SMARTFIRE

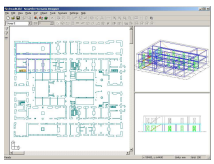
Fire Safety Engineering Group
The University of Greenwich
London SE10 9LS

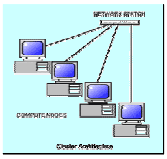
SMARTFIRE: The SMART CFD system for Fire Modelling

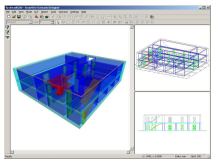
SMARTFIRE is an advanced Computational Fluid Dynamics (CFD) fire simulation environment developed by the Fire Safety Engineering Group (FSEG) at the University of Greenwich. Unlike other CFD software, used to simulate fire, SMARTFIRE has been ***specifically designed and developed*** as a Fire Simulation Tool ***to be used by Fire Engineers*** and is based on more than 30 years of CFD fire modelling experience of FSEG.

SMARTFIRE provides the fire engineer with a desk-top fire-laboratory enabling rapid turnaround of fire simulation analyses. SMARTFIRE has many unique features designed to make problem specification, execution and analysis straightforward and efficient, allowing the fire engineer to concentrate on design issues rather than wrestling with CFD and software issues.

SMARTFIRE Capabilities Include:





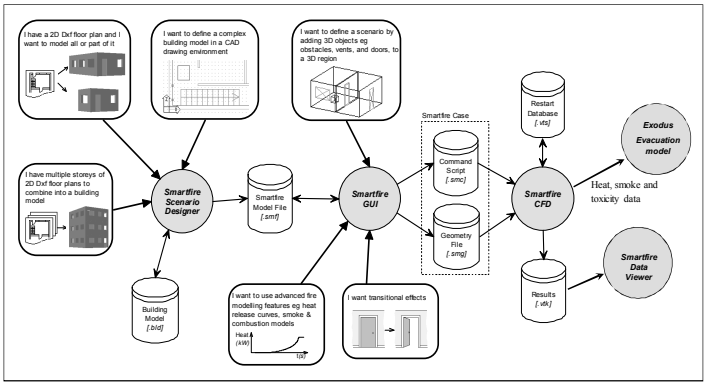


- **CAD interface that allows complex geometries to be rapidly modelled;**
- **Expert automatic mesh generator tuned to the requirements of fire analysis;**
- **Extremely user friendly graphical user interface allows rapid specification of physical and numerical parameters. Provides for interactive graphical monitoring of solution progress;**
- **Parallel computing capability which can dramatically reduce run times;**
- **Semi-automatic link to the EXODUS suite of evacuation software allowing complex fire data to be effortlessly imported into evacuation simulations;**
- **A choice of three radiation models**
- **Gaseous combustion models.**
- **Toxic gas generation prediction models;**
- **Sprinkler and water mist modelling capability;**
- **A powerful post processing visualisation environment providing the engineer with rapid access to the results.**

SMARTFIRE Research and Development:

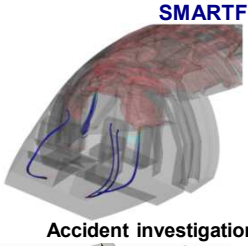
FSEG have an on-going commitment to research and development in Computational Fire Engineering. This R+D supports the continual development of the SMARTFIRE software. Features currently under development and nearing completion include:

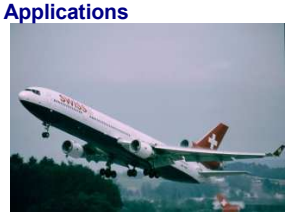
- **Fully unstructured mesh capability;**
- **Solid fuel combustion models;**
- **LES turbulence models;**
- **Experiment Engine solution control;**
- **Hybrid Field-zone model.**



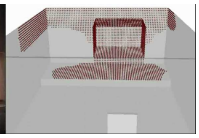
User interaction with the *SMARTFIRE* suite of tools

SMARTFIRE Applications

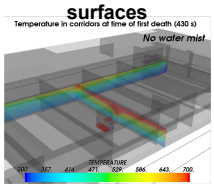


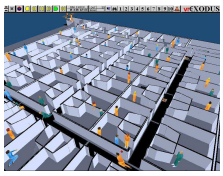


Accident investigation (Swiss Air crash in Canada)

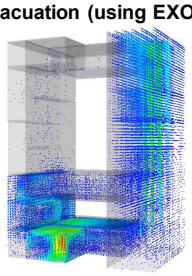


Rhode Island night club fire simulation: 800K contour; comparison of experiment and SMARTFIRE prediction showing combusting surfaces

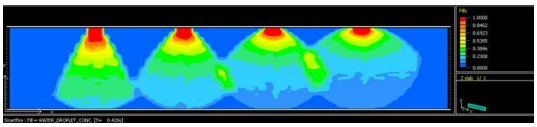


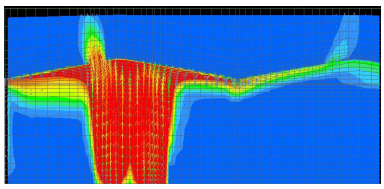


Fire and evacuation (using EXODUS) analysis of passenger ships



Fire Safety performance analysis of building designs





The SMARTFIRE Tool Set

SMARTFIRE is composed of three main software components :

The Pre-Processing tools

The ***Scenario Designer*** can be used to facilitate importing 2D CAD building plans into the SMARTFIRE system.

