bushfire CRC

ANNUAL REPORT 2006/2007
Bushfire Cooperative Research Centre

Established and supported under the Australian Government's Cooperative Research Centres Program

CONTENTS

EXECUTIVE SUMMARY

The Bushfire CRC is addressing many of the key questions for the fire industry. Leading researchers are working closely with our industry partners on issues that have been identified as critical to their business. The work is exciting and is now starting to deliver outcomes to the partners who had the foresight to invest in the future of long term bushfire research.

These outcomes are starting to make a difference across Australasia and are attracting international attention. The successful and ongoing transfer of knowledge remains a challenge for the partners of the Bushfire CRC and this annual report is a timely occasion to show how the Bushfire CRC is currently delivering on its commitment to build a sustainable research capacity in fire and emergency management.

The current financial year sees the completion of the fourth of the seven-year life of Australia's first attempt to focus nationally on the bushfire related research needs of fire and land management agencies. The industry, which includes the Bushfire CRC's 18 core partners and eight associate partners, is now benefiting increasingly as a number of current research projects reach advanced stages, while others with longer term horizons are now comprehensively established.

Among a number of research-related highlights the year has seen the release of an analysis of *The Effectiveness and Efficiency of Aerial Firefighting in Australia Part 1*. Given the escalating cost of fire suppression both at a national and international level, the industry has identified the need for considerable rigour in the on-going evaluation of both the effectiveness and efficiency of the various technologies, and particularly of aircraft.

An earlier, interim copy of this report was provided to the National Aerial Firefighting Centre (NAFC) and to the Federal Department of Transport and Regional Services. NAFC subsequently secured additional federal support of $2.5m for the 2006/07 fire season. The report was also helpful in terms of subsequent negotiations regarding on-going federal support in this area.

In another national first an Australian Seasonal Bushfire Outlook for 2006-7 Workshop was held. This workshop, which participants agreed should become a regular pre-fire season event, was coordinated by the Bushfire CRC with its partner the Bureau of Meteorology as part of its Fire Weather and Fire Danger project. The report from the workshop was subsequently widely circulated and played an important role in informing pre-season preparations in all States and Territories, including being tabled in the Western Australian Parliament by the Minister for Environment and Conservation.

With 148 research projects underway across the Bushfire CRC, further achievements are listed elsewhere in this annual report.

A critical milestone in the life of the Bushfire CRC this year was the completion of the Third Year Review, in accordance with DEST guidelines. The Review Panel's report emphasized the progress made by the Bushfire CRC in three years in forging linkages between a large and geographically spread industry and a strong cohort of researchers working in a wide range of disciplines relevant to bushfire. In its response, the Bushfire CRC's Governing Board noted that the Review found the Bushfire CRC was working well in the key areas specified in its 'vision' and 'mission', and in the Commonwealth Agreement.

One of the key reasons for establishing the Bushfire CRC was to address the serious and growing national shortage of bushfire related researchers – as such it is pleasing to report that post-doctorate fellows and post-graduate students now number over 80 – a lasting legacy of the Bushfire CRC. One of the resultant challenges now confronting the industry is to ensure that a

good number of these promising young graduates find suitable employment within the fire and land management agencies.

Conferences and workshops provide a regular opportunity for researchers and practitioners to come together, and as the work of the Bushfire CRC progresses, for the ever important 'technology transfer' to occur within the broader industry.

