

TOWARDS A GLOBAL AGENDA FOR FIRE RESEARCH

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Introduction

The purpose of my remarks is to report on some recent activities of the FORUM for International Cooperation in Fire Research, and suggest a strategy for building support for the sorts of research being discussed at this Conference. These remarks are based in part on a paper developed by Ken Richardson for the FORUM entitled, "A Prospectus for a Global Fire Research Agenda"[1], on discussions deriving from that paper at the FORUM meeting in Taipei in August of 2000, and additional thoughts of my own.

By way of overview, first I will say a few words about the FORUM, its perspective on the need for fire research and a global fire research agenda--where we are on it today and proposed action steps. Paul Croce will touch again on this topic in his closing remarks.

Forum for International Cooperation in Fire Research, FORUM

The Forum for International Cooperation on Fire Research, FORUM, was established about 14 years ago as an informal organization to provide a means for sharing on mutual issues and needs, communication, and cooperation among the world's leaders of fire research programs or facilities [2]. Membership includes 15 members from Canada, China, Finland, Germany, Italy, Japan, New Zealand, Norway, Sweden, Taiwan, United Kingdom, and the United States and 24 corresponding members. The FORUM meets annually at the site of one of its members and co-hosts a national symposium for bringing international attention and expertise to issues concerning the advance of fire safety engineering in the host's country. Nine members from 7 nations participated in the 13th meeting, which took place in Taipei, in October 2000. Past symposia have addressed issues such as advancing fire safety engineering, performance-based codes, and developing fire research capacity.

One of the most notable products of the FORUM was a survey of computer-based fire models written by Ray Friedman of Factory Mutual Research Corporation (FMRC) in 1990 and updated by popular demand by him in 1991 [3][4]. The documents have been widely used and cited in the fire safety engineering community. More recently, the FORUM has initiated cooperative research projects involving a number of member institutes. The most recent of these is a project being led by Dr. William Pitts of the National Institute of Standards and Technology (NIST), on heat flux measurement. (I will say a bit more about this project and other FORUM activities later in this presentation.) Also, the FORUM actively supports the activities of its members' staff who participate in the International Council for Research and Innovation in Building and Construction (CIB) Working Commission W14 on Fire and related International Organization for Standardization (ISO) activities in TC 92 on Fire Safety. I have had the honor to chair the FORUM since its inception until now. My successor as chair of the FORUM is Paul Croce of Factory Mutual Global who will provide a complementary perspective on the future for fire research in his presentation at the close of this Conference.

From the very beginnings of the FORUM, members have been plagued by lack of resources for fire research. In fact, one of the points we used to form the FORUM was to leverage our scarce research funds and reduce or eliminate needless duplication. Since that time, a number of member institutes which had been public sector organizations have been privatized, and as a result have become much more like consultancies than research institutes. Two others have ceased to exist. Simultaneously, funding for fire research has diminished somewhat as well.

Two years ago, at our meeting hosted by the Building Research Establishment (BRE) in Garston, UK, we concluded that the FORUM should develop a global fire research agenda; one that could be marketed among multi-national corporations as well as national governments to complement what we can do collaboratively on existing funds. We commissioned Ken Richardson, formerly of the Institute for Research in Construction (IRC), Canada, to develop a draft prospectus we could use to move this idea forward. His report [1] was reviewed by FORUM members and discussed in our meeting in Taipei last fall. This presentation is the first airing of the resulting proposal to establish a Global Agenda for Fire Research.

Fire Problem

There are many ways fire interferes with our lives or livelihoods. Collectively, these comprise the total burden of fire. Topping the list is loss of life and injury, including the unacceptably high rate of death and injury to fire fighters. Next comes property loss. In addition to the direct loss of property to fire is the impact of such losses on the interruption of function to business or essential service in some cases resulting in loss of market or even business failure. Further, fire protection is not cheap. Today in most cases the costs of fire protection are some multiple of the direct costs of property loss due to fire. Fire and fire protection requirements influence owners and contractors in ways that can reduce productivity, and/or raise serious environmental limitations or impacts. Fire safety and security often involve competing influences and/or requirements. Finally, fire safety requirements and standards can have significant impacts on access of products to markets and international trade. In short, the implications of fire and fire safety are pervasive and costly.

