



# Fire Engineering

January 2002, Volume 8



## Distance Learning Completes First Year

The new distance-learning programme in fire engineering has completed its first full year of operation. Among the activities were the two 3-day block sessions for the ENFE 603 Fire Safety Systems class. The class included students who travelled from Auckland, Nelson and Dunedin plus the full-time on campus students. The sessions were organised by the course instructor, Mike Spearpoint, the Fire Laboratory technician, Grant Dunlop and the Fluid Mechanics Laboratory technician Ian Sheppard.

In the first block session, the students examined the performance of different types of heat and smoke detectors to a range of fires and potential false alarms. The students also conducted sprinkler spray discharge measurements and hydraulic calculations in the Fluid Mechanics Laboratory. A range of sprinklers were examined at realistic design pressures and flows in order to assess the uniformity of water delivery to the floor. Raincoats were necessary as some people appeared to be very keen to get as wet as possible.

The second block session included a full-scale wooden pallet fire with automatic sprinkler operation and a comparison test without a sprinkler. Students estimated the expected time



*Mike Lake closely checks the sprinkler operation while Judith Schulz and Yen-Fang Tu provide moral support from a somewhat drier location.*

of sprinkler operation and the student that came closest got their evening dinner paid for by the rest of the class, congratulations Yen-Fang Tu! Finally, Charley Fleischmann demonstrated some of the principles of smoke control systems by filling the fire engineering laboratory with hot artificial smoke and using the fans as an extract system.

Social activities were organised during the evenings so that students, particularly those from off campus, could get to know one another.



*PhD student Tony Parkes shares the benefit of his knowledge while Clayton Wastney, Leigh Clark and Morehu Rangi (L-R) share a more light-hearted moment in the laboratory.*

*Leigh Clark and Luke "it's been a big day" Rutherford get first-hand experience of the fire laboratory filling with artificial smoke while Mike Lake and Fadi Jirjees look in from the outside.*



## Industry liaison

The department keeps close contact with the fire protection industry both locally and internationally. Mike Spearpoint spent a week with Arup Fire in Perth, WA and met up with three ex-graduates from our programme. Mike Spearpoint and Andy Buchanan attended the FPANZ Contractors Group meeting in Christchurch. We keep in regular contact with both the local and national chapters of the SFPE and Mike Spearpoint gave a presentation on mains-powered smoke alarms to the local chapter.

The degree programme is also supported by visitors and assistance from a range of organisations. This year the BIA ran a seminar on the updated Approved Document especially for the students. Hamish MacLennan from Holmes Fire and Safety gave a series of seminars on human behaviour in fire. Roy Dobson of Fire Fighting Pacific was particularly helpful in identifying interesting buildings for the ENFE604 Fire Engineering Case Study course. Russell Gregory of Wormalds NZ provided sprinkler equipment for the Fire Safety Systems course. Local consultants such as Carol Caldwell from Caldwell Consulting and Brady Cosgrove from Cosgrove Major shared their knowledge of fire engineering practice. Contributions from Brian Roff of Christchurch City Council and Mark Chubb and Paul Burns of the New Zealand Fire Service were also appreciated. The students gain much from their interaction with these people.

Jonathan Nyman has been awarded a TIF Scholarship in association with Winstone Wallboards Ltd. Jonathan will be working with Hans Gerlich to investigate the impact of realistic fires on drywall constitution, following on from Bevan Jones' TIF Scholarship last year. Testing will be carried out at BRANZ.

---

## PhD projects

---

**Fabien Dangeron** is investigating relationship between wildfire behaviour and structure survivability, using Gorse scrub fuel as a case study. The overall goal is to combine the factors that affect the likelihood of ignition of structures by scrub fires, by integrating relationships between fire intensity, setback distance, and building construction materials. This study is supported by New Zealand Forest Research with the help of Grant Pearce.



