Fire **S**afety **E**ngineering **G**roup

Centre for Numerical Modelling and Process Analysis

Director: Professor Edwin R Galea PhD CMath FIMA MIFireE

the UNIVERSITY *of* GREENWICH

Office 020 8331 8706
FAX 020 8331 8925
Direct Line 020 8331 8730

Our Ref CMS/EG/FB

Date 06 August 2002

PRESS RELEASE

maritimeEXODUS first evacuation model to declare full IMO compatibility

New version launched today is most sophisticated marine evacuation model available

maritimeEXODUS V3.0 is the first evacuation model to declare full compatibility with the IMO interim guidelines on advanced evacuation analysis approved at May's meeting of the Maritime Safety Committee (15 to 24 May 2002 – seventy-fifth session). The interim guidelines apply to all new and existing passenger ships, including ro-ro ferries; they require all advanced analyses to be performed using computer models capable of representing each occupant as an individual and defining the layout of the ship in detail. In addition, they must be able to simulate the interaction between the occupants and the layout and pass eleven prescribed test cases.

Professor Ed Galea, Director of the Fire Safety Engineering Group of the University of Greenwich, the development team behind maritimeEXODUS said that the new version not only meets the guidelines but also exceeds them in three key areas.

"By introducing universal minimum standards IMO has signalled the coming of age of advanced evacuation analysis in the maritime industry. In line with our policy to stay ahead of the regulatory curve the new version of maritimeEXODUS has three key capabilities that exceed the guidelines: the ability to simulate heel and trim, fire, smoke and toxic gases, and abandonment. These capabilities ensure the model remains the most sophisticated marine evacuation simulator available. It has already been used on a wide range of evacuation simulations, from a Thames riverboat all the way up to Royal Navy warships. Our objective is to turn the desktops of naval architects into virtual laboratories in which designers can reach the optimal solution cost effectively, without exposing anyone to the potential dangers of a trial evacuation."

maritimeEXODUS V 3.0

maritimeEXODUS V3.0 tracks the path of each passenger as they gather at their assigned assembly point and await the order to abandon the vessel. The model simulates how individuals interact with each other and the ship's structure, and is the first to include their reaction to list and heel, and hazards such as heat, smoke and toxic gases. It is also the first ship evacuation model to simulate the use of various life saving appliances such as davit-launched lifeboats during abandonment.

To simulate these complex relationships the package uses sophisticated rule-based systems to control the interaction of five advanced sub models (occupant, movement, behaviour, toxicity and hazards). Individuals have knowledge of the ship's layout, an ability to react to communication, individual motivation and queue recommitment behaviour. This level of sophistication contrasts with traditional approaches to evacuation analysis such as 'simple' hydraulic hand calculations that grossly oversimplify the evacuation process, and other modelling approaches that treat thinking humans as fluids flowing through pipes, or mindless automata bouncing around the vessel interior ('ball-bearing' models).

The software draws extensively on data and experience captured in experiments and from real life incidents. For example, the ability to simulate heel and trim is based on data collected from University of Greenwich's partner, BMT Fleet Technology Limiteds SHEBA facility, one of the world's largest marine evacuation simulators. The speed and behaviour of individuals and groups ranging in age from five to 80 years have been analysed (with and without life jackets) in a number of conditions, including list and contra-flow situations.

maritimeEXODUS has two further advanced capabilities:

People circulation in non-emergency conditions: through the introduction of the 'Itinerary' function, Version 3 extends maritimeEXODUS beyond emergency scenarios to normal circulation patterns in ships. This will help to predict how the vessel layout will perform in normal usage such as when the first restaurant sitting ends or the next cinema showing begins. Crew can also be tasked with special functions during emergencies such as damage control or passenger direction.

Advanced virtual reality visualisation: the vrEXODUS virtual reality post-processor enables simulations to be viewed as advanced 3D movies displaying people as actual figures moving and interacting.

The pioneering capabilities of maritimeEXODUS have been recognised in three major awards: the British Computer Society Award for IT in 2001, the CITIS (Communications & IT in Shipping) Award for Innovation in IT for Ship

Operation and Safety in 2002, and the Royal Institution of Naval Architecture/Lloyds Register Award for Ship Safety in 2002. In addition, the UK MOD has endorsed the model as the escape tool that most closely meets it's for the development of warship escape design guidance and assessment.

maritimeEXODUS is jointly marketed by BMT companies FleetTechnology Limited in Canada and SeaTech Limited of the UK, in partnership with the University of Greenwich.