To put the magnitude of this issue in context, a number of years ago, I commissioned a study in the United States to try to get a sense of the total magnitude of the economic burden of fire in the United States [5, 6]. The results were staggering. Whereas, the total loss of life and injury to fire has decreased somewhat over recent decades, they remain unacceptably high with some 4000 deaths, including about 100 fire fighter deaths, annually and on the order of 100,000 debilitating fire injuries. In the U.S., direct fire losses to property today are over \$10 billion [7]. However, the total economic burden of fire turned out to be a whopping \$128 billion. This figure does not include a number of the items mentioned above. For example, it does not account for productivity, environmental or security impacts, what the U.S. Government, especially the military, spends for fire safety, or the economic implications of fire safety requirements and standards to product manufacturers.

Clearly, in an increasingly competitive global economy, the burden of fire is a factor that must be taken more seriously!

A hint of the relative impact of fire among different nations is provided by the figure below from Richardson's study [1].

Impact of Global Fire Problem

<u>Country...</u>	<u>Fire Costs as % of GDP*</u>
United States	.80
Canada	.91
Japan	.78
Sweden	.63
United Kingdom	.66

*Wilmot 1999.ENBRI 1999

Obviously, all other factors being the same, any nation that spends a disproportionate share of its resources on fire safety puts itself at a competitive disadvantage!

FORUM Plan for a Global Fire Research Agenda

FORUM Vision

The vision of the FORUM is to use science and engineering to address this issue. Our vision for the future is one in which the problem of fire is appropriately harnessed and includes the following conditions:

- Fire Science and Fire Safety Engineering are globally practiced,
- Products and Facilities are “Engineered for Fire Safety,”
- Consequently, there are minimal fire losses, and fire safety is provided cost-effectively, and
- Barriers to innovation and trade imposed by current fire safety codes and standards are gone.

This would be a wonderful state of affairs, but what will it take to achieve this vision? The FORUM proposes development of a Global Fire Research Agenda and a Global Network of Fire Research to support and implement it. Even though there has been remarkable progress in fire science and engineering in recent decades as evidenced by many other papers in this conference, we still have a long way to go, and an array of issues remain, including for example the following:

- Inadequate knowledge of and data on fire losses, risks and costs,
- Bewildering array of, mostly empirical, tests, methods, standards, practices,
- Costly, duplicative systems for product acceptance,
- Costly, often less than fully effective fire protection and high risk fire fighting practices,
- An undefined fire research agenda and no roadmap or resources dedicated to it.

Underpinning most of these issues is the fact that the work of fire research is far from completed. Despite the existence of computer-based fire incident-reporting systems in a number of countries, the knowledge and data needed to reliably predict fire risk simply does not exist. Fire research efforts around the world are meager relative to the challenge, and sadly many of these are duplicative, nor are they well coordinated or collaboratively focussed on mutually agreed needs and priorities. We simply lack a common framework and agenda for pursuing our mutual interests in fire safety.

Goal

The goal for the proposed Global Fire Research Agenda is simply, to provide the technical basis and practical tools for breakthrough reduction in the losses and costs of fire globally.

In light of the foregoing the drivers for this effort include, to...

- Reduce the human and economic losses to fire,
- Reduce the burdens of fire and fire safety on business and multi-nationals,
- Open access to global markets for product manufacturers,
- Reduce risk exposure,
- Enable deregulation/reform, and leverage scarce resources,
- Enhance the public good and quality of life.

Strategy

The FORUM proposes as a strategy for accomplishing this goal the following steps:

- Form Global Network and organization to service it.
- Develop the Global Fire Research Agenda.
- Develop participation in and financial support of it.
- Form collaborative teams to carry out the research and deliver results.