*Fabien sampling material prior to test burn.*

**Linus Lim** is investigating the effect of restraint on the behaviour of fire-exposed concrete floor systems. Linus is constructing six concrete slabs that will be fire tested at BRANZ during the middle of this year. The purpose of these tests is to investigate the effect of tensile membrane action on the fire resistance of floor slabs. The floor slabs comprise flat slabs and proprietary composite steel and concrete systems. They measure 3.3m x 4.3m, with thicknesses ranging from 100mm to 130mm. The programme is supported by the



*Casting of concrete floor slabs*

Heavy Engineering Research Association (HERA), BHP NZ Steel, dimond Industries, Forgan Jones, Speedfloor and Firth Industries. Cartage and storage has been donated by Tim Smith of Smith Crane & Construction Ltd.

For more information please see Linus's web page at <http://www.civil.canterbury.ac.nz/postgrads/linus/>.

**Ee Yii** is working on modelling post-flashover compartment fire. The objective of the research is to model post-flashover fires with realistic fuel types and ventilation scenarios. A computer model using the single-zone modelling concept has been developed. A set of fire experiments has been carried out to investigate the ventilation effects for a post-flashover compartment with both vertical and horizontal vent openings. The experiments use a reduced-scale test compartment 1m by 1m by 1.5m deep, lined with mineral wool board. A 300mm diameter pan, located at the centre-back of the compartment, is constantly fed with heptane liquid fuel. The compartment has two adjustable vent openings, a door vent and a circular roof vent. The door vent is placed at the front end of the compartment; and the roof vent is placed at the centre of the roof. Different combinations of roof and door vent sizes have been tested. Measurements taken during the experiments include the gas temperature inside the compartment, the velocity of gas flow across vent openings and the fuel mass



*Ee Yii standing beside his test furnace*

loss rate. The results will provide valuable information to the study of post-flashover compartment fires. This project is funded by the Foundation for Science, Research and Technology (FoRST).

**Tony Parkes** is continuing his research into compartment fires and is developing a plate thermocouple apparatus to measure the radiant heat flux in his compartment experiments. These plate radiometers consist of a stainless steel sheet with a thermocouple welded to one side. Using heat transfer analysis, the temperature of the plate can be used to calculate an associated heat flux. Small scale cone calorimeter and compartment experiments have been carried out to calibrate the plates. Results to date have shown a good comparison between the plates and a heat flux gauge. The construction of an experimental compartment (dimensions of 2.4m wide, by 1.2m high, by 3.6m long) is in progress. This compartment will have at least six fuel sources located evenly throughout the compartment and one side will have a fire rated window. Tony's research will focus on the burning rate and behaviour of multiple fires in a compartment due to ventilation and radiation enhanced compartment effects. This project is funded by FoRST.

---

## Visitors

---

Alex Kline, who is completing his Master's of Science in Fire Protection Engineering at the University of Maryland, spent 6 months in the department helping Charley Fleischmann prepare new laboratory demonstrations for the ENFE 602 Fire Dynamics class and taking some of the courses during the first semester. Continuing the exchange schemes with Lund University in Sweden, Daniel Ekström and Frida Nimeus attended classes at Canterbury. Kathleen Almand, Society of Fire Protection Engineers (SFPE) Executive Director, also visited the Department and gave a talk to the local SFPE Chapter on the future of the SFPE.

---

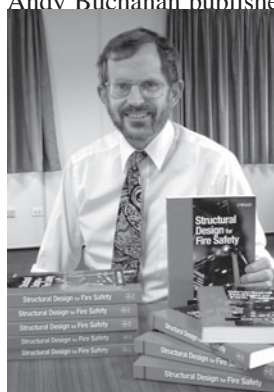
## Publications

---

This year the second edition of the Fire Engineering Design guide was published. A number of experts from New Zealand and Australia contributed to the book. The edition includes new material on documentation and peer reviews, domestic fire safety, design fires for computer modelling and new detector technology, and also expands on current practices and regulations in Australia. The book was launched in New Zealand during June in Christchurch, Wellington, Rotorua and Auckland. In November the book was launched in Australia in Melbourne, Brisbane and Sydney. For more information or to order the book look at the Centre for Advanced Engineering (CAE) website at <http://www.cae.canterbury.ac.nz/order.htm>, or phone +64 3 364 2478.



Andy Buchanan published his book "Structural Design for Fire Safety" this year through John Wiley & Sons. More information is available on the Wiley website at <http://www.wiley.com/Corporate/Website/Objects/Products/0,9049,71747,00.html>. This book forms the basis of ENFE601 Structural Fire Engineering which is taught in the first semester every year.



Several articles have been also been published in journals and

conference proceedings:

Buchanan, A.H. Five years of performance based fire safety in New Zealand. *Intl. Jon Engrg Performance Based Fire Codes*, v 1 no 3, 1999:118–22.

Buchanan, A.H. Fire performance of timber construction. *Progress in Structural Engrg and Materials*, v 2 no 3, 2000:278–89.

Spearpoint, M.J. & Quintiere, J.G. Predicting the burning rate of wood using an integral model. *Combustion and Flame*, v 123, 2000:308–24.

Spearpoint, M.J. & Quintiere, J.G. Predicting the ignition of wood in the cone calorimeter. *Fire Safety Journal*, v.36 no.4, 2001:391–415.

Spearpoint, M.J. & Smithies, J.N. The performance of mains-powered residential smoke alarms with a backup energy source. *Proc. 12th Intl Conf. on Fire Detection*, AUBE 2001, Gaithersburg, USA 2001.

---

## SiF '02 - Second International Workshop Structures in Fire

---

The task of determining the behaviour of structures exposed to fire, either from testing, from calculation methods, or from numerical modelling, is very complex and requires much experience. Following the success of the First Workshop held in Copenhagen, the Second Workshop will be held at the University of Canterbury on the 18<sup>th</sup> and 19<sup>th</sup> March 2002. For more information see <http://www.civil.canterbury.ac.nz/fire/conferences/SiF2002.htm>

---

## Conferences and visits

---

Linus Lim recently returned from a trip to Europe, attending the Interflam international fire engineering conference in Scotland and performing collaborative research in Belgium. The conference was held between 17<sup>th</sup> – 19<sup>th</sup> October 2001 in Edinburgh and featured about 100 technical fire engineering presentations. Linus also attended a full-scale fire test in Cardington, UK. The test, organised by the Building Research Establishment (BRE), featured a compartment fire in part of a seven-storey concrete frame structure. A month was spent in Liege, Belgium, working with Dr. Jean-Marc Franssen to model the behaviour of his floor slabs that will be fire tested in BRANZ next year. The modelling involved 3-dimensional computer analysis of the floor slabs in fire with a special non-linear finite element program, SAFIR. The purpose of modelling these floor slabs is to verify the concrete shell element in the program so that it can be extended to other applications.

Charley Fleischmann spent 2 weeks in Chongqing University in China, as a guest lecturer. He gave several lectures on Compartment Fire Dynamics, Performance Based Fire Engineering Design, and Fire Engineering Education, and spent several hours in informal discussions with students about their research and university life at Canterbury. Chongqing University has a small graduate program in Fire Engineering, under the direction in Prof. Fu. Their primary research focus is in the area of Atrium fire protection and smoke management. Seeing the limited resources in China makes one appreciate the facilities available at Canterbury.

Andy Buchanan and Mike Spearpoint attended the 5<sup>th</sup> Asia-Oceania Symposium on Fire & Technology, Newcastle, Australia in December. Andy gave a plenary presentation on the fallacies and facts surrounding the design for fire resistance. Mike gave a paper on the use of web-related mark-up

languages for the exchange of fire data and was awarded joint third best paper of the conference.

## NZ Fire Service Commission visit

The New Zealand Fire Service Commission visited the department in association with its regional visit held in Christchurch. The Commission has been a major sponsor of the programme since its inception through the provision of the New Zealand Fire Service Commission Lecturer position currently held by Mike Spearpoint and the scholarships awarded each year to up to five of the Master's students. The Commission, chaired by Dame Margaret Bazley, discussed a range of topics with the department to examine how the research and teaching fits in with the Commissions objectives. The Commission then met with the current students and watched a fire test under the furniture calorimeter.



*Andy Buchanan and the MEFE students having discussions with Dame Margaret Bazley*

## Keeping in contact

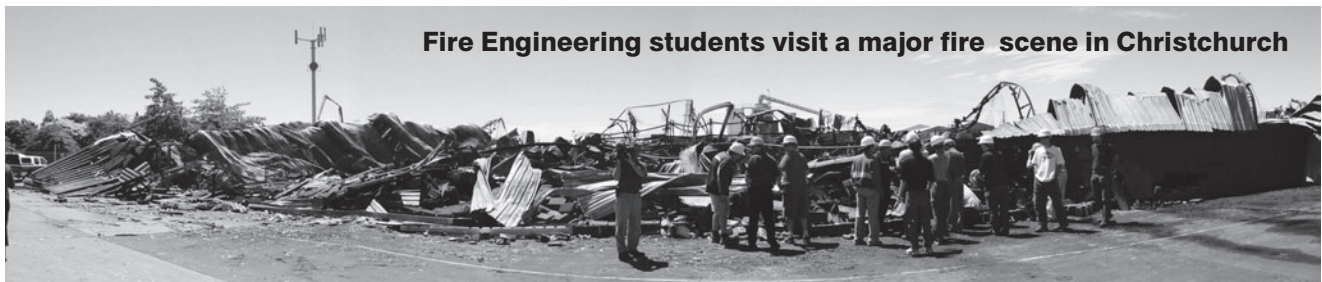
If your address changes or you know someone else who would like to receive this newsletter, please contact us. If you are one of our former students and you would like to share your news then send us a paragraph and we will publish it next issue.

## 2002 Courses being offered

Semester 1	ENFE 601 Structural Fire Engineering ENFE 602 Fire Dynamics ENFE 611 Risk Assessment
Semester 2	ENFE 603 Fire Safety Systems ENFE 610 Advanced Fire Dynamics ENFE 604 Fire Engineering Case Study

ME(Fire) is an 12-18 month full-time degree, starting in February 2002 and finishing by August 2003. It requires six courses and a research report. The part time degree takes at least 3 years and can be completed through our distance-learning programme. The entry requirement is a B.E. degree in Chemical, Civil, Mechanical or Electrical engineering. Engineers from any part of the world are welcome. Please check our website for more information about courses, enrolment and distance learning at <http://www.civil.canterbury.ac.nz/fire/firehome.html>.

For more information on study, research, scholarships or publications, contact: Charley Fleischmann at [charley@civil.canterbury.ac.nz](mailto:charley@civil.canterbury.ac.nz) or Mike Spearpoint at [mike@civil.canterbury.ac.nz](mailto:mike@civil.canterbury.ac.nz)



**Fire Engineering students visit a major fire scene in Christchurch**

## Fire Engineering Research Reports

2001/1	Flammability of Upholstered Furniture Using the Cone Calorimeter	A Coles
2001/2	Radiant Ignition of New Zealand Upholstered Furniture Composites	F Chen
2001/3	Statistical Analysis of Hospitality Industry Fire Experience	T Y A Chen
2001/4	Performance of Gypsum Plasterboard Assemblies Exposed to Real Building Fires	B H Jones
2001/5	Ignition Properties of New Zealand Timber	C K Ngu
2001/6	Effect of Support Conditions on Steel Beams Exposed of Fire	J Septuro
2001/7	Validation of an Evacuation Model Currently Under Development	A Teo
2001/8	2-D Analysis of Composite Steel - Concrete Beams in Fire	R Welsh
2001/9	Contribution of Upholstered Furniture to Residential Fire Fatalities in New Zealand	C R Wong
2001/10	The Fire Safety Design of Apartment Buildings	S Wu

The most recent Fire Engineering Research Reports are listed above. Previous reports are listed on our website at <http://www.civil.canterbury.ac.nz>, with many available for download as PDF files. You may purchase a hardcopy at NZ\$50 each, postage included. If interested, please contact Catherine Price at [c.price@civil.canterbury.ac.nz](mailto:c.price@civil.canterbury.ac.nz).