# Performance-Based Fire Safety Design – Current Status and Future Research Needs

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## Abstract：

The progress in fire safety science in the second half of the 20th century lead the fire safety communities in numerous countries throughout the world to establish performance criteria for fire safety. The idea was that engineering calculations should replace the prescriptive code solutions and thereby make designs more flexible and less expensive. However, two major obstacles have created significant challenges to the new approach, which therefore still can be thought of as being in its infancy:

Fire is a very complex phenomenon, involving chemical reactions, heat transfer and fluid dynamics. To further the complexity, the time scales of fires span the range from chemical reaction times (~microseconds) to the fire duration times (hours, days), and the physical scales span the range from the flame thickness (~millimeter) to that of the fire's extension (kilometer for wildland fire). As such, the first major obstacle is our fundamental understanding of a range of fire phenomena.

The human desire and need for constant progress and unique experiences in a global society has led to architectural expressions, extreme living and enhanced transport needs. As such, mankind are building taller buildings, longer tunnels, and more complex infrastructures, all at the same time as we want to preserve our cultural heritage buildings and explore, and perhaps live in, outer space. As there is no means to do experiments to understand all the nuances in this progress, fire safety design has to rely on modeling. Hereby lays the second major obstacle, as research studies have shown that the current models have significant shortcomings when it comes to predicting temperatures, heat release rates and species production, even for relatively simple configurations.

In order to improve the fundamental understanding and modeling capabilities, a concerted international effort in fire science that includes training of researchers and engineers is needed.

## Biography

Grunde Jomaas 副教授于 2008 年获美国普林斯顿大学博士学位，2008-2009 年在巴黎中央理工学院从事博士后研究，2009 年加入丹麦工业大学任助理教授，现为丹麦工业大学土木工程系副教授。目前主要研究方向包括宇航飞船及空间站火灾安全、层流预混火焰的传播及稳定性等。现任欧洲航天局（ESA）和美国国家航空和宇宙航行局（NASA）“宇航飞船火灾安全”合作研究项目协调人、Fire Technology 编委和 IAFSS Newsletter 编委等职。迄今已在 Proceedings of the Combustion Institute、Combustion and Flame、Journal of Fluid Mechanics、Physics of Fluids 等学术期刊发表论文近 20 篇，被 SCI 引用近 300 次，并做邀请报告 15 次。

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