Important examples of this transfer of knowledge over the twelve months have included:

- A Bushfire CRC Fire Managers' Research Workshop at the University of Wollongong in July, that saw some 200 agency fire managers, researchers and students in attendance
- The annual joint Bushfire CRC/AFAC conference, which was held in Melbourne in August and attended by around 1300 national and international delegates
- Bushfire CRC representation at the 3rd International Fire Ecology and Management Congress in San Diego (USA) in November (over 1000 delegates), and at the 5th International Conference on Forest Fire Research in Portugal later in the same month (around 300 delegates)
- The Bushfire CRC was also prominently represented at the 4th International Wildland Fire Conference in Seville, Spain in May, with a capacity crowd workshop on Bushfire CRC research and with the Bushfire CRC becoming a founding member of the Fire Management Action Alliance
- Research Program end user/researcher workshops in November and December at Mt Macedon, in Perth in May, and two in Melbourne in June. Regular briefings were also provided to relevant AFAC policy groups and to the Forest Fire Management Group, a part of the national Primary Industries Ministerial Council
- A one day forum at Parliament House Canberra in March 2007 specifically to address the issue *Are Big Fires Inevitable?* The forum, which was attended by around 150 invited participants and several federal ministers and politicians, was designed to address several themes including drought and related climate factors, the fire and water relationship, community related interface issues and forest land management strategies
- Agency executive briefings by a Bushfire CRC sponsored, US based international wildfire expert in Brisbane, Hobart and Adelaide and related public seminars in Canberra and Melbourne
- Two CRC projects (one on arson, and the other on smoke prediction) featuring prominently in the Australian Government's Innovation Report for 2006/07, the report citing the arson work as "*a great example of how the Cooperative Research Centre scheme is bringing government and industry together to tackle issues facing Australia*"
- The completion of an evaluation of the effectiveness and efficiency of smoke alarms, for the Australasian Fire Authorities Council to reach a national position on smoke alarms.
- A public forum at Cooma in April that focussed on the range of research programs currently underway in the Australian Alps, and a public forum at Wangaratta in June that was attended by some 90 people
- A fire research and education program in the Territory Wildlife Park in the Northern Territory, which receives 70,000 visitors a year.
- *The Day the Flames Came* – an educational documentary DVD on the lessons learnt from 1961 fires in the small town of Dwellingup, Western Australia. Produced by the Bushfire CRC and Western Australian partners, the Department of Conservation and Environment, and the Fire and Emergency Services Authority. The DVD was launched at the Melbourne annual conference and was distributed widely to fire managers.

The media again assisted in informing the wider community of the role the Bushfire CRC is playing. Commentary was regularly sought at the height of the bushfire season. Other public communication included:

- The broadcast of a 23 minute radio documentary on BBC Worldwide that prominently featured the Bushfire CRC's work.

- Support from the ABC national radio network facilitated widespread coverage of the bushfire forum at Parliament House including dedicated website coverage. This was followed up with an ABC TV *Four Corners* national television current affairs program that used the forum as a focus on the current state of bushfire management in New South Wales and Victoria.
- A segment on ABC TV *Catalyst* program focused on Bushfire CRC research into vehicle safety during a bushfire.
- The Bushfire CRC and the Australian Science Media Centre organised a national media briefing on bushfires in mid-October.
- The Bushfire CRC took advantage of the World Science Journalists' Conference in Melbourne in April to promote bushfire research to 500 science journalists and communicators from around the world including a field trip to a bushfire affected area.
- A six page Bushfire CRC research feature in the February edition of *Australian Farm Journal,* a nationally distributed farm business magazine.
- In January the *Canberra Times* ran a front page story "Threat to Bushfire Research" highlighting the issue of ongoing funding for the Bushfire CRC.
- Four issues of the industry journal *Fire Australia*, a joint venture between the Fire Protection Association, the Australasian Fire Authorities Council and the Bushfire CRC.

Early in the life of the Bushfire CRC the Board recognised the value in establishing an enduring industry and community resource and this led to the formation of the Fire Knowledge Network. The latest research and lessons from the past are now being enhanced as part of the development of the Fire Knowledge Network. It is being designed to become a focal point for fire knowledge within Australia, New Zealand and linked globally. It is bringing together the broad spectrum of research, both within the Bushfire CRC and from the many researchers in other organisations, together with local knowledge and lessons from history.

Utilising the principles of knowledge management to acquire, create, share and use knowledge the Fire Knowledge Network is being designed with a number of components for connecting fire research, information and experience.