FUTURE DEVELOPMENTS

maritimeEXODUS capabilities are being further enhanced under the European Union project FIRE EXIT. The project's objective is to deliver to the maritime industry a quantum leap in the level of reliability, realism and design utility of today's ship evacuation software. It will take as its starting point the leading edge of current technology - maritimeEXODUS V3.0 in ship evacuation software, SMARTFIRE V3.0 in fire simulation software (also developed by FSEG of the University of Greenwich) and the BMT SHEBA large-scale experimental facility. The FIRE EXIT consortium comprises ten partners from seven countries including University of Greenwich, UK; BMT, Maritime Consultancy, UK; De Noord Ship Yard, Netherlands; TRIBON CAD Vendor, Sweden; DNV, Classification Society, Norway; METTLE, Consultancy, France; MSC, Ship Operator, Italy; BMT Fleet Technology Ltd, Maritime Consultancy, Canada; Marine Institute, Memorial University of Newfoundland, Canada; and National Research Council Institute for Marine Dynamics, Research Facility; Canada. The project involves a combination of theoretical developments and a comprehensive experimental programme of model tests, large-scale tests and full scale ship trials in order to amass data on human performance under dynamic motions, with and without smoke, and on passenger performance during the abandonment phase.

Enquiries:

Prof Ed Galea
Fire Safety Engineering Group
University of Greenwich
30 Park Row
Greenwich SE10 9LS, UK

Phone: +44 (0)20 8331 8730
Fax: +44 (0)20 8331 8925
email: e.r.galea@greenwich.ac.uk
web: http://fseg.gre.ac.uk

Mr. Ian Glen
BMT Fleet Technology Ltd,
311 Legget Drive,
Kanata, Ontario, Canada; K2K 1Z8

Phone: +1 613 592 2830
email: evacuation@fleetech.com
web: www.fleetech.com/ses/

Mr. Gwynne Lewis
BMT SeaTech Ltd,
Grove House, 7 Ocean Way,
Southampton SO14 3TJ, UK

Phone: + 44 (0)2380 63 5122
email: enquiry@bmtseatech.co.uk

BACKGROUND NOTES

The Fire Safety Engineering Group at the University of Greenwich is recognised as a world leader in the field of human behaviour simulation. The modelling philosophy behind maritimeEXODUS has been developed and refined through 12 years of research into understanding and simulating evacuation, as well as the rigours of the peer review process in both academic journals and doctoral examination. maritimeEXODUS carries the pedigree of aviation and building versions of the software, which are regarded as the most sophisticated models in their sectors. airEXODUS and buildingEXODUS have been used on projects in 22 countries, ranging from the Airbus-A380 'super-jumbo' to the Sydney Olympic Stadium.

TECHNICAL NOTES

maritimeEXODUS is written in C++ using Object Orientated techniques, and utilises a rule-based approach to control the simulation. For additional flexibility these rules have been categorised into five interacting submodels that operate on a region of space defined by the geometry of the enclosure. Internally, the geometry is covered in a mesh of nodes. The nodes are linked by a system of arcs. Each node represents a region of space typically occupied by a single person.

FIVE SUB MODELS

Movement specifies how individual passengers move around a space, including speed, overtaking, side stepping, or other evasive actions.

Behaviour determines a passenger's response to the current prevailing situation on the basis of his or her personal attributes. The behaviour submodel functions on two levels: local and global: local behaviour determines an individual's response to his or her local situation, while the global behaviour represents the overall strategy employed by the individual. This may include such behaviour as returning to their cabin to collect a life jacket or moving immediately to an assigned assembly station.

Passenger describes an individual as a collection of defining attributes and variables such as gender, age, max running speed, max walking speed, response time, agility, etc. Some attributes are fixed while others are dynamic, changing as a result of inputs from other submodels.

Hazard controls the atmospheric and physical environment. It distributes pre-determined fire hazards such as heat, smoke and toxic products throughout the atmosphere and controls the opening and closing of exits, vessel orientation etc.

Toxicity determines the effects on an individual exposed to toxic products distributed by the hazard submodel. These effects are communicated to the behaviour submodel, which, in turn, feeds through to the movement of the individual.

FOUR MODES OF OPERATION

A maritimeEXODUS model for a vessel passes through four development phases during its construction:

Geometry Mode, which allows the naval architect to define the physical layout of the vessel. This can be constructed manually using the interactive tools provided, imported from a CAD DXF file or loaded from a library case.

Passenger Mode is used to generate the group of passengers to be used in the evacuation study. As in the Geometry mode, interactive tools are provided to assist with population definition. Entire populations or subgroups of people can also be stored and recalled from a user-defined library. The IMO standard population has been defined as part of the user library.

Scenario Mode is used to control scenario specifics such as exit capabilities, fire hazards, heel and trim orientation etc.

Simulation Mode allows a simulation to be run either interactively or in batch mode. This mode provides the naval architect with an interactive 2D view of the vessel that graphically displays the evacuation as it evolves. The naval architect can also use this mode to specify a range of scenario specific data that can be saved for analysis.