

A proposal to create a new Workshop series called the “***International Workshop on Measurement and Computation of Fire Phenomena***” (abbreviated as the MaCFP workshop)

## **Background and motivation**

The general objective of the “*International Workshop on Measurement and Computation of Fire Phenomena*” (abbreviated as the ‘MaCFP workshop’ series) is to establish a structured effort in the fire science community to advance fundamental progress in fire modeling. This is to be achieved by gathering experimentalists and modelers together to identify the key research topics of interest and knowledge gaps and thereby establish a common framework for fire modeling research. The MaCFP workshop is intended as an open and international collaboration between fire scientists; it is intended as a series of workshops, with a planning meeting taking place in 2015, with the first workshop taking place in 2017, and with follow-up workshops organized every 2 years.

## **Objectives**

The central objective of the MaCFP workshops is to target fundamental progress in fire science and to advance predictive fire modeling. Thus, improved understanding of fire related phenomena is the main goal, rather than ‘scenario driven’ research. Still, the prediction or reconstruction of fire scenarios will obviously benefit from the expected progress. As such, this workshop series is intended to be complementary to the existing V&V guide as developed for FDS (<https://code.google.com/p/fds-smv/>), as well as to the existing FM Global Open Source Fire Modeling Workshop series (<https://sites.google.com/site/firemodelingworkshop/>). The MaCFP workshops are envisaged to provide a fundamental basis for creating new tools in support of various applications such as the development of efficient fire protection solutions, the development of the Performance-Based Fire Safety Design approach, the evaluation of fire resistance of materials and structure, and others.

The specific objective of the MaCFP workshop is to focus on the improvement and validation of CFD-based fire models. The expected outcomes are:

- Development of a digital library of well-documented fire experiments that can be used as targets for models;
- Development of advanced fire models that are soundly based on fundamental science and rigorously tested against experiments;
- Development of best practices in both experimental and computational fire research;
- Active participation and support of a significant segment of the fire science community and promotion of fire science.

Validation-related topics of interest for the first MaCFP workshop include:

- The clarification of what is meant by validation and the identification of target fire experiments
  - Simple building block problems (e.g. fundamental experiments to test and improve physical and chemical sub-models, both in the gas phase and the condensed phase) versus complex real-world fire tests;
  - A range of experiments from reduced-scale (*e.g.*, laboratory-scale) experiments up to full-scale experiments;
  - Configurations with controlled or uncontrolled fuel flow rates, *i.e.*, with gaseous fuel or with liquid/solid fuel;
  - Blind tests versus fully documented tests.
- The identification of the kind of experimental data that may be needed for validation:
  - Local versus global quantities;
  - Data quality standards in terms of resolution (in space and in time) and uncertainties ;
  - Measurements of fluctuation intensities (in addition to mean quantities);
  - Completeness of the data base (*e.g.*, global measurements of fuel flow rate, heat release rate, flame length, vent flows and/or air entrainment rates; local measurements of flow velocity, temperature, chemical species, soot particles, heat fluxes, *etc.*);
  - Measurements in the solid phase (pyrolysis) and liquid phase (liquid fuel as well as suppressants) and their interaction with gas phase phenomena.
- The identification of the kind of modeling standards and methodology that may be needed for validation:
  - Guidelines for the documentation of the selected numerical schemes and the treatment of boundary conditions;
  - Guidelines for the design of the computational grid and the demonstration of grid convergence;
  - Guidelines for the selection of physical sub-models to treat unresolved processes, *i.e.*, processes associated with the turbulent flow, fuel-air mixing, combustion, soot formation, thermal radiation, *etc.*;
  - Guidelines for the treatment of condensed fuel sources, *i.e.*, evaporation or pyrolysis processes, as well as suppressants (e.g. sprinkler sprays, water mist spray).

- The publication of a list of existing experimental databases that the fire science community would recognize as well-documented target fire experiments suitable for validation of CFD-based fire models;
- The gathering of experimental data records and the creation of an internet-based digital library of well-documented target fire experiments recognized as suitable for validation of CFD-based fire models;
- The identification of problems/models for which data are lacking and for which new experimental campaigns are needed, and the definition of research priorities following the identification of gaps.

In order to ensure progress and quality in the outcome of the MaCFP workshop series, specific targets should be established, for example for 2 years after the 2015 planning meeting and then from every workshop to the next.

The MaCFP workshop is modeled after the successful example of the TNF Workshop (<http://www.sandia.gov/TNF/abstract.html>). The TNF Workshop was established approximately twenty years ago in the combustion science community and has since then emerged as an exceptionally effective framework for the collaborative development and promotion of the field of turbulent combustion. The TNF Workshop offers: (1) a digital library of well-documented target flame experiments; (2) examples of comparisons between experimental measurements and simulation results; and (3) the active participation and support of the entire turbulent combustion scientific community in the data collection and analysis.

### **Format, audience and funding**

We envision the MaCFP workshop as a 2-day workshop that would be organized immediately before or after a well-attended international fire research meeting, for instance the IAFSS Symposium. In a preliminary step, we propose to organize a planning meeting in 2015 as a stand-alone event with participation by invitation only. The planning meeting will define the objectives and focus areas of the first MaCFP workshop, as well as define the scope of the preparation work needed. The first MaCFP workshop would then be organized immediately before or after the 12<sup>th</sup> IAFSS Symposium in Lund, Sweden. The exact date and location of the 2015 planning meeting are yet to be determined. The organizing committee for the planning meeting is composed of Bart Merci (Ghent University, Belgium), Jose Torero (University of Queensland, Australia) and Arnaud Trouvé (University of Maryland, USA).

The exact format of the workshops is also yet to be determined but is likely to be a mix of poster/oral presentations by researchers, one or two plenary talks by invited keynote speakers and group/panel discussions, guided by plenary introductions and concluded by reports of main outcomes. It is intended to be centered around in-depth topical discussions. Proceedings will be edited and put online on a dedicated workshop website. The proceedings are intended to review progress, summarize

the accomplishments of the workshops and provide guidance with clear objectives for the next workshop.

The target audience is the experimental and computational fire research community. The workshops will be open and participation will be encouraged by proper advertisement, for instance by publishing a Letter to the Editor in reputable outlets like the IAFSS Newsletter and Fire Safety Journal. The organizing committee will prepare a program and make final decisions on invited speakers, discussion leaders and panelists. We envision an audience of approximately 50 researchers.

To encourage participation, we propose to hold the workshop without a registration fee. Participants will be expected to fund their own travel expenses. The organizing committee will look for sponsorship in order to support operational costs (rental of meeting space, catering of meals and coffee breaks, *etc*).

This proposal was produced by a Task Group that was formed (informally) following discussions that took place in February 2014 at the 11<sup>th</sup> IAFSS Symposium in Christchurch, NZ. In particular, discussions that took place during the February 9 workshop entitled “Benchmarking/Data Sharing” (<http://www.iafss.org/symposium/11th-symposium/>) form the basis of the proposal.

### **Task Group structure**

The co-leaders of the Task Group are:

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The Task Group members are:

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