Context and major developments during the year

In a report co-authored by the Bushfire CRC, and released by the Federal Minister for the Environment and Heritage in February 2006 titled *Climate change impacts on fire-weather in south-east Australia*, the CSIRO observed that "The south-east region of Australia is particularly vulnerable to bushfire – along with southern California and southern France it is identified as one of the three most fire-prone areas in the world. It is therefore critical that we prepare for the potential of increased fire risk associated with the hotter and drier years we may experience in the future…"

Meanwhile, in northern Australia, the Tropical Savannas CRC has reported that evidence from climate change models under enhanced greenhouse conditions is that "…the frequency of extreme events such as floods and droughts will probably increase…" but that "higher temperatures may also cause fuels to become drier thus the rates of fire spread may increase with a resultant rise in fire intensities."

In much of Australia, and in parts of New Zealand, fire, park and forest management agencies are confronting increasing urbanisation, prolonged drought and global warming, increasing strains on forested water catchments, and concerns about their continued ability to adequately manage fire.

As scientists begin to better understand the probable impacts of global warming it is vital that Australia first consider the broader issues of fire management as the nation develops policies in areas ranging from water and biodiversity conservation, to urban planning, carbon sequestration, and the maintenance of key aspects of indigenous culture.

The Bushfire CRC is providing the fire management knowledge for Australia's land management agencies to actively participate in these critical issues.

The last 10 years has seen an unprecedented level of scrutiny of the management of Australian bushfires, particularly in Victoria and the ACT/NSW (a long running Coronial Inquiry in South Australia is yet to report). During the year the Bushfire CRC was invited to make a submission to a Victorian Parliamentary Inquiry into the *Impact of Public Land Management Practices on Bushfires in Victoria* (This can be found on the Bushfire CRC website). In addition, four researchers have provided considerable assistance to the on-going South Australian Wangary Coronial Inquiry.

In the latter part of the year the Board and, in particular its industry partners, through the Australasian Fire Authorities Council, commenced development of a proposal for a new Cooperative Research Centre that would build on the achievements of the current Bushfire CRC.

The industry recognises that, with the Bushfire CRC, Australasia has a nationally coordinated research program that must continue. Much of the research is long term and is only beginning to be taken up by the broader fire industry.

The industry and the current CRC Board are now seeking expressions of interest from potential new partners who wish to be involved in this post-Bushfire CRC venture.The new CRC bid for Commonwealth funding is due to be submitted in the 2008 grant application round. It will form a critical part of the national infrastructure in its management of fire for the community.

The tentatively titled *Fire - Environment and Society CRC* is being designed to support the continuing evolution of the Fire Knowledge Network as a means to share research findings. It will also continue to build a new generation of researchers for the industry while it makes Australian businesses more stable in the face of a changing climate.

The proposed new CRC will be designed to undertake research projects that will deliver economic and social benefits to individuals, communities and industry throughout Australasia. It will be designed to build on the work of the current Bushfire CRC and to conduct research that confronts the issues of the next two decades.

The Governing Board of the Bushfire CRC saw a number of changes during the year. Resigning Board members were: Raymond Canterford, Leonard Foster (resigned in December), Anne Gardiner, Philip Koperberg, Ian MacDougall (Chairman, resigned in March), Robyn Owens and Timothy Vercoe. Board appointments during the year were: Neil Bibby, Jo-Anne Bloch, Naomi Brown, Murray Dudfield, Leonard Foster (re-appointed, and elected Chairman in April), Brian Richardson, Alistar Robertson and Ewan Waller. [*See Table 2 for details*]

There was only one change in specified staff in the Bushfire CRC office during the year, with Education Manager Kellie Watson taking up a position with Sustainability Victoria.