The ***GUI*** and the embedded Automated ***Meshing tool*** are coupled into a highly intuitive tool capable of creating highly complex modelling scenarios. Linkage to the ***EXODUS*** suite of evacuation models can also be specified.

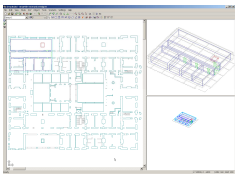
The CFD engine

The ***CFD*** Engine provides fully interactive control and solution monitoring including 2D slice visualisations, interactive 3D data visualizations and line graphs. A ***parallel CFD*** engine is also available to allow office based PCs to work together as a powerful computing resource.

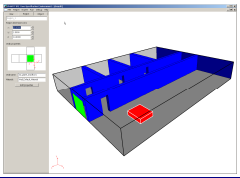
The Post-Processing tools

The post-processing can be performed using the CFD engine or for Virtual reality style graphics the ***Data Viewer*** can be used. The data viewer allows the easy production of VR style graphics and animations for effective client facing.

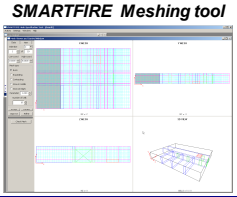
SMARTFIRE Scenario designer



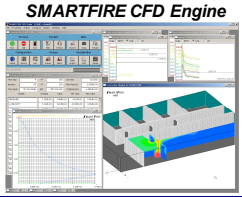
SMARTFIRE GUI



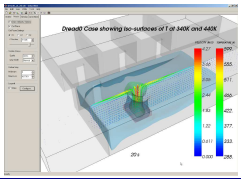
SMARTFIRE Meshing tool



SMARTFIRE CFD Engine



SMARTFIRE Data Viewer



THE QUEEN'S ANNIVERSARY PRIZES FOR HIGHER AND FURTHER EDUCATION 2000 & 2002

WINNER OF IT AWARDS 2001 BCS THE BRITISH COMPUTER SOCIETY

THE EUROPEAN IST PRIZE WINNER

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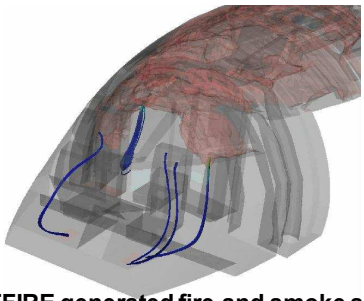
•A WORLD LEADER IN COMPUTATIONAL FIRE ENGINEERING

•The Fire Safety Engineering Group (FSEG) of the University of Greenwich was founded by Prof Galea in 1986. The research and consultancy interests of the 30 strong team are focused on the development and application of Computational Fire Engineering (CFE) tools for the simulation of evacuation, non-emergency circulation of people, combustion, fire/smoke spread, structural response to fire and fire suppression. High profile applications of FSEG skills and technology in the built environment, aerospace, marine and rail sectors include:

- ***9/11 WTC*** – evacuation analysis
- ***Airbus A380 super jumbo*** - evacuation analysis
- ***SwissAir MD11 disaster inquiry*** – fire analysis
- ***New Royal Navy aircraft carrier (CVF)*** – evacuation analysis
- ***Ladbroke Grove rail disaster inquiry*** – fire/evacuation analysis
- ***Sydney Olympic Stadium*** – evacuation analysis

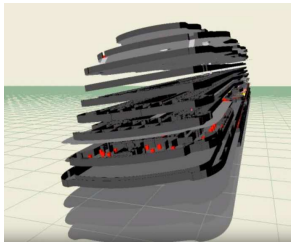


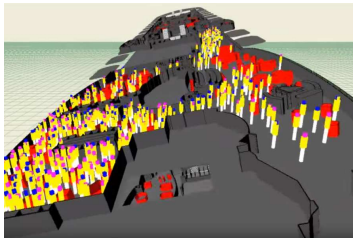
SMARTFIRE generated fire and smoke spread in above ceiling aircraft space

•INTERNATIONAL RESEARCH AND CONSULTANCY

•FSEG is one of Europe's leading centres of excellence in CFE. It is also one of the largest university-based groups dedicated to the modelling of fire and related phenomena in the world. FSEG has published over 330 academic and professional publications on fire and related topics. Since 2010 FSEG has generated over £10 million worth of research and consultancy funding and its research and consultancy activities have been supported by a client base including:

•EADS, BAe Systems, BA, Buro Happold, BMT, Canary Wharf Management Ltd., EPSRC, EU, European Space Agency, Mitsubishi, LPC, MCA, NHS, Arup, RINA, Borealis, Rockwool, Thales, The Engineering Link, MOD, Lloyds Register, CAA, FAA, FRA, Boeing, NTSB, Bombardier, Canadian Dept of Trans, US Dept of Trans, Canadian Transportation Safety Board, US Federal Rail Administration.





