FUSION 1998 and FUSION 1999 in the first issue of *Perspectives on Information Fusion* [1], this paper provides additional memories of the organizers.

FUSION 2022 is the 25th International Conference on Information Fusion. Since 1998, the conference has been held annually with no interruption in North America (10), Europe (10), Asia (2), Australia (1), and Africa (1) and virtually (1). As the only annual international conference focused on information fusion, it has attracted a core of regular international attendees from academia and industry, along with students who are the future of the fusion community. Many research collaborations and projects have resulted from conversations during coffee breaks and at social events. The technical program presents the latest advances in information fusion research and trends, e.g., large numbers of machine learning



25 FUSION conferences held on five continents.

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**FUSION 1998, LAS VEGAS, NV**


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**X. RONG LI, CHAIR, STEERING COMMITTEE**

I will add more background to the report on FUSION 1998 that appeared in the first issue of the *Perspectives* magazine [1]. FUSION 1998 was the first of the FUSION conferences. In summer 1997, Dongping (Daniel) Zhu and Hamid Arabnia met at the annual International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA) in Las Vegas, NV. With a Ph.D. from Virginia Tech in neurofuzzy and expert systems in 1993, Daniel was an entrepreneur who just started Zaptron Systems, a small company in Silicon Valley. Hamid was associate professor of computer science at the University of Georgia and had a small company, Computer Science Research, Education, and Application (CSREA), which ran a dozen or so professional conferences each year, many of which were in Las Vegas. They were both interested in starting a new conference. Their interaction during PDPTA '97 led to the idea of having such a conference in data fusion (Daniel suggested and Hamid agreed). Since neither of them were active in the data fusion area, they sought someone in this area to help. Of these two people, Daniel was the more energetic and proactive then. He searched the Internet and found me. I was told the above origin by both of them at FUSION 1998.



Dongping (Daniel) Zhu, Yaakov Bar-Shalom, and Rong Li.

In early fall 1997, Daniel called me and we had a long talk. He said he contacted me because he knew I had many publications, including books, in the target tracking and data fusion area. He proposed having a new conference on data fusion and appointed himself as the general chair. He invited me to serve as the steering committee chair. I hesitated at first for several reasons. Earlier, Neil Gordon told me briefly that someone was proposing a conference on fusion, and I didn't think it was a good idea—I've always thought that there are in general too many conferences. Even worse, Daniel was not really in the traditional data fusion area, so it was neither proper nor likely for him to succeed in starting such a conference. But after our conversation, I thought more about it and concluded that such a conference was probably a good idea for the fusion research

community. Most importantly, we could offer this opportunity and let the community decide. So I decided to promote it actively and accepted Daniel's invitation.



Shozo Mori, Chee-Yee Chong, and Jim Llinas.

Then I contacted, mostly by phone, about three dozen of well-known researchers in the fusion area. The idea of having such a conference was well received by most of them. I then formed the steering committee with 18 of those researchers who agreed to serve, including notably (and alphabetically) Henk Blom, Chee-Yee Chong, Oliver Drummond, Alfonso Farina, Ivan Kadar, Rudolf Kruse, Jim Llinas, Shozo Mori, and Pramod Varshney. I also arranged for Prof. Yaakov Bar-Shalom at the University of Connecticut, a towering figure in tracking and fusion, to deliver a keynote speech. In the hope of having a broad scope for the conference, Daniel invited another keynote speaker, Colin Johnson, an editor of *Electrical Engineering Times*, who was not in the fusion area.

Daniel got some other people on board and formed the apparent organizing team, but the de facto organizing team was only the three of us—I don't think anyone else really did anything significant for the organization of FUSION 1998. Other than promoting the conference and getting people involved, Daniel also maintained the conference website. Hamid didn't get anybody involved, but his CSREA handled all logistics, including the conference site (Monte Carlo Resort and Casino, Las Vegas), paper processing (acceptance and rejection), technical program setup, and conference registration. It was efficient because CSREA held a parallel conference, the International Conference on Imaging Science, Systems, and Technology. I met Chee-Yee for the first time at FUSION 1998, although we were on the phone multiple times before the conference. His first comment when we met was that three brave young guys had started the FUSION conference and made an interesting history. Yes, indeed, we are all indebted to Daniel for this.

Dr. Rabinder Madan, a program director at the Office of Naval Research (ONR), had been supporting fusion research, including me, for some years. So I called Rabi for financial support of the conference. After some negotiation he finally agreed to \$8,000, mainly for student support, and he would serve as general cochair. I submitted a proposal to ONR and received

the money through my school—the University of New Orleans (UNO). I also submitted a proposal to Dr. William Sander of the Army Research Office (ARO) and received \$9,999 through UNO to support FUSION 1998. Through his connections, Daniel received some financial support from the Army Night Vision and Electronic Sensors Directorate. As far as I remember, these were the only financial supporters for FUSION 1998. In the end, according to the brief financial report Hamid sent me in April 1999, FUSION 1998 had a deficit of \$8,887, which was covered by the surplus of PDPTA '98. But this information was not necessarily reliable. Later, we learned that Hamid's CSREA was a for-profit organization. That's why we decided to move away from CSREA for future conferences and form a fusion society to be the sponsor.



Rong Li, Jean Dezert, Vincent Nimier, and Alain Appriou.

According to the documents I still have, FUSION 1998 was truly international. It had a total of 161 attendees from 24 countries or regions, in which 45% were from United States. Papers were submitted from 34 countries or regions (fewer than half were from United States); 166 of them were accepted (159 regular papers and 7 short papers), and 144 of the accepted papers were presented at the conference. The conference proceedings included 136 papers in 29 sessions. This was indeed good success for a first conference. According to Hamid, FUSION 1998's acceptance rate was low (something around 40%), which surprised me a lot and is still hard to believe. He said that's because there were many low-quality submissions from third-world countries (e.g., countries in the Middle East had more than 30 submissions, which was never repeated in later FUSION conferences, to my knowledge).

Around the time of FUSION 1998 and at the conference, several activities were undertaken to explore the possibility of forming a fusion society to sponsor future FUSION conferences. I prepared and distributed to conference attendees and via email a questionnaire that included a bunch of what we thought were important questions. We received several dozen written responses. At the conference, in addition to many informal discussions, we had a couple of more formal occasions to discuss these responses. I also set up a website, [Infofusion.org](http://Infofusion.org), to solicit input on a fusion society, as well as fusion conferences, and

to disseminate useful information on fusion research. The responses were mostly positive for future fusion conferences and the society. Then, the formation of ISIF and the annual International Conference on Information Fusion took off [1].

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### FUSION 1999, SUNNYVALE, CA

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#### X. RONG LI, GENERAL VICE CHAIR

During FUSION 1998, I tried to form committees to make the preparation of FUSION 1999 more formal and systematic for the benefit of the fusion community, but Dongping (Daniel) Zhu resisted, mainly because he had his own interest as an entrepreneur. Right after FUSION 1998, he appointed himself again as the general chair for FUSION 1999 and announced it on the FUSION 1999 website, which he maintained. I was not happy with this but eventually agreed to serve as general vice chair, given the situation. Then, I was eager to make the technical program rigorous. At the suggestion of some people, I called Prof. Pramod Varshney of Syracuse University and invited him to serve as the program chair, as well as recommending Prof. Peter Willett of University of Connecticut as his deputy. In his always pleasant and gentle manner, Pramod was happy to accept the invitation, along with Peter. Mainly due to their good efforts and rich experience, the technical program, including a rigorous review process, was a great success and set a good example for later years to follow. I was happy about the outcome. However, since Hamid Arabnia's CSREA was no longer involved with FUSION 1999, Daniel did a lot of work beyond website maintenance, including many time-consuming logistics jobs such as local arrangement. This justified his choosing of the conference to be in Sunnyvale, CA, in Silicon Valley, where his company Zaptron was located.

Because of my research background, I knew more fusion experts with a defense and/or aerospace background, as reflected in the steering committee's makeup of FUSION 1998. For 1999, I tried to broaden the scope of the FUSION conference, especially on the non-military application side such as robotics, and get more fusion experts on that side involved. Toward this end, I invited Prof. Ren Luo of Taiwan's National Chung Cheng University to give a keynote speech at FUSION 1999. Ren initiated the IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI) in 1994 when he was in the United States and had dominated MFI ever since.

My invitation had a more specific purpose: we took this opportunity and tried in vain to persuade Ren to consider some type of collaboration or coordination between the MFI and the FUSION conferences. But he clearly showed no interest in such potential. MFI and FUSION have been independent conferences ever since, with little coordination. However, Prof. Uwe Hanebeck of the Karlsruhe Institute of Technology, Germany, was general chair for both the MFI and the FUSION conferences in 2016. I really hope Uwe and other likeminded people can make a better effort to connect MFI and FUSION conferences.

**CHEE-YEE CHONG, FINANCE CHAIR**

I became the FUSION finance chair because I was the ISIF treasurer. As an outsider to the fusion community, Daniel wanted the conference finances to be transparent to ISIF. It also helped that we both lived close to the conference hotel in Sunnyvale, so we could meet frequently. Since ISIF was a newly formed society with no money in the bank, Daniel signed the contract on behalf of FUSION 1999. In fact, he paid the fees associated with the incorporation of ISIF. This was a financial risk to Daniel, but he was confident that his investment would pay off given the attendance of FUSION 1998.

The eventual financial success of FUSION 1999 was the result of excellent marketing to attract participation, as captured by a screenshot of the FUSION 1999 website, which included four other fusion-related meetings in 1999—the National Symposium on Sensor and Data Fusion (NSSDF-99), the National Aeronautics and Space Administration (NASA) Data Fusion–Data Mining Workshop, MFI 1999, and EuroFusion99. The key people from these conferences were invited to join the executive committee and/or give plenary talks: Frank White from NSSDF, Ken Ford from NASA, Luo from MFI, and Mark Bedworth from EuroFusion99. The NASA Workshop held immediately after FUSION 1999 was free to FUSION 1999 attendees and helped to boost attendance. NASA also provided funding support. The executive committee included Belur Dasarathy, who was active in SPIE fusion meetings, ran a website on sensor fusion, and was the founding editor in chief for the *Information Fusion Journal*. The result was a 25% increase attendance from FUSION 1998, with 15 people from France who would go on to organize FUSION 2000 in Paris, France.



FUSION 1999 website.

Since ISIF had no reserve, Daniel would not be paid for his services if there was a loss. Thus, he performed most of the conference administration and local arrangements functions

himself, including hotel negotiation, website management, proceedings publication, and registration invoices and payment. He had help from other volunteers. In addition to collecting the papers for the proceedings, Publication Chair Bob Levinson took preregistration via fax. Erik Blasch, besides contacting sponsors, spent his own time and money to make the CD-ROMs. We spent the bare minimum on social events and did not provide lunch. For the welcome reception, I monitored the hors d'oeuvre trays and ordered replenishments in real time. By maximizing revenue and minimizing expenses, FUSION 1999 had a moderate surplus after paying Daniel for his services. This surplus provided ISIF with a healthy balance in the bank.

**FUSION 2000, PARIS, FRANCE**

**JEAN DEZERT, ORGANIZING COMMITTEE**

The decision to organize the first FUSION conference in Europe, and especially in Paris, France, was made during a meeting of several founding members of ISIF, in particular Yaakov Bar-Shalom, Xiao-Rong Li, Chee-Yee Chong, and Erik Blasch at FUSION 1999 in Sunnyvale, CA. As early as 1999, the need was felt to develop and promote the tracking and fusion theme through a truly international conference that would minimize conflicts of interest among private sponsors, organizers, and researchers. With this in mind, Alain Appriou, Jean-Pierre Le Cadre, and I decided to apply to organize FUSION 2000 in Paris with all the passion of youth.



Jean-Pierre Le Cadre, Gabriel Ruchet, and Ivan Kadar.

The first challenge was to strengthen our small core, and the second one was to find solid financial sponsors ready to take the financial risk in the event of a deficit. The reputation and address books of Alain and Jean-Pierre, as well as my connection with Yaakov and Xiao Rong, helped in the first challenge. For the second one, the French National Research Council, the French Office National d'Etudes et de Recherches Aérospatiales (ONERA), and Thomson-CSF were the three sponsors for the event, covering the local organization, the printing of the proceedings, the secretarial, and the website development (Sylvain Gaultier

from ONERA). The choice of the venue naturally fell to the Cité des Sciences to give scientific color to this conference.



Gala dinner on the bateaux mouches on the Seine River.

For the social event, it seemed obvious to us that the choice of a dinner and a night visit of Paris on *bateaux mouches* was the best option, which would potentially attract more foreign participants with their families to Paris for this conference. This choice was wise, and many people whom I saw again years later during the following conferences still remembered this night visit to Paris during FUSION 2000. Some even came from afar on a “honeymoon” in Paris during FUSION 2000. In 2000, powerful web development tools and social networks did not exist. Although present in universities since the 1980s, LaTeX was not yet well mastered by the majority of researchers, and we had no database of email addresses to promote the event. We built the mailing list quickly from the two small conferences, FUSION 1998 and FUSION 1999 (with mainly American participants), extended by analyzing recent articles relating to the areas covered by the conference. I spent hours, evenings and weekends, but it was worth it, because doing so brought high participation of both European and non-European researchers. The plenary speakers were Henri Prade, Philippe Smets, Dov Gabbay, and David Schum thanks to Alain’s contacts. The intents behind these choices were to broaden the conference to researchers close to artificial intelligence and to try to forge links between people in defense applications (radar scientists who essentially did tracking and multisensing with probabilistic methods) and those who developed nonprobabilistic techniques for decision support in both civilian and military fields of application. I think in particular that Philippe, with his presence, his passion, and his outspokenness, had a strong impact on participants and young researchers. I still remember him. What a guy!

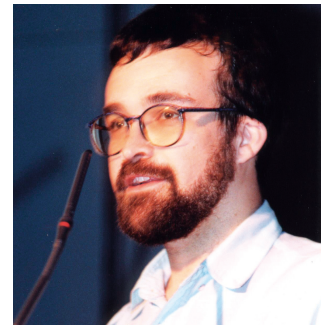


Philippe Smets.

One of the most striking memories during the organization concerns the edition of the paper volumes of the proceedings

of the conference. ONERA’s printer worked days and nights to produce cardboard boxes of volumes that were then stacked in the corridors of the basement, from floor to ceiling. They were absolutely everywhere. Unfortunately, attendees who had to travel preferred the CD-ROM, leaving us with many orphan paper copies of the proceedings. Another neophyte error was the massive sending of call-for-papers messages by email to promote the conference with a PDF file attached. Unfortunately, a too high number of messages bounced back from outdated email addresses and blew up the ONERA mail server (I won’t be caught again). The organization of this conference was a very big job for me, and I lost a few pounds (which unfortunately I have since gained back).

The breakthrough of this first European conference was, I think, a change of scale and dimension, which allowed it to be established as a truly international conference. It also opened the door to alternatives to pure Bayesian approaches to tracking and fusion, allowing nonprobabilistic techniques to be maintained in the topics of the following conferences.



Jean Dezert.

It is difficult to predict the future, especially in the current context, which does not favor the development of conferences. However, face-to-face interactions are essential among researchers to establish new contacts and collaborations. I do not believe in the sustainability of purely online conferences, even if for the moment we have few choices other than compromises. Participants enjoy going to conferences, discovering new places, and chatting and socializing with their colleagues. I think it is as vital for them as it is for me. Moreover, if the conference tightens up on the basic themes (filtering and tracking only), I fear that it will end up attracting only limited audience and will lose the prestige built up over the last (almost) 3 decades. It is imperative that talented young researchers take up the torch and invest in the organization of future editions of the FUSION conference.

### FUSION 2001, MONTREAL, CANADA

#### ELISA SHAHBAZIAN, PROGRAM COCHAIR

The fourth FUSION conference in 2001 was held in the cosmopolitan and bilingual city of Montreal, Canada, August 7–10, during a record-breaking heat wave and 35 days without rain. The chosen venue of the 30-story Hotel Delta Centre Ville was centrally located, close to historic Old Montréal and Chinatown, and only minutes away on foot from downtown. The buffet-style banquet was held in the rotating penthouse restaurant Tour de Ville, which gave the attendees a view of the city and the harbor and featured Canadian cuisine from coast to coast. The organization and sponsorship were shared by Lockheed Martin Canada (LM Canada), the Network for Computing and

Mathematical Modeling of the Centre de Recherches Mathématiques (CRM) of the Université de Montréal, the Defense Research Establishment Valcartier (now Defence Research and Development Canada–Valcartier), the Canadian Space Agency, and Mathematics of Information Technology and Complex Systems, and the conference was under technical cosponsorship of the IEEE Aerospace and Electronic Systems (AES) Society.



Yaakov Bar-Shalom, Elisa Shahbazian, and Jim Llinas.

In addition to the numerous Canadian technical joint contributions of academia, defense research, and industry, these organizations contributed in the administrative tasks synergistically, with CRM supporting the conference registration. Finally, hard-copy proceedings (the last time for ISIF) were published, including figures in color, jointly collated by LM Canada researchers and students from academia. Such collaboration ensured a low registration cost, even for 2001.

The FUSION 2001 conference had 261 participants in attendance, seeing 146 technical contributions from 304 authors representing 19 countries. Several keynote speakers took the floor every morning of the conference, including the Canadian astronaut Bjarni Tryggvason; Guenther Palm of Ulm University, who presented an interesting robotic project of two teams of robots playing soccer; and Pierre Valin (LM Canada and technical chair). A panel discussion, posters, and booths completed the program.



Pierre Valin.



FUSION 2001 Canadian committee and attendees, including Eric Ménard, Daniel Turgeon, Dale Blodgett, Jean Couture, Eric Lefebvre, Elisa Shahbazian, Bruce McArthur, Chris Helleur, Stéphane Paradis, Jean Roy, Eloi Bossé, Claude Tremblay, Daniel Roy, Yannick Allard, Jean-François Truchon, Frédéric Lesage, Hugues Demers, Guy Michaud, and Pierre Valin.

As Erik Blasch and Pierre Valin reported, “The mood was enthusiastic and the weather as usual sunny, and hot enough to warrant short sleeves or even shorts!”

## FUSION 2002, ANNAPOLIS, MD

### X. RONG LI, GENERAL CHAIR

As the general chair of FUSION 2002, looking back, I am particularly proud that it made many firsts in the history of the FUSION conference.

FUSION 2002 was the first conference that made a sizable amount of profit and thus made a major contribution to ISIF’s “primitive accumulation of capital.” With the help of Sponsors Program Chair Nageswara Rao, I secured a record number of financial sponsors with a record amount of financial support, including various U.S. government agencies, as well as ISIF and the IEEE AES Society. In addition, various professional societies were our technical sponsors, including several societies of IEEE, the Institution of Electrical Engineers (now the Institution of Engineering and Technology [IET]), and the American Institute of Aeronautics and Astronautics.



FUSION 2002 organizing committee and attendees, including Thia Kirubarajan, Pierre Valin, Jean-Pierre Le Cadre, Kaouthar Benameur, Mohammad Farooq, Jean Dezert, Mahendra Mallick, Bijoy Ghosh, Yaakov Bar-Shalom, W. Dale Blair, Xiao-Rong Li, Wolfgang Koch, Benjamin Slocumb, Erik Blasch, Shozo Mori, Chee-Yee Chong, Alexander Tartakovsky, Peter Willett, and Nageswara Rao.

To make the conference more attractive and to help ISIF grow financially, we made a self-sacrifice deal—ISIF and the IEEE AES Society would share the profit but would not take the loss if any occurred. ISIF had limited financial resources, since it was formed only in 1998, and the IEEE AES Society granted us use of its name for recognition but did not want to take the risk. As the general chair who signed all contracts, I was quite concerned about the financial risk. For example, to lower the room rates, our contract with the conference hotel specified that we would be penalized if not enough hotel rooms were booked (i.e., below a threshold) by a certain date in June. I had been nervous for a month or so because far fewer rooms than expected were booked, until the threshold was suddenly exceeded in the final couple of days. If that hadn’t happened, my wife would have been quite unhappy. In the end, FUSION 2002 made a good profit of \$46,000, which was quite significant at that time.

FUSION 2002 was the first FUSION conference sponsored financially by IEEE. Mainly because of Dale Blair’s ground-

work, it was financially sponsored by the IEEE AES Society. The success of FUSION 2002 facilitated IEEE's sponsorship in later years. Such sponsorship improves the FUSION conference's image and recognition significantly, although the international fusion community as a whole may want to maintain its independence from IEEE in many other aspects. I handled all the tedious paperwork required by IEEE for FUSION 2002. Partly based on this experience and the resultant understanding, when I was later in charge of FUSION 2017, resisting pressure from some ISIF board members, I decided not to seek financial sponsorship from IEEE for two main reasons: (a) IEEE's regulations and the Chinese government's regulations may have conflicted, which would have been a disaster for FUSION 2017, and (b) I firmly believed that FUSION 2017 would make a good profit and I would want ISIF to take all of it, rather than share with IEEE as done for FUSION 2002.

Knowing Dale's ability and energy in such activities and his close connection with the IEEE AES Society, I had been trying to get him involved in ISIF and FUSION conferences for some time. FUSION 2002 was the first year he was fully involved, as its steering chair. His contribution was so great that FUSION 2002 might be mistaken by an outsider as an educational conference of Georgia Tech (Dale's affiliation). History has proved that he has been such an important presence in ISIF and FUSION conferences ever since that it would be hard to get rid of him. In addition, partly due to Dale's contribution, I did not feel overwhelmed by organizing FUSION 2002. For example, Elisa Shahbazian, FUSION 2001's program chair, predicted that as general chair, I would personally have fewer than six papers (as in 2001) for FUSION 2002, but I found time to finish eight papers. The good experience with FUSION 2002 was a major reason I was willing to take the lead in organizing FUSION 2017. However, that time, I was totally overwhelmed because of the tremendous amount work and less experience of the organizing team, although the team worked harder than the one for FUSION 2002.



W. Dale Blair (far right) and some student attendees.

FUSION 2002 had a student paper program, with Dale as the main driving force. This started the FUSION conference's

tradition of formally having a student paper program. A student paper is any paper for which a student is the principal author and primary contributor. The student paper program had the following components: The principal authors presented accepted papers in a special session so designated; travel expenses up to \$500 of the principal author of each student paper were granted. In addition, conference registration fees were waived for the principal author, the principal author of each paper could choose to take a tutorial free of charge, and one paper was selected for the best student paper award, with a certificate, a \$250 prize, and its principal author presenting the paper orally at a conference luncheon. More than 30 students attended FUSION 2002.

Students are the future. To be successful, the conference should attract more students, even at the expense of financial loss for the conference.

FUSION 2002 also started the tradition to have a tutorial program. I recognized the need and asked Chun Yang of Sigtem Technology to take the lead as tutorial chair. In the end, a full array of (10) half-day tutorials in parallel sessions were given. This allowed more than 120 attendees, especially students, to learn about several disciplines or focus on one main subject. It was a great success.



X. Rong Li.

### FUSION 2003, CAIRNS, AUSTRALIA

#### ROB EVANS, GENERAL CHAIR

The sixth International Conference on Information Fusion was held in July 2003 in the Radisson Hotel in the city of Cairns in the warm tropical north of Australia. Many attendees enjoyed visiting the range of interesting sites near Cairns, including the beautiful islands of Great Barrier Reef and the vast jungle of Daintree National Park. Plenary speakers included Yaakov Bar-Shalom discussing dynamic sensor scheduling and Madhyam Srinivasan describing his work on optical flow and insect navigation. A strong lineup of seven tutorials attracted strong attendance. Overall, it was a rewarding conference, both technically and socially, for everyone.



FUSION 2003 group picture.

## FUSION 2004, STOCKHOLM, SWEDEN

### PER SVENSSON, GENERAL CHAIR, AND JOHAN SCHUBERT, TECHNICAL PROGRAM CHAIR

The seventh International Conference on Information Fusion was held in Stockholm, Sweden, from June 28 to July 1, 2004. The conference was sponsored by ISIF and received substantial financial and organizational support from the Swedish Defence Research Agency. In addition, we received significant financial support from Saab AB and Ericsson Microwave Systems AB. Lockheed Martin Corp., Sjöland & Thyselius



Stockholm City Hall.

AB, and the *International Journal of Information Fusion* were important contributors. The conference program contained 55 technical sessions on 26 different topics, as well as three invited paper sessions, two panel discussions, and for the first time at a FUSION conference, a best paper presentation. On the first day, we had a tutorial day with eight tutorial sessions, all taught by experts who are internationally recognized in their fields.

That year, we made a concerted effort to raise of the FUSION conference to the high standard that can be expected of an international academic conference. To give more time for reviewers to perform thorough reviews and more time for authors to respond to the reviewer suggestions and improve their papers, we moved the submission deadline forward by 1 month. We promoted the conference heavily through thousands of emails and hundreds of posters sent to departments all over the world. One of the goals was to obtain submissions from the management of uncertainty (MoU) community in an attempt to bring the information fusion and the MoU communities closer. Thus, the promotion was directed to both the information fusion and the MoU communities, and we received several papers from the MoU community at that year's conference.

The conference received a record number of 279 submissions, up from 242 the prior year. A total of 171 papers were accepted, for an acceptance rate of 61.3%. The three themes of the general conference (theoretical and technical advances, algorithms and systems, and applications) received 195 submitted papers, of which 116 were accepted, for an acceptance rate of 59.5%. The seven special sessions received 84 submissions with 55 papers accepted, for a slightly higher acceptance rate of 65.5%. These

rates were somewhat lower than in previous years but more in line with other high-quality academic conferences.



Jesus Garcia and Andres Soto.

The program committee consisted of 115 international experts. For the first time, at least three independent reviewers, assigned through computerized matching based on reviewing topics, reviewed each submission. In addition, 56 extra reviewers participated in the review process. All submissions to special sessions went through the same review process as other submissions. Special session organizers served as a fourth reviewer in their sessions. In total, 907 review reports were made. This review effort was more than twice that of the previous year as a result of the dedication of the members of the program committee to achieving a top-quality conference.

We would like to take this opportunity to thank all members of the program committee for their great effort. Working with so many highly dedicated people was truly a great experience.

At the end of the conference, on its last day, the champagne was cold, dry, and free!

## FUSION 2005, PHILADELPHIA, PA

### JOHN J. SUDANO, GENERAL CHAIR

The FUSION 2005 conference was held at the Wyndham hotel in Philadelphia, PA, July 25–29, 2005. The conference featured three distinguished plenary speakers: Dr. Ted Bially, director of the U.S. Defense Advanced Research Projects Agency/Information Exploitation Office (DARPA/IXO) and a familiar name to fusion engineers; Dr. Allen Waxman, director of multisensor exploitation for BAE Systems Advanced Information Technologies; and Dr. Wilson Felder, director of technology development for the Federal Aviation Administration (FAA). Our sponsors, the IEEE AES Society, the IEEE Philadelphia Section, and ISIF, provided a venue to our membership—engineers, scientists, academics, and end users—and the latest technical advances in the area of information fusion. The participating authors brought forth the best they had to offer their associates and were able to transfer their technologies to a wider base of users, who included 342 attendees from more than 30 nations. Participants were able



## Information Fusion History

to upgrade their knowledge and experience in the development and application of fusion system design. In addition, all participants had the opportunity to discuss avenues for international collaboration, as well as to develop long-term relationships among different research centers and academic groups. There were more than 300 peer-reviewed papers, posters sessions, and 17 tutorials representing more than 12 countries.



Subrata Das, Mitch Kokar, Ivan Kadar, Enrique Ruspini, Dan Corkill, and Erik Blasch.

The conference opened on Tuesday morning with Ted's plenary presentation. On Wednesday morning, Wilson was the plenary speaker; aviation technology development is another great application area for information fusion. On Thursday morning, Allen, an image fusion researcher, educated us on the latest technologies as applied to multisensor imagery exploitation, radar range profile fingerprinting and vehicle tracking, and information fusion and mining.



Fulvio Oliveto, Glenn Shafer, John Sudano, Erik Blasch, and James K. Beard.

Dr. Glenn Shafer, the honorary chairman, was a great asset at the conference; he interacted with many participants, especially many younger engineers. The eighth International Conference on Information Fusion would not have been possible without the enthusiastic support and dedication of the organizing committee members, and I profusely thank them.

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### FUSION 2006, FLORENCE, ITALY

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#### **STEFANO CORALUPPI AND PETER WILLETT, GENERAL COCHAIRS**

Florence, Italy, offered a wonderful backdrop for an impressive FUSION conference in 2006. The organizational effort benefit-

ed from strong support from the nearby North Atlantic Treaty Organization (NATO) Undersea Research Centre (NURC, now the NATO Centre for Maritime Research and Experimentation). The venue itself was a refurbished 16th-century monastery, the Convitto della Calza, that was just the right size for the gathering of nearly 400 participants, a FUSION record at the time. The conference started the day after Italy's impressive World Cup win, so all the Italians were in great spirits!



Craig Carthel, Stefano Marano, Peter Willett, Bob Lynch, Alfonso Farina, Stefano Coraluppi, and Alberto Baldacci.

The conference itself was well planned and executed, with leadership by Dr. Stefano Coraluppi (then of NURC and now at Systems & Technology Research) and Prof. Peter Willett (University of Connecticut). For many, 2006 marked the year in which FUSION really came into its own and combined an excellent technical program with a world-class experience for attendees.



Small but exquisite meeting room.

The conference featured excellent plenaries by Marcel Hernandez, Roy Streit, and Nils Sandell, combining recent cutting-edge research with historical perspectives on advances in distributed fusion. Notwithstanding the high technical caliber of the conference, FUSION 2006 is best remembered for the social program. Roy remembers the welcome recep-



Palazzo Vecchio, Florence.

tion and banquet dinner as follows: “For me a lasting memory is the welcome in the Palazzo Vecchio. The speech by a city Dignitary [*Assessore Giani*] was translated flawlessly into English by Stefano. That speech in that great and illustrious Hall [*Sala dei Cinquecento*], was a moment I will never forget. Another was the venue of the banquet. Again, absolutely unforgettable with its magnificent view overlooking the city.”

### FUSION 2007, QUEBEC CITY, CANADA

#### **PATRICK MAUPIN, TECHNICAL CHAIR, AND ANNE-LAURE JOUSSELME, TECHNICAL AND TUTORIALS CHAIR**

Quebec City, Canada, hosted the 10th edition of the International Conference on Information Fusion, July 9–12, 2007, at the hotel Loews Le Concorde on the Plains of Abraham, within the Battlefields Park. The FUSION 2007 attendees enjoyed the Québec City International Summer Festival, a gathering every summer of world-class musical artists. The organizing team was Éloi Bossé (executive chair), Alexandre Jouan (program chair), Pierre Valin, Anne-Laure Joussemle, Patrick Maupin, Henry Leung, and Anne Clément. With 377 participants, the conference saw record Canadian participation (about 30% of the attendees). The 300 papers submitted allowed the selection of about 240 papers to be presented.



Alexandre Jouan, Guy Vezina, Pierre Valin, Eloi Bossé, Anne Clément, Patrick Maupin, and Anne-Laure Joussemle.

The technical program was completed by a selection of tutorials reaching out to the artificial intelligence community with and led by Glenn Shafer, Henri Prade, and Eric Grégoire.

During the gala dinner, the Painchaud Family (three brothers and one sister) entertained the audience, playing classic French-Canadian music mixing stringed instruments (violins, viola, guitar, piano, banjo, etc.). Erik Blasch (Air Force Research Laboratory, Wright-Patterson Air Force Base, OH) was chosen by the band for some exhibition on the stage, and they had him wear his first Canadian shirt. Maybe in anticipation of his future life?



Erik Blasch (center) and the Painchaud Family.

The 10th FUSION conference was an opportunity to innovate in some aspects. In particular, a student sponsorship program supported at the level of 10,000 CAD by the ONR allowed registration fees to be cut in half for qualified students. The best papers were also honored during the welcome cocktail to increase attendance at their subsequent presentations. In addition a forum of two full days was offered for poster presentations, which stimulated participation and discussions. After the conference, Alain Appriou (ONERA, France) confessed that “FUSION 2007 undeniably stands out in the history of our community as a major scientific event.”

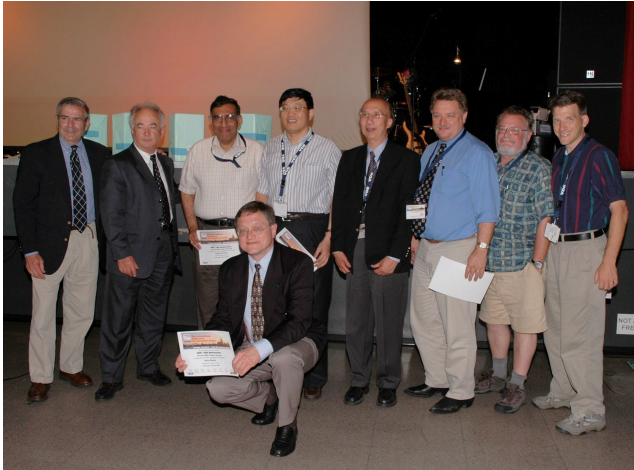
### FUSION 2008, COLOGNE, GERMANY

#### **WOLFGANG KOCH AND PETER WILLETT, GENERAL COCHAIRS**

FUSION 2008 was not only the 10th anniversary of ISIF but put Germany on the map of our community. Cologne, the melting pot fusing people, languages, and cultures for more than 2,000 years, was the right choice. Her visible witnesses of a grand culture in the heart of Europe, modern liveliness, and beautiful skyline dominated by the famous cathedral sheltering the Shrine of the Three Wise Men created an atmosphere to discover new frontiers in our innovative branch of knowledge.

## Information Fusion History

The venue by the river Rhine also overlooked a historic site for FUSION, where Christian Hülsmeyer performed his radar experiments in April 1904—one of the first examples of producing situational awareness by sensor data fusion.



Award recipients: Jim Llinas, Yaakov Bar-Shalom, Pramod Varshney, X. Rong Li, Chee-Yee Chong, W. Dale Blair, Pierre Valin, Erik Blasch, and Darko Musicki (in front).

The mayor of Cologne received us in the historic town hall, built on the foundations of the city's Roman governor. One of us, Richard Klemm, the world-known radar scientist and classical pianist, entertained us there with pieces taken from *Carnaval* by Robert Schumann, one of the great sons of the Rhineland, providing us a glimpse of the Rhine Valley Carnival even in July.

On the flagship of the German Rhine fleet, we had the banquet while cruising and conversing on the waves. Many of us experienced ballroom dancing as a genuine FUSION task. Since this ship also served Benedict XVI when visiting Cologne in 2005, we gave the gift that he received then, a faithful copy of a Roman vase, to the former presidents of ISIF, among whom Yaakov Bar-Shalom seemed like a pope of fusion.



Wolfgang Koch and Peter Willett.

We believe we arranged an extraordinary technical program, with 262 presentations in six tracks. Organizing a top-class conference is a wonderful experience, one of the last real

adventures in modern life. It required many hands, heads, and hearts to make it a success.

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## FUSION 2009, SEATTLE, WA

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### CHEE-YEE CHONG, GENERAL COCHAIR

FUSION 2009 was held in Seattle, WA, after the Great Recession and during a pandemic. Despite these challenges, the conference managed to set a record in the number of submitted papers, attendance, sponsorship, and surplus due to the tireless effort of the organizing committee and some luck.

Seattle was selected as the conference location partly because it is the headquarters for Boeing, which agreed to sponsor the reception at the Museum of Flight. With Boeing as the lead, the conference also attracted other corporate sponsors, such as Northrop Grumman, BAE Systems, the Cardiff University Brain Research Imaging Centre, the Georgia Tech Research Institute, and Metron. U.S. government research sponsors with international offices—the Air Force Office of Scientific Research, Army Research Laboratory /ARO, and ONR—also provided financial support. It was fortuitous that commitments for support were made before global stock markets crashed in October 2008. Since then, U.S. government agencies have changed their policy and stopped sponsoring the FUSION conferences, including W. Dale Blair, Chee Chong, Robert Lobbia, DiAne Lobbia, S. Jay Yang, Kuo-Chu Chang, Roy Streit, and Mahendra Mallick.



FUSION 2009 organizing committee, including W. Dale Blair, Chee Chong, Robert Lobbia, DiAne Lobbia, S. Jay Yang, Kuo-Chu Chang, Roy Streit, and Mahendra Mallick.

The conference invited three plenary speakers from government, industry, and academia. The government speaker was Dr. Charles Morefield, director of the Information Processing Techniques Office (IPTO) at DARPA. IPTO funded breakthroughs that are technology enablers for information fusion, including the Internet and artificial intelligence. Charles wrote the paper that laid the foundation for track-oriented multiple hypothesis tracking. The industry speaker was Dr. Larry Stone, chief executive of Metron and a member of the U.S. National Academy of Engineering for his contributions to search theory. In 1986, he

produced the probability maps used by the Columbus America Discovery Group to locate the *SS Central America*, which sank in 1857, taking millions of dollars of gold coins and bars to the ocean bottom 1.5 miles below. The academia speaker was Dr. Chris Urmson from Carnegie Mellon University and Google, who led the team that



Tammy Blair (center).

won the DARPA Urban Challenge in 2007. He was one of the original leaders of Google's self-driving car project, which later spun off into Waymo in 2016. His plenary talk had little mention of machine learning, which has become the key technology for self-driving vehicles. The technical program also did not have any papers on machine learning.

2009 was also a year with a pandemic. In spring 2009, a

novel influenza (H1N1) virus emerged. It was detected first in the United States and spread quickly across the United States and the world. Even though it spread quickly, eventually infecting more than 60 million people over 1 year in the United States alone, the mortality rate was low compared to COVID-19. Since there were no travel restrictions, conference attendance was not affected and set a record. However, some people



Robert Lynch.

fell sick during the conference. Tammy Blair, the administrative chair, was infected and died a few days after the conference. ISIF established the Tammy Blair Best Student Paper Award in her memory.

Despite the record attendance and financial sponsorship, the record surplus of FUSION 2009 would not have been possible without the extensive use of volunteers for conference management. In particular, Tammy did everything from hotel contract negotiations, to CD cover design, registration support, and too many other things to list. Bob Lynch, the general cochair, was so stressed out that he announced at the conference banquet that he would retire from ISIF. Fortunately, he changed his mind and continued to make important contributions to ISIF operations until he passed away in 2015. The ISIF Robert Lynch Award for Exceptional Service was established in his memory. Most

conferences after FUSION 2009 have used conference management companies to support conference administration so that the organizers can focus on the technical program.

## FUSION 2010, EDINBURGH, UNITED KINGDOM

### SIMON MASKELL, GENERAL CHAIR

FUSION 2010 was hosted in Edinburgh, Scotland, and thanks primarily to the IET's help, was an overtly professionally run conference that attempted to enable ISIF to demonstrate maturity beyond its years: ISIF was 13 years old in 2010. Perhaps unsurprisingly, the conference did suffer from the global recession. It constrained the financial headroom compatible with FUSION 2010 making a surplus, and this limited the physical space allocated for some parallel sessions.

However, just like every young teenager coming to terms with financial reality, FUSION 2010 also offered glimpses of an exciting future, perhaps best evidenced by the plenary sessions. Andrew Blake spoke about technology that was subsequently integral to the release of the Kinect console (which was released later in 2010 and went on to sell 8 million units in its first 60 days).

In the plenary panel session, experts in their respective methodological fields struggled to solve a (deceptively) simple-looking fusion problem involving just three datapoints and a high-impact decision. A particularly memorable moment was when one perceptive panelist asked why we were



David and Elizabeth Krout.



Evangeline Pollard, Roy Streit, and Paul Bui Quang.

using math to tackle a problem that is inherently about psychology. Paul Newman spoke about technology for autonomous cars (and has since, among other accolades, gone on to develop the first autonomous vehicle permitted on public roads in the United Kingdom). In that context, FUSION 2010 showed us all that we, as a community, had the capacity to make a difference.



David Salmond, Neil Gordon, Simon Maskell, and Yvo Boers.

### FUSION 2011, CHICAGO, IL

#### DARIN DUNHAM, GENERAL COCHAIR

The FUSION 2011 conference was held in Chicago, IL, and was remarkable in many aspects. The opening reception was on the 99th floor of the Willis Tower and provided the option for attendees to get their picture taken on the glass ledge. The banquet dinner was on Navy Pier, and we had a Blues Brothers-style band that entertained everyone. At one point, there was good conga line dancing. The inaugural 5K race began



Peter Willett, Sunshine Smith-Carroll, and Darin Dunham.

with Kannappan Palaniappan edging me out for the win by 1 second. About 20 people went to the Chicago White Sox game the evening of the last day of the conference. It was great fun introducing several Europeans to America's pastime.

Sunshine Smith-Carroll and I volunteered to be chairs, and we didn't have much experience. However, we were well advised by Peter Willett.

The rest of the organizing team was Lance Kaplan, Neil Gordon, Juan Vasquez, Dale Blair, Wayne Blanding, Roy Streit, and David Hall. Coming out of the recession, we thought attendance would surpass 400, as there were 398 people at Edinburgh the previous year. Registration ended up at 364, which was a little disappointing, but we had a great time.

### FUSION 2012, SINGAPORE

#### GEE WAH NG, GENERAL COCHAIR

It was fun organizing FUSION 2012 in Singapore, ideally placed to act as a bridge between west and east. FUSION 2012 attracted a higher volume of participants from Asian countries, besides the regular attendees from Europe and America. The organizing committee worked hard to make the event successful and one of the most memorable, exceeding 500 participants, the highest in the FUSION conference history to that point.

For the first time, we had the program information on mobile apps, in addition to the usual hardcopy. We had the banquet at the Grand Copthorne Hotel, along the Singapore River. Participants loved the 30-minute boat ride. As a Singaporean, I also took such a boat ride for the first time and enjoyed the city view as we cruised along the river.

At my banquet table, I discovered that my general cochair, Prof. Yaakov Bar-Shalom, had taste buds that were unmatched for Asian spicy chili. He took a whole lot of the red-hot chili seeds and said that was still below his expectation on the level of spicy hot. Quietly, I was worried for him, because he had to speak the next morning at the conference. Of course, he proved me wrong, and his voice was as clear as usual the next day, including Yang Rong, Mahandra Mallick, Gee Wah Ng, Yaakov



FUSION 2012 attendees eating durian fruit, including Yang Rong, Mahandra Mallick, Gee Wah Ng, Yaakov Bar-Shalom, Sze-Kim Pang, and Brian Ang.



Gee Wah Ng.

Bar-Shalom, Sze-Kim Pang, and Brian Ang.

I also remember the durian session we had with some conference participants. Durian is the “king of fruits,” with a strong odor, and FUSION 2012 fell in durian season.

I also love the T-shirt designed for the FUSION 2012 conference’s working committee members and helpers. To this day, I still have the T-shirt with the phrase “Fusion 2012” clearly printed. Once

again, I would like to thank every FUSION 2012 participant, the ISIF board members, and the working committee members who made the event successful and a memorable one.

**FUSION 2013, ISTANBUL, TURKEY**

**MURAT EFE AND ROY STREIT, GENERAL COCHAIRS**

FUSION 2013 will be remembered as the one that almost got away, as prolonged public protests and clashes between protesters and riot police in the month or so before the conference nearly had it canceled. It did not help that the clashes were in Taksim Square, which looks on a map to be close to the FUSION conference venue and almost across the street from one of the conference hotels. The conference went on after the bold decision by the organizing committee not to cancel and the even bolder decision by the ISIF board to go ahead.

Despite many individual cancellations, 362 people registered for the conference and had an excellent time. A few even boasted that they took part in protests, dodging police-fired gas canisters. In addition to these problems, the travel plans of many U.S. authors and attendees were unexpectedly disrupted through no fault of their own by funding sequestration that was imposed by the U.S. government just days before the confer-



Ottoman Marching Band in the main conference hall.

ence was to begin. Many hurried accommodations had to be made, but the conference was held and nearly all accepted papers were able to be presented.

The Askeri Müze (Military Museum), which was a war academy during the Ottoman times, was chosen as the conference venue, and the opening reception was held in the garden of the museum. The first day witnessed a show by the Ottoman Marching Band displayed in the main conference hall. The gala dinner was held on an island of the Bosphorus where people had to be taken by boats. A live performance attracted many people to the dance floor. Many conference attendees, along with their companions, enjoyed Istanbul and other attractions all around Turkey before and after the conference.

Memories of Istanbul are precious and extend beyond the conference: a tour of the justly famous Grand Bazaar and a possibly overzealous carpet salesman, a delightful boat cruise on a lovely day up the Bosphorus to the edge of the Black Sea that put 2,000 years of history on display, the delicate and exquisite beauty of the Blue Mosque and awe-inspiring antiquity of the Hagia Sophia, and hotel rooftop dinners with good friends overlooking the Hippodrome and the Obelisk of Theodosius.



FUSION 2013 group picture.

This undoubtedly touristy list is incomplete in one special way—it does not describe the joy evident in the citizens of Istanbul as they celebrated Ramadan, which in 2013 encompassed the days of the conference. As the afternoon daylight drew to a close, many establishments set out small tables in public spaces so that, precisely at dusk, the observants would break their daytime fast. Summer days are long, the city is dazzling, and food shared with others is a deep cultural bond. Yes, memories of Istanbul have lasted long after the end of the conference. It is but one example of why ISIF is truly an international society.

**FUSION 2014, SALAMANCA, SPAIN**

**JESUS GARCIA HERRERO, GENERAL COCHAIR**

Organizing the 17th edition of the FUSION conference in 2014 was an experience full of challenges and joy, since it

## Information Fusion History

was the first time that Spain was the host country for this conference. The proposal was developed by a Spanish-based team (Universidad de Salamanca and Universidad Carlos III de Madrid), inspired by Prof. James Llinas (also with Spanish origins) to combine the standards of our ISIF conference with the local taste of Spanish traditions. The city of Salamanca was selected as an ideal place for this purpose, with a record of hosting international conferences while providing a condensed offering of Spanish history, culture, and services for visitors.



FUSION 2014 attendees and organizing committee, including Fernando de la Prieta, Jose Manuel Molina, Joachim Biermann, Jesus Garcia, James Llinas, Javier Bajo, Kellyn Rein, Geoff Gross, and Eric Little.

We received 386 registered attendees who came from more than 30 countries, with the biggest numbers from United States, Germany, China, Spain, France, the United Kingdom, and Sweden. The conference venue was in the historic part of the city, at the center of the cultural, economic, commercial, and social life.



Tractor-guided tour to see bulls.

The social program included receptions at historic buildings of Salamanca and offered cocktails and Flamenco concerts in known pubs of the city. The place for the banquet dinner had a happy surprise for attendees: Villar de los Alamos was a typical place dedicated to growing purebred Spanish bulls and horses and offered a guided tour on tractors with trailers for visitors to see the bulls in their living place.

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## FUSION 2015, WASHINGTON, DC

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### PAULO COSTA, GENERAL COCHAIR

FUSION 2015 was held in the capital of the United States, organized by George Mason University's Center of Excellence in Command, Communications, Computing, Intelligence, and Cyber, with the support of IEEE's AES Society. All conference activities occurred on a dedicated floor at the Grand Hyatt, which is located walking distance from the Washington Mall and provided the focus and convenience to leverage the richness of the technical program. The conference's 389 attendees were presented with 282 articles (out of 357 submissions), across a schedule that included 12 tutorials, 22 special sessions, and various parallel activities. The three plenary speakers, Moshe Kam, Colleen Keller, and Edward Cope, lent their unique spark of excitement to its technical program.

The social program included a reception housed at the Mansion on O Street. Its 100 rooms and more than 70 secret doors offered a unique blend of music museum, executive lodging, restaurant, retreat venue, bed and breakfast, tourist attraction, and treasure hunt locale. Yet the most anticipated event of the social program was the gala dinner, which was held at the National Portrait Gallery.



Giuliana Pallotta, Kathryn Laskey, Anne-Laure Joussemme, Paulo Costa, Thia Kirubarajan, David Crouse, and Pieter de Villiers.

Dinner was served in the Robert and Arlene Kogod Courtyard, an enclosed courtyard with an elegant glass canopy offering a uniquely sophisticated atmosphere. The night's main attraction was a 17-musician jazz band performing a range of numbers that covered various periods of American music.

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## FUSION 2016, HEIDELBERG, GERMANY

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### UWE HANEBECK, GENERAL COCHAIR, AND FLORIAN PFAFF, LOCAL ARRANGEMENTS COCHAIR

FUSION 2016 was a large and spectacular event in Heidelberg with various highlights that people still talk about today. Hei-

Heidelberg is perhaps one of the most symbolic cities in Germany, situated in the heart of Old Europe. Near Germany's oldest and one of its most reputed universities, Heidelberg represents the very idea of European university life that is fusing ideas, attitudes, and mentalities from many countries. Moreover, the romantic ruins of Heidelberg's castle symbolize the successful fusion of former enemies that has become the root of modern Europe.

As the venue for FUSION 2016, we selected the Kongresshaus Stadthalle Heidelberg (Heidelberg Convention Center) as it is centrally located and can be reached easily.



FUSION 2016 welcome cocktail.



Fredrik Gustafsson in the Kongresshaus main room.

With its sumptuous, late 19th-century architecture and flashes of art nouveau brilliance, the Kongresshaus formed a stunning backdrop for more than 20 tutorials and 300 oral presentations that were organized in 44 regular and 22 special sessions. Thirteen function rooms provided 2,500 m<sup>2</sup> of floor space for our 451 participants and 28 registered accompanying people. Various industry sponsors supported the event financially and with exhibitions during the event. Memorable social events include the 5K run along the river, the welcome reception in the spacious foyer at the conference venue, and the gala dinner at the Technic Museum Speyer.



Uwe Hanebeck.

## FUSION 2017, XI'AN, CHINA

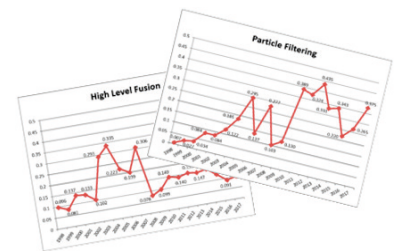
### X. RONG LI, GENERAL COCHAIR

What was most unique, memorable, and interesting at FUSION 2017 was its 20th-year special program to celebrate the anniversary. Well, this was debatable: While our preparation of the special program was in full swing, a well-known fusion expert (Shozo Mori) pointed out that 2017 marked the 19th (not the 20th) anniversary of the FUSION conference, because the first anniversary was the second FUSION conference (FUSION 1999). This was devastating for us yet rigorous in the academic sense, albeit a distinction often overlooked in practice. By the same token, the new millennium started in 2001, not 2000 as everyone thinks. As an engineering professor, I wanted both practicality and academic rigor, so the "20th Anniversary Program" was renamed the "20th-Year Special Program."



Song of Everlasting Sorrow show.

The work for this special program was most challenging and time consuming, so much so it was probably more than all other work combined for organizing FUSION 2017. The most challenging item was the "Area Trend in Information Fusion," including in particular: identifying representative topical areas, finding objective ways to reveal the trend, collecting relevant data, and making valuable observations about the trend. Knowing the value of such a trend analysis for the fusion community, the organizing team spent countless hours on this task and sought outside help. Following the principles that the results should (a) be as objective as possible, (b) show the time trend of each area, and (c) allow meaningful comparisons between areas, the team decided to use the same number (finally settled at six) of keywords (phrases) to represent each area and show their relative occurrences to indicate trends.



FUSION topic trends [2].



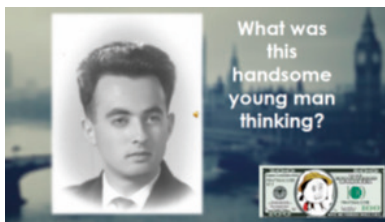
## Information Fusion History

The special program also had many other components, including providing the following of all FUSION conferences up to 2017: important facts (e.g., organizing teams, plenary talks, best [student] paper awards, tutorials, and special sessions); useful statistics (e.g., countries, organizations, and people who contributed most, as well as topics that were most popular, as reflected in the form of word clouds); recognition of those who contributed most in conference attendance, technical contributions, or conference service; and obituaries of fusion experts. All these are still available on the FUSION 2017 website under ISIF.org, and a report of the program appeared in *ISIF Perspectives on Information Fusion* [2].



20 years of FUSION word cloud.

Another unique, important, and memorable component of FUSION 2017 was the “Workshop on Fusion, Tracking, and Estimation—A Tribute to Yaakov Bar-Shalom,” in recognition of his meritorious contributions at his 75th birthday. The workshop consisted of an afternoon session and an evening session. In the afternoon session, Yaakov made a presentation, and a representative group of his Ph.D. graduates and former research associates—Kuo-Chu Chang, Jean Dezert, X. Rong Li, and Thia Kirubarajan—each made an academic presentation as a tribute to the professor. As the organizer, I also made welcome remarks and presented important facts of Yaakov’s academic contributions as a scholar and as a teacher, such as books, publications, and students, including in particular his academic genealogy and two word clouds, one for the keywords in his publications and the other for his research collaborators. The evening session was full of fun and enjoyed by everyone there. An interview of Yaakov with interesting questions was conducted. A recorded dancing performance of several of his Ph.D. graduates and research associates in a cartoon style was presented. Based



Movie in tribute to Prof. Yaakov Bar-Shalom.

on a real record with many representative photos of Yaakov, starting from his infant time, a movie of an imaginary story

was shown about a “lost kid YBS” coming back that inspires young people to follow in his footsteps to pursue their romance.

## FUSION 2018, CAMBRIDGE, UNITED KINGDOM

### LYUDMILA MIHAYLOVA, GENERAL COCHAIR

The 21st International Conference on Information Fusion was in the memorable city of Cambridge, United Kingdom. The general chairs for the event were Prof. Simon Godsill, Prof. Simon Maskell, and myself.



Karl Granström, Emre Özkan, Simon Godsill, Lyudmila Mihaylova, and Erik Blasch.

It was attended by more than 500 participants from academia, industry, and other organizations. The conference was remarkable in many aspects—from the venue to inspiring discussions, sessions, and networking opportunities, well attended by both academics and industrial representatives. FUSION 2018 took place in the Department of Engineering at the University of Cambridge, which is centrally situated on Trumpington Street.



Welcome reception at St John's College.

The city of Cambridge has attractive architecture, both ancient and modern. Cambridge is at the heart of the high-technology center dubbed Silicon Fen, with its economic strengths from industries such as software and bioscience and many start-up com-



Simon Godsill introducing the keynote of Neil Gordon.

panies that have spun out of the university. The dinner was held in the Duxford Museum. Participants were able to enjoy reception drinks under the wings of some of the world's most iconic aircraft, including a Concorde, before being seated for dinner.

The celebration of the 25th anniversary of particle filter was one of the remarkable events, with a talk by Neil Gordon, David Salmond, and Adrian Smith. It sparked interesting discussions and inspired ideas for the next generations of methods beyond particle filters. FUSION 2018 showed that the vibrant fusion community is expanding across multiple disciplines.

**FUSION 2019, OTTAWA, CANADA**

**ELISA SHAHBAZIAN, GENERAL COCHAIR, AND MIHAI FLOREA, LOCAL ORGANISATION CHAIR**

In July 2019, Canada hosted the FUSION conference for the third time, after Montreal in 2001 and Quebec City in 2007. Ottawa, Canada's capital, is a hub of knowledge-based industries, research institutes, and higher education, with more engineers than any other Canadian city, many active in information fusion and related fields. It was thus a natural choice for welcoming the international community of information fusion on July 1, Canada Day. The Shaw Centre offered a perfect venue in downtown Ottawa, near the Rideau Canal. James Llinas and myself were general

cochairs, supported by Mihai Florea as local organizer. The attendance was quite high (above 400 participants), as was the number of submissions received (372). We proposed a rich program focused on advancing multi-disciplinary and innovative methods for solving the most challenging problems in the field, inclusive of methods that could be called disruptive to traditional concepts in data and information fusion. We favored student participation with initiatives such as the student pass, which allowed students to attend three tutorials at a very low cost. During coffee breaks, FUSION 2019 attendees could visit exhibits



Elisa Shahbazian.

and demonstrations in the hallways and discuss posters with their authors, as well as visit the booth for the next year's conference (2020). The invited conference keynote and panel speakers discussed novel data fusion methods, as well as challenges for fusion in novel application domains. The keynote of Tracey Lauriault from Carleton University, Ottawa, Ontario, on data fusion in the open smart city context led to the first interview of the *Perspective* magazine, published in issue 3. The 5K run took place early in the morning on the first day of the conference on the shores of the Rideau Canal, which connects Ottawa to Lake Ontario and the Saint Lawrence River at Kingston, Ontario.

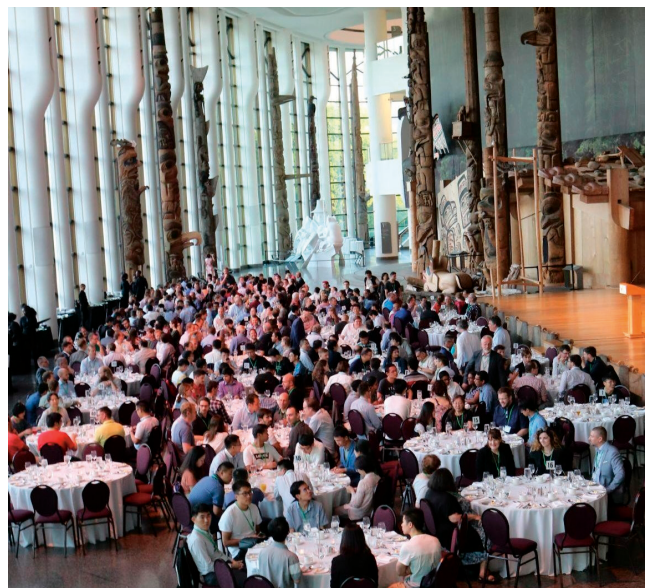


Mihai Florea.

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FUSION 2020 booth.



Ottawa's Canadian Museum of History.

The gala dinner was held at the Canadian Museum of History. The museum's spectacular Grand Hall and River Salon houses the world's largest indoor collection of totem poles. Guests had the chance to visit the museum prior to the gala dinner. The museum was open for the participants to browse before dinner.

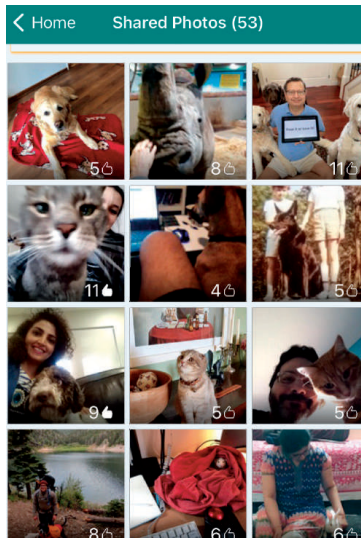
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### FUSION 2020, VIRTUAL

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#### PIETER DE VILLIERS, GENERAL COCHAIR

ISIF hosted its 23rd International Conference on Information Fusion online, July 6–9, 2020. On April 2, 2020, the ISIF Board of Directors and the South African Local Organising Committee, in consideration of the effects of the COVID-19 pandemic, decided to proceed with the FUSION 2020 conference hosted as a virtual online event. Dr. Paulo Costa, the 2020 ISIF president, announced, “Witnessing the strong participation of our community, ISIF and the FUSION 2020 organization jointly opted for conveying the conference in a virtual format only, while keeping all the technical program intact.” The program did not deviate substantially from the original conference agenda, with the only component omitted being the social events. The conference was attended by 278 people and featured 16 tutorials and 169 papers that were viewed by attendees from 24 countries.



“Pose with your pets” competition.

The hosting of FUSION 2020 was an exciting prospect since our successful bid to the ISIF Board of Directors in Xi'an, China, at the 2017 FUSION conference. I clearly remember the anticipation and relief as we heard that our bid was successful. The subsequent years were filled with an increasing level of work and commitment to plan and prepare for this conference, and it was our greatest wish to offer the regular and new attendees a conference experience that they would not forget. Alas, COVID struck and our hopes were dashed. We scurried to get the infrastructure in place for a virtual conference and managed to get the support of the board to postpone the onsite event to 2021. Little did we know that the pandemic would still persist throughout 2021. Nonetheless, we managed to host the online event, and there was quite significant social media interaction among attendees via the Whova app we used. Thanks to our loyal and capable army of reviewers, we managed to keep the technical quality of accepted papers at the high standard that was a hallmark of previous FUSION conferences.

I have some charming memories of social interactions that resulted from the “pose with your pets” competition initiated by Alta de Waal on the conference app. It was also satisfying to see the presentations and attend discussions on the live question-and-answer (Q&A) sessions, in which the paper presentations were discussed. These ran mostly smoothly because of the excellent efforts of the session chairs. I was pleased that the efforts of the organizing team and relevant chairs paid off. We managed to keep FUSION alive in the midst of a global pandemic.

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#### ALTA DE WAAL, GENERAL COCHAIR

Hosting an online conference when no one could fathom such a concept only 3 months prior is a stressful experience. Multiple time zones and parallel tracks added to the complexity. It was a deep disappointment not to host the conference after we had so many plans to make it special and memorable in South Africa. However, as Napoleon said, “A genius is the man who can do the average thing when everyone else around him is losing his mind.” We are no geniuses but strived to provide a platform for the fusion community to engage their research—as best as we could—when it would not have been frowned upon to skip the conference. We are proud of that we kept up the FUSION conference momentum, which is the heartbeat of the community, during the pandemic.

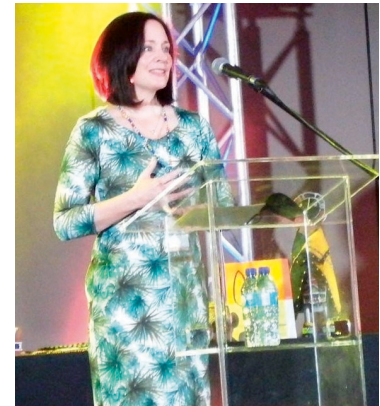
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### FUSION 2021, SUN CITY, SOUTH AFRICA

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#### ALTA DE WAAL, GENERAL COCHAIR

The ISIF hosted its 24th International Conference on Information Fusion at the Sun City Convention Centre in Rustenburg, South Africa, November 1–4, 2021. The conference was attended by 214 people, of whom a quarter attended onsite. We were still able to attract 211 paper submissions, of which 146 were accepted. This equates to an acceptance rate of 69%. FUSION 2021 was hosted at a superb conference venue, the Sun City Convention Centre. Sun City is situated a mere 200 km from Johannesburg and borders Pilanesberg National Park, allowing participants to see the Big Five animals of Africa.



Alta de Waal.

The physical hosting of FUSION 2021 was constantly on a knife edge, and looking back, the conference dates were planned perfectly in a period when the COVID wave in South Africa was at its lowest. Two weeks later, the Omicron variant hit South Africa, and it goes without saying that the onsite dream would have been destroyed. Although the

physical presence was small, it encouraged more interaction, especially between students and more experienced researchers. It was a special and intimate conference, although the presence of online attendees could be felt through the hybrid format.

**PIETER DE VILLIERS, GENERAL COCHAIR**

Never in the history of the FUSION conference was it ever expected of an organizing committee to arrange two successive FUSION conferences. That opportunity fell into the lap of the South Africa FUSION organizing team. The onsite 2020 conference was first postponed to July 2021 and then November 2021 because of the COVID pandemic that simply did not want to relent. We were offered a fortunately timed window in November, when infection rates dropped to almost zero in South Africa, just before the Omicron variant struck. We managed to assemble a group of local and international attendees at Sun City, Rustenburg, South Africa, and the group of about 70 was large enough to feel like a small crowd. The rest of the 200+ participants attended virtually.



FUSION 2021 attendees, including Keith LeGrand, Samantha LeGrand, Lisa Leishman, Robert Leishman, and Molahlegi Molope.

Those who managed to travel to the venue were treated to exquisite meals; hot, sunny weather; luxury accommodation; and breathtaking game viewing in the neighboring Pilanesberg National Park. The onsite component also allowed those who attended virtually to have the feeling that there were people in



Leopard sighting on the golf course.

the room and stimulated live questions and discussions. This was an improvement over what was possible the previous year, where the prerecorded presentations and the Q&A sessions were somewhat disjointed.

On the way to the boma braai (bonfire and barbecue), some attendees were treated to a rare leopard sighting on the golf course. The knowledge of this event made some hesitant to attend the FUSION fun run, which took place on the same golf course the next day. However, others improved on their times. The gala dinner was a treat. The food and wine were exquisite, and there was live entertainment by impressive gumboot dancers. It was a night to remember. Where FUSION 2020 survived on life support, the 2021 conference received a jolt, and the heart of the conference has started beating again. We look forward to the conferences in Linköping, Sweden, and Charleston, SC, where FUSION will be on the mend and going from strength to strength.

**FUSION 2022, LINKÖPING, SWEDEN**

**FREDRIK GUSTAFSSON, GUSTAF HENDEBY, AND TERENCE VAN ZYL, GENERAL COCHAIRS**

It feels like a long time has passed since we presented our winning bid in Cambridge, United Kingdom, in 2018. Indeed, the COVID-19 pandemic has interrupted our planning in many ways. First, the conference was postponed 1 year to give South Africa a second chance to organize an onsite conference. Second, it has been difficult to plan with so many uncertainties involved, since many issues around the local arrangement depend on how the pandemic will develop. Luckily, we have close collaboration with the local conference organizer, conference venue, and hotels, whose staff have been understanding. There have been no extra costs for the cancellation in 2021, and no binding contracts have had to be signed.



FUSION 2022 conference venue.

At the time we wrote these lines (March 2022), we had around 230 paper submissions for the 2022 conference. We had expected about double the amount. It seems that the aftermath of the pandemic is still affecting many potential authors. There are travel restrictions in place, concerns about new COVID waves, and possibly a new era that has started with less traveling, particularly overseas. In any case, the organization committee and the ISIF board have a strong preference to get back

## Information Fusion History

to the old normal again, with a fully onsite conference. To be prepared for provable circumstances, such as travel restrictions and visa issues that would prevent onsite participation, we will allow for prerecorded presentations. Unfortunately, there will be no provisions for virtual attendance. We hope that this will give the attendees the usual conference experience, with negligible risk for technical struggles and avoiding the somewhat impersonal feeling in mixed onsite–online sessions. We have marketed FUSION 2022 as the most normal FUSION conference ever. Let’s hope this comes true.

## PHOTO CREDITS

(In alphabetic order) Chee-Yee Chong, Stefano Corraluppi, Paulo Costa, Jean Dezert, Darin Dunham, Murat Efe, Rob Evans, Mihai Florea, Jesus Garcia, Fredrik Gustafsson, Uwe Hanebeck, Alexandre Jouan, David Krout, X. Rong Li, Gee Wah Ng, Florian Pfaff, John Sudano, Pieter de Villiers, Alta de Waal, and Peter Willett.

## REFERENCES

1. Chong, C.-Y. Early history of International Society of Information Fusion. *Perspectives on Information Fusion*, Vol. 1, 1 (June 2016), 37–42.
2. Li, R. X., and Han, D. The 20th-year special program of FUSION 2017. *Perspectives on Information Fusion*, Vol. 2, 1 (June 2019), 5–13.

1	FUSION 1998	Las Vegas, Nevada, USA	Dongping Daniel Zhu, Rabinder N. Madan
2	FUSION 1999	Sunnyvale, California, USA	Dongping Daniel Zhu, Mark Bedworth, Xiao-Rong Li
3	FUSION 2000	Paris, France	Alain Appriou, Jean-Pierre Le Cadre, Jean Dezert
4	FUSION 2001	Montréal, Quebec, Canada	Jacques Hurtebise, Éloi Bossé, Elisa Shahbazian
5	FUSION 2002	Annapolis, Maryland, USA	Xiao-Rong Li
6	FUSION 2003	Cairns, Queensland, Australia	Rob Evans
7	FUSION 2004	Stockholm, Sweden	Per Svensson
8	FUSION 2005	Philadelphia, Pennsylvania, USA	John Sudano, James K. Beard
9	FUSION 2006	Florence, Italy	Stefano Corraluppi, Peter Willett
10	FUSION 2007	Quebec City, Quebec, Canada	Éloi Bossé, Alexandre Jouan
11	FUSION 2008	Cologne, Germany	Wolfgang Koch, Peter Willett, Jürgen Grosche
12	FUSION 2009	Seattle, Washington, USA	Chee-Yee Chong, Robert Lynch
13	FUSION 2010	Edinburgh, Scotland, UK	Simon Maskell
14	FUSION 2011	Chicago, Illinois, USA	Darin Dunham, Amy Sunshine Smith-Carroll
15	FUSION 2012	Singapore	Gee Wah Ng, Yaakov Bar-Shalom
16	FUSION 2013	Istanbul, Turkey	Murat Efe, Roy Streit
17	FUSION 2014	Salamanca, Spain	Juan M. Corchado, Jesus Garcia, Jose Manuel Molina
18	FUSION 2015	Washington, DC, USA	Paulo Costa, Kathryn Laskey
19	FUSION 2016	Heidelberg, Germany	Uwe Hanebeck, Wolfgang Koch
20	FUSION 2017	Xi’an, China	Xiao-Rong Li, Roy Streit
21	FUSION 2018	Cambridge, England, UK	Simon Godsill, Lyudmila Mihaylova, Simon Maskell
22	FUSION 2019	Ottawa, Ontario, Canada	Elisa Shahbazian, Jim Llinas
23	FUSION 2020	VIRTUAL	Pieter de Villiers, Alta de Waal, Fredrik Gustafsson
24	FUSION 2021	Sun City, South Africa	Pieter de Villiers, Alta de Waal, Fredrik Gustafsson
25	FUSION 2022	Linköping, Sweden	Fredrik Gustafsson, Gustaf Hendeby, Terence van Zyl

25 FUSION conferences, locations and chairs.