In terms of its core partners, the year saw the finalisation of arrangements that resulted in the New Zealand Rural Fire Service and the University of Canterbury taking out joint core membership, for the remainder of the current Bushfire CRC's term, while the University of Wollongong became an associate partner. Memoranda of Understandings were signed with the University of California, Berkeley, the Forest Fire Research Institute at the University of Coimbra, Portugal, and the US Department of Agriculture Forests Service.

Finally, we would like to place on record my thanks and our appreciation for the efforts of the entire Bushfire CRC family (stakeholders, researchers, Board members, staff and colleagues) for their efforts over the year. Efforts that have so capably helped to keep Australasia at the forefront of the international bushfire management challenge. Stimulating and productive times would seem to lie ahead.

Len Foster	**Gary Morgan**
Chairman	**Acting Chief Executive Officer**

NATIONAL RESEARCH PRIORITIES

An Environmentally Sustainable Australia

Transforming the way we utilise our land, water, mineral and energy resources through a better understanding of human and environmental systems and the use of new technologies.

The Bushfire CRC's research is examining how land can be managed through the use of fire to ensure a reduction in risk to the community.

The focus is on:

- Maintaining and enhancing the quality and quantity of water.
- Maintaining the health of soils ecosystems
- Maintaining and enhancing the biodiversity
- Examining how climate change will impact on fire regimes, and ecological systems

Promoting and maintaining good health

Promoting good health and preventing disease, particularly among young and older Australians.

The Bushfire CRC research program includes assessing the impact of fires on the health and safety of communities and fire fighters. It is examining the impact of bushfire smoke on communities and determining ways to better predict where smoke will travel. This is helping to reduce the incidence of conditions such asthma. It is also undertaking research into the impact of smoke related problems specifically in fire fighters to ensure better health in this aging workforce. In addition, the Bushfire CRC is conducting research into how fire agencies can provide more productive roles for aging volunteers.

Safeguarding Australia

Safeguarding Australia from terrorism, crime, invasive diseases and pests, strengthening our understanding of Australia's place in the region and the world, and securing our infrastructure, particularly with respect to our digital systems.

Core to the mission of the Bushfire CRC is reducing the bushfire risk to the community, critical infrastructure, industry and ecosystems. This includes research into effectiveness of incident management systems and the effectiveness of techniques and technologies utilised by the fire and emergency service agencies.

Table 1: National Research Priorities and CRC Research

NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
AN ENVIRONMENTALLY SUSTAINABLE AUSTRALIA – *Transforming the way we use our land, water, mineral and energy resources through a better understanding of environmental systems and using new technologies*	
Water – a critical resource	10
Transforming existing industries	30
Responding to climate change and variability	20
PROMOTING AND MAINTAINING GOOD HEALTH – *Promoting good health and preventing disease, particularly among young and older Australians*	
Ageing well, ageing productively	5
Strengthening Australia's social and economic fabric	10

NATIONAL RESEARCH PRIORITIES	CRC RESEARCH (%)
FRONTIER TECHNOLOGIES FOR BUILDING AND TRANSFORMING AUSTRALIAN INDUSTRIES – *Stimulating the growth of world-class Australian industries using innovative technologies developed from cutting-edge research*	
Breakthrough science	10
Smart information use	5
SAFEGUARDING AUSTRALIA – *Safeguarding Australia from terrorism, crime, invasive diseases and pests, and securing our infrastructure, particularly with respect to our digital systems*	
Critical Infrastructure	15
Understanding our region and the world	10
Protecting Australia from terrorism and crime	5

GOVERNANCE AND MANAGEMENT

The Bushfire CRC operates through an incorporated not for profit company, Bushfire CRC Ltd. The Company, Bushfire CRC Ltd was registered in March 2003 and began formal CRC operations in July 2003. Participating parties are members of the company, which is limited by guarantee. The Bushfire CRC's Stakeholders' Council consists of representatives of each of the participating agencies.
The Council meets twice a year to review and receive updates on the progress of research, education, communication and other activities, and to provide strategic advice to the Governing Board. The Governing Board, has nine members including two independent members, and meets regularly. The company's constitution allows for participants who contribute cash of $100,000 or more per annum to vote and nominate members to the Governing Board. Both the Stakeholder Council and the Governing Board have the same independent Chairman.