•maritimeEXODUS: Simulation of assembly while vessel is heeling

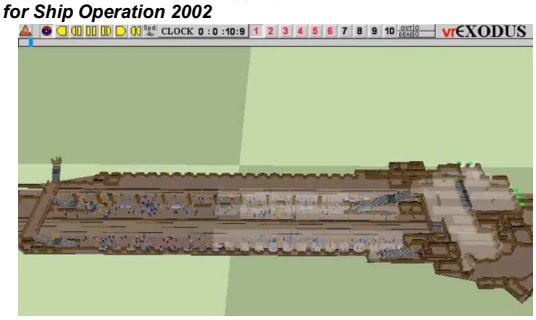
Examples of FSEG research and consultancy projects include:

- Analysis of naval/passenger ship design for evacuation
- Fire/smoke analysis for underground stations
- Evacuation analysis of high-rise buildings
- Fire/evacuation design and certification analyses for aircraft
- Circulation/evacuation analysis for airports and subways
- Analysis of evacuation provision for hospitals
- Prediction of toxic gas generation resulting from cable fires
- Full-scale and experimental scale evacuation trials in aircraft, buildings, ship and rail environments.

•AWARD-WINNING SOFTWARE

•Research undertaken by FSEG has lead to the development of the CFE software: SMARTFIRE, buildingEXODUS, airEXODUS, maritimeEXODUS and railEXODUS. These products are distributed world-wide by FSEG to customers in 35 countries. FSEG's innovation has been recognised through a number of prestigious awards:

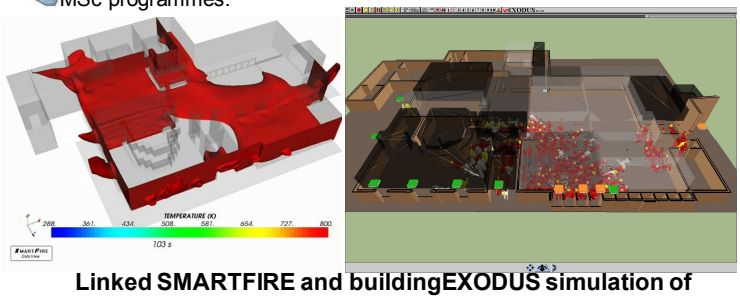
- ***International Journal of Maritime Engineering Medal of distinction 2014***
- ***The Guardian University Award for Research Impact 2014***
- ***SFPE Bono Award 2008***
- ***Royal Aeronautical Society's Gold Award and George Taylor Prize 2006,***
- ***IST prize 2004 awarded by the EU and the European Council of Applied Sciences, Technology and Engineering***
- ***Queen's Anniversary Prize 2002***
- ***British Computer Society IT Award, 2001***
- ***Royal Institution of Naval Architecture/Lloyds Register Safer Ship Award 2001***
- ***Communications & IT in Shipping Award for Innovation in IT for Ship Operation 2002***



•buildingEXODUS: Occupant interaction with SMARTFIRE generated fire, smoke and toxic gases during evacuation from a station

KNOWLEDGE TRANSFER

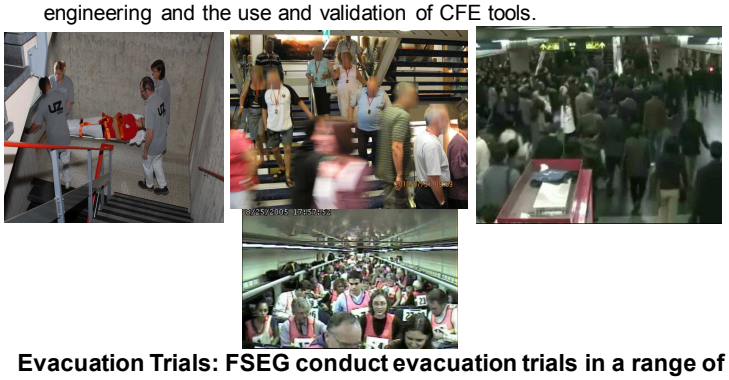
Members of FSEG are actively involved in the supervision of doctoral and masters level research students concerned with fire safety and the development and delivery of fire safety engineering courses, including, short courses for industry, MSc by Research and Taught MSc programmes.



Linked SMARTFIRE and buildingEXODUS simulation of Rhode Island disco fire incorporating smoke, heat, toxic and irritant gases.

HELPING SET INTERNATIONAL STANDARDS

FSEG expertise is sought by standards bodies such as the BSI, ISO, IMO and SFPE and is used to set standards in life safety, fire safety engineering and the use and validation of CFE tools.



Evacuation Trials: FSEG conduct evacuation trials in a range of environments including hospitals, ships, underground stations and rail cars in order to collect human performance data

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