Research Agenda

The FORUM has already given some thought to the objectives and content of such a global agenda as outlined below:

Objectives of Research Agenda and Major Research Topics

1. Incident and risk data, and supporting infrastructure.
Web-based data - incident, denominator, and cost;
Risk modeling tools;...
2. Facilitate development of innovative products and services.
Better, lower cost, lower loss, e.g. designer polymers, advanced composites,...
with demonstrated value added,...
3. Develop tools for product acceptance and differentiation.
Test methods and standards that are scientifically-based, harmonized, and with
legacy links;
Tools for market value, evaluation of performance in use...
4. Develop improved fire protection and fire fighting technologies.
Advanced suppression, sensing, control;
Suppressant delivery,
Fireground tools & electronics, advanced equipment..
5. Enable and promote performance-based codes and regulations.
Verified quantitative tools and models, data, demonstrations, value added,
consistency...
6. Provide human objectives and behavioral data and tools.
Desired/acceptable levels of risk, values
Fire & risk perceptions; behaviors, tenability, motivation,...
7. Conduct use-inspired fundamental fire research to support above.
Mechanisms, Fire dynamics, Consequences,...

This research agenda addresses some of the same themes identified by the Society of Fire Protection Engineers (SFPE) described earlier in this conference by James Quiter, specifically, risk, human behavior and fundamental fire research. Whereas, the SFPE Workshop [8] explicitly identified "data," the FORUM agenda in topics 2, 3, 4 explicitly identifies additional target audiences in addition to fire protection engineers - i.e., material and product producers, fire protection technology manufacturers, and the fire services.

Already, and within the existing members' resources, the FORUM has initiated a series of projects addressing aspects of this agenda as follows:

1. Collaboration on Heat Flux Measurement. (William Pitts, NIST)
2. Web site inventory of ongoing fire research. (Richard Bukowski, NIST, CIB W14)
3. Cataloging fire research data and protocols for fire incident data/reporting. (Russell Thomas, IRC)

4. Global strategy for product fire safety acceptance. (Paul Croce, FM Global)

I'd like to comment briefly on the first and last of these projects. The heat flux measurement project is the result of a FORUM-sponsored international workshop on *Measurement Needs for Fire Safety* that was held at the National Institute of Standards and Technology (NIST) on April 4-6, 2000 [9]. The purpose of the workshop was to identify measurement issues of sufficient mutual interest among a number of FORUM members to justify collaborative research. The major issue to emerge from the workshop was measurement of heat flux, an issue that arises in a number of different fire tests at various scales. Once the topic was identified and interested parties identified, a second workshop was held, this time at BRE in the UK to outline the project plan and participation. Representatives from BRE (UK), FM Global (USA), NIST Building and Fire Research Laboratory (USA), Southwest Research Institute, State Key Laboratory of Fire Science (China), SINTEF (Norway) and the SP Swedish Testing Laboratory (Sweden) attended the planning session. The participating Forum laboratories recognized a need to make accurate measurements of heat flux having well characterized measurement uncertainties. They noted a surprising lack of consistency between the laboratories with regard to heat flux gauge calibration facilities and operating procedures. The potential effects of these differences for inter-laboratory experimental measurement comparison are unknown. The members of the planning session unanimously agreed that there was much to be gained by a coordinated effort designed to improve the current state of heat flux measurement. The group concluded to gain endorsement of the project by the FORUM, complete a round robin of heat flux gauge measurements within 12 months and write a report shortly, thereafter. The group is planning to reconvene in Edinburgh, Scotland, in September 2001. At that time, progress will be reviewed and the next steps for the effort identified [10].