The Governing Board has four committees:

- A **Compliance Committee** that oversees corporate governance, audit responsibilities, finance and compliance.
- An **End Users Research Committee** that ensures the research conducted meets the strategic aims of the Bushire CRC and the needs of the users.
- A **Human Resources Committee** to advise on and oversee the Bushfire CRC's personnel matters including selection, remuneration and performance management.
- An **Education Committee** that is responsible for providing strategic advice on the overall development of the Bushfire CRC's postgraduate program and on new educational initiatives.

Bushfire CRC Organisation Chart

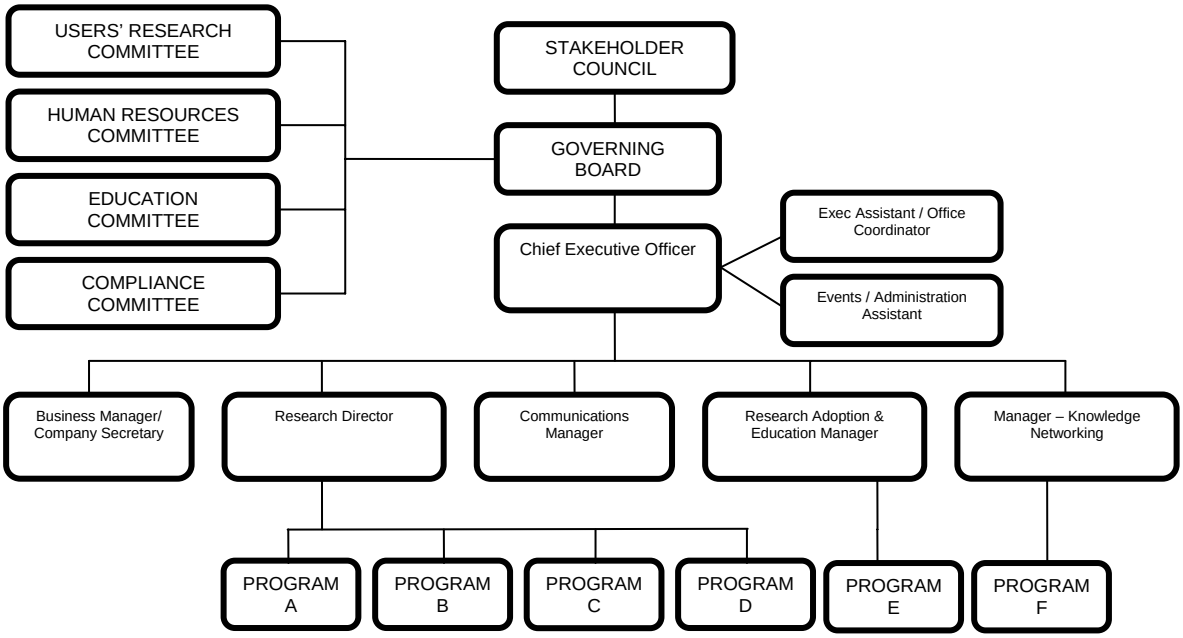


Table 2: Specified Personnel

2.1 CEO and Bushfire CRC staff

Name	Organisation	Position / Role	Changes during the year
Kevin O'Loughlin	Bushfire CRC	CEO	
Richard Thornton	Bushfire CRC	Research Director	
Ian Wilson	Bushfire CRC	Business Manager	
Gary Morgan	Bushfire CRC/AFAC	Manager, Strategy and Implementation	
Kellie Watson	Bushfire CRC	Education Manager	Resigned May 2007
David Bruce	Bushfire CRC	Communications Manager	
Leslie Crombie	Bushfire CRC	Knowledge Networking Manager	

Governing Board Members

Directors have been in office for the full financial year unless otherwise stated. The Bushfire CRC Board met six times during the year ending 30 June 2007.

Name	Organisation	Position / Role	Board meetings attended
Ian MacDougall	Bushfire CRC	Independent Chairman (resigned 31 March 2007)	4
Len Foster	Bushfire CRC	Director Independent Chairman (resigned 18 December 2006 and reappointed 1 April 2007)	4
John Baird	Rector, Australian Defence Force Academy	Director	5
Neil Bibby	Chief Executive Officer, Country Fire Authority	Director (appointed 18 June 2007)	1
Naomi Brown	Chief Executive Officer, Australasian Fire Authorities Council	Director (appointed 18 December 2006)	3
Ray Canterford	Assistant Director, Bureau of Meteorology	Director (term expired 30 April 2007)	3
Murray Dudfield	National Rural Fire Officer, New Zealand Fire Service	Director (appointed 15 June 2007)	1
Anne Gardiner	Director, Head of Compliance, Credit Suisse Asset Management (Aust)	Independent Director (term expired 30 April 2007)	5
John Gledhill	Chief Officer, Tasmania Fire Service	Director	5
Phillip Koperberg	Commissioner, NSW Rural Fire Service	Director (resigned 17 April 2007)	4
Robyn Owens	Pro Vice-Chancellor Research, University	Director (term expired 30 April	5

	of Western Australia	2007)	
Brian Richardson	General Manager, Ensis Forest Biosecurity and Protection	Director (appointed 15 August 2007)	5
Alistar Robertson	Dean, Faculty of Natural and Agricultural Resources	Director (appointed 18 June 2007)	0
Ewan Waller	Chief Fire Officer, Department of Sustainability and Environment	Director (appointed 15 February 2007)	3
Timothy Vercoe	Director, Asset Protection Centre, CSIRO Forestry and Forest Products	Director (resigned 15 August 2006)	0

2.2 Programme Leaders

Name	Organisation	Position / Role
Jim Gould	Ensis Bushfire Research	Program A
Mark Adams	University of New South Wales	Program B
John Handmer	RMIT University	Program C
Bob Leicester	CSIRO	Program D
Christine Owen	University of Tasmania	Program E

Core partners

- Bureau of Meteorology
- Country Fire Authority of Victoria
- CSIRO - Divisions of Manufacturing & Infrastructure Technology, Forestry and Forest Products, and Sustainable Ecosystems
- Department of Sustainability and Environment, Victoria
- Emergency Management Australia
- Fire and Emergency Services Authority of Western Australia
- Melbourne Metropolitan Fire and Emergency Services Board
- New South Wales Fire Brigades
- New South Wales National Parks and Wildlife
- New South Wales Rural Fire Service
- National Rural Fire Authority, New Zealand
- Queensland Fire and Rescue Service
- Forests of NSW
- Tasmanian Government (Tasmania Fire Service, Forestry Tasmania, Parks and Wildlife Service)
- University of Canterbury, New Zealand
- University of Melbourne, School of Forestry and Ecosystem Science
- University of Tasmania
- University of Western Australia
- University of New South Wales

Associate Partners

- ACT Department of Justice and Community Safety
- Australian National University
- ACT Emergency Services Authority
- James Cook University
- La Trobe University
- RMIT University
- South Australian Country Fire Service
- South Australian Department of Environment and Heritage
- South Australian Metropolitan Fire Service
- University of New South Wales
- University of Wollongong
- Charles Darwin University
- Department of Industry and Resources, Chemistry Centre, Western Australia