The project, 'Global Strategy for Product Fire Safety Acceptance,' was initiated at the Taipei meeting of the FORUM in 2000. This issue arose from the reaction of FORUM members to the development within the EU of the so-called "single burning item test." This is a new empirical test, being developed to resolve issues within the EU, which is likely to confront all nations via international standardization. Many wonder if it wouldn't be better to work together to address the real issues of flammability measurement rather than have our resources preemptively redirected to review, each from a national perspective, a new empirical test method. This issue led to a review of the options we all face for end use approval of new products for flammability. They include:

1. Ad hoc tests. Such tests are often misleading, wasteful and not directly related to actual fire conditions of concern. Nonetheless because they are often simple, inexpensive or have for decades been widely used, they predominate.
2. Small and/or intermediate and large-scale tests. These may be better models of reality. But, typically they only provide information about very limited real conditions. They tend to be more costly yet, again largely due to decades of use and are widely relied upon.
3. Property data coupled with model of intermediate test which is correlated with large scale. This approach has more scientific appeal and is possible now for limited areas of application for which verified fire models exist. It is beginning to gain acceptance though difficult issues arise with comparisons to legacy data from Options 1 and 2.
4. Small-scale property data combined with modeling of context of use. This is the ideal, but has not yet been achieved except for a few limited cases.

The FORUM discussion of this issue led to a group consensus on the following points:

1. Approval tests get ingrained. Once established they are difficult if not impossible to remove or even revise. Also, they create burdensome legacy issues.

2. FORUM members should encourage and advocate use of most practicable scientifically based technology (i.e., Options 4, 3 or failing that 2).
3. In moving from prescriptive towards performancebased codes and standards more scientifically based tests are required to provide data required for predictive models (Options 3 & 4).
4. It is the FORUM's intent to promote development and use of tools - accurate data, tests, models - as basis for establishing equitable performance levels needed to support performancebased codes and standards.
5. Rather than accede to tradition FORUM members bear responsibility to demonstrate the value of using most practicable, scientifically rigorous technology.
6. Research labs need to serve interests of all parties - industry, regulators, and society.
7. Research laboratories have further responsibility to advance the science needed to progress.

The FORUM's rationale for this position is based on a number of points. First, globalization is not yet complete, but coming fast and actions in one nation or continent have serious and often costly repercussions on us all. Currently, there are three major global markets - EU, Americas, and Asia/Pacific. Practically, it would be good for there to be focussed research efforts within each of these major markets so that methods proposed for international standardization do not co-optimely result in unfair competitive advantage. Adoption of an inadequate test doesn't necessarily improve safety and can add unreasonable burden of cost to manufacturers of products. Failure to press this FORUM position in one market may preclude options for others, or result in parochial or less suitable and more costly tests for product acceptance.

The FORUM members drafted these points in Taipei. Paul Croce agreed to draft a position paper based on these points. (Paul will have more to say on this topic in his presentation at the close of the conference.) Following this conference, the FORUM plans to approach the Inter-jurisdictional Regulatory Coordination Committee (IRCC) and/or World Federation of Testing and Accreditation Organizations (WFTAO) to join in sponsoring a study of impact of proceeding with less than best practicable technology, and to convey to them and to ISO the FORUM's views on this issue.

Global Network

Consequently, the FORUM has outlined a strategy and plan for establishing the Global Fire Research Agenda and the needed infrastructure to make it work. How do we propose to make this happen? The FORUM suggests the formation of a Global network of organizations and individuals who care about fire safety research and see the value of it and/or are committed to doing something about it. We envision the network lacing together participants from a wide range of types of organizations including the following:

- Research Laboratories and Centers
- Academic Centers
- Product and Fire Testing Laboratories
- Corporate Research & Development Centers
- Fire Service Organizations
- Standards Developing Organizations
- Insurance Industry
- Representatives of "at risk" Populations
- National Government and Corporate sponsors

Already the FORUM has begun to contact specific firms and individuals from such groups and so far the responses have been encouraging. However, it is clear this is a major undertaking and success will not come easily. We foresee a number of key issues that must be overcome to be successful in this enterprise. They include the following:

1. Leadership – an effort of this nature needs a high level, highly visible, well-known champion to carry the message forward and to ignite support for it. Already we have identified potential candidates and are hopeful to have a leader in position within the next few months. We will look to that person to take this paper and Ken Richardson's earlier work to prepare a detailed prospectus and plan for moving the agenda forward.
2. Participation - and Commitment – an early task for the leader and the FORUM members will be to build up participation in and financial commitment to this effort.
3. Results – an essential requisite for success, of course, is that the effort produce results, including relatively near term value add to the sponsors. Considering burdens of fire and the prospects for impact from a focussed, concerted fire research effort such as that outlined above, we believe this is doable.
4. Advocacy – Since fire is a global problem and a significant issue for many in international trade we believe it essential to have broad multi-national support for this effort. That support should come from multinational corporations, national governments, and major national and international organizations.
5. Resources – Obviously, this effort is going to have a price. The FORUM members are seeking to leverage their collective resources by joining with others in a directed research program that will enable what no one of us can do by going it alone.

Towards developing advocates and/or potential sponsors, the FORUM sees as potentially compelling value propositions for each of the target sponsoring groups, the following:

Multi-National Corporations (Owners, Constructors, Suppliers...)

- reduce the burden of regulation
- reduce cost of trade barriers
- enhance or sustain market access, position

National Governments, International Agencies...

- reduce human and economic burden of fire,
- to leverage diminishing resources, more efficient regulation,...
- reduce waste in system, sustainability - longer life more cost-effective, ...
- enhance trade position
- reduce vulnerability to disaster, terrorists, etc.

Fire Services...

- reduce firefighter losses
- enhance profession

Towards selling the global agenda, we believe it necessary to (a) build on existing funds through collaborative research ventures, e.g., modeled after the approach used by the International Energy Agency; and (b) obtain new funds. Specific early target opportunities may include, drawing from the above listing, for example,

- Direct economic benefits, e.g., to well-known global “owners” - Hilton, Marriott; “users” - testing labs, insurance companies.
- Facilitate international trade, e.g., for manufacturers of wire & cable, electronic equipment, fire protection equipment,

- Provide Public Policy Issue appeal, e.g., by addressing specific issues relevant to national governments,
- Reduce losses, e.g., by responding to expressed needs of specific governments, such as, Thailand, China, or other governments facing unusually large fire losses; or supported by organizations like the International Technical Committee for the Prevention and Extinction of Fire (CTIF).

Action Steps

The FORUM has outlined a specific action plan for the coming months to move this idea forward, which includes the following steps:

1. Find champion.
2. Review and improve the prospectus & research agenda.
3. Identify and visit with key potential sponsors of agenda.
4. Revise and adapt agenda to meet their concerns.
5. Form virtual global network organization. (link to existing organization e.g. SFPE, FPRF, CIB, ...)
6. Build active support/funding for agenda.
7. Establish modus operandi for program management.
8. Develop proposals and form project teams.
9. Monitor progress, deliver results.

Obviously, this is not a finished work. Much remains to be done and a number of difficult issues need to be resolved. For example, the prospectus needs to be sharpened and offer clearer value propositions to specific potential sponsors. It will be important to gain sufficient support and advocacy from private sector bodies to build advocacy from governmental bodies. Also, there are many operational details to be worked. For example, how will project selection be handled, and using what criteria and processes? How will project teams and leaders be selected, and by whom? There are further issues dealing with matters such as intellectual property and the possibility of flow of funds across national borders. It will probably be desirable to form an alliance with an existing international body, such as SFPE, CIB or others to address some of these matters.

Conclusion

I have offered a case for a global fire research strategy and agenda. There is no question of the need, or of the potential for practical benefit. I believe the FORUM has made a good start. It is seeking to build on this effort by working with others. Action steps have been defined. Surely this vision and plan can be improved, but we need to start somewhere. Clearly, the focussed energies of many are needed to support its development.

Finally, the FORUM is seeking broad participation and input. We invite your comments and suggestions. Most importantly, we seek your partnership and commitment to this effort. Together we can do it. If we don't who will? Who else can? I believe we must. Thank you.

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