RESEARCH PROGRAMMES

Key Research Achievements

The Effectiveness and Efficiency of Aerial Firefighting in Australia	This report has provided additional rigour in the ongoing evaluation of the effectiveness and efficiency of aerial Firefighting, which has been helpful in negotiations for federal support for aerial firefighting initiatives and has lead to additional funding support for these activities.
Seasonal Bushfire Outlook Workshop 2006-2007	A national first though which fire service agencies have been provided with significant information on weather and fire danger outlooks for the period as compiled by Bushfire CRC researchers. This information has had a major influence informing pre-season preparations in all states and Territories. Fire service agencies have agreed for this to be a regular event.
National Bushfire Forum – *Are Big Fires Inevitable*	Attended by more that 150 invited participants, this one day forum at Parliament House Canberra in March highlighted the interaction of drought and related climate change issues, fire and water, community interface and forest land management strategies in addressing the question – Are Big Fires Inevitable?
Developing an ongoing capability in bushfire research	One of the key reasons for establishing the Bushfire CRC was the national shortage of bushfire researchers. The Bushfire CRC now has more than 80 post–doctoral fellows and PhD students working in the area, many with international recognition. This will provide a lasting research capability for the industry.
Contribution to Australian innovation	Two Bushfire CRC projects (bushfire arson and smoke prediction) have been recognised in the Australian Government's *Innovation Report 2006/7* as making a significant contribution in bringing together government and business to tackle the major issues facing Australia.

Reasons for milestones not being reached

The majority of agreed milestones have been met. Where milestones have not been met these predominately relate to weather conditions that have not been conducive to data collection including projects where fire events have destroyed data collection points. Other delays in meeting milestones have been associated with the shortage of researchers in the industry and the difficulty in appointing suitable candidates to research projects. In some instance working with the industry has identified that individual pieces of work are better merged into a larger project that can provide greater benefits – this has lead to some milestones being replaced. Where this has occurred or is proposed a variation to the Commonwealth Agreement will be sought.

Nature of major consultancies and their contribution to the CRC

The Bushfire CRC has continued to undertake consultancies for BlueScope Steel, the Climate Change Institute, ACTEW and the Australian Fire Authorities Council (AFAC) and individual fire service agencies during this financial year. These have all enabled the Bushfire CRC to undertake a broader scope of work than would have been otherwise possible.

BlueScope Steel –BlueScope Steel was interested in understanding the behaviour of various building elements under wildfire conditions. These included fences, water tanks and power poles. The Bushfire CRC undertook research in conjunction with the NSW Rural Fire Service at its test site at Mogo, NSW. The work compared BlueScope's steel products against other commercially available alternatives. This has enabled the Bushfire CRC to provide guidance to its partner agencies on the effectiveness of various products.

The work with the Climate Change Institute resulted in increased understanding of the impact of climate change on fire danger across Australia and has resulted in a substantial report that has generated significant media and community interest.

Work with individual fire service agencies (in particular Department of Sustainability and Environment, Victoria, and NSW Rural Fire Service) has enable to extension of existing Bushfire CRC projects into guidelines and other products that are more accessible to the industry.

Nature of any grants and how they contribute to the CRC

The Bushfire CRC has not received any grants during this period.

Any changes proposed to future research directions

The Third Year Review indicated that the general direction of the Bushfire CRC was still relevant and the research outcomes would provide benefit to the industry and the community. The detailed review of the projects indicated that the current direction is still supported by the industry. However, some minor changes to the Commonwealth Agreement to reflect new projects and projects that are not to be continued is in progress.

A number of significant external pressures, in particular climate and demographic change will become important as planning for a new CRC progresses.

RESEARCH PROGRAMMES

Research Activities and Achievements

Program A: Safe Prevention, Preparation and Suppression

End User Leader: Phillip Koperberg, NSW Rural Fire Service (to April 2007)
Shane Fitzsimmons (April - end June 2007)
Program Leader: Jim Gould, Ensis - Bushfire Research Group (CSIRO)

Overview

Bushfire management has four related goals – to prevent an uncontrolled bushfire occurring, to prepare in case it does, to suppress it if it arrives, and to enable rapid recovery after the event.

Fire managers need reliable tools that make the best use of emerging technologies to support their decisions in how best to manage the landscape, before, during and after a bushfire.

This program is providing a better understanding of key issues such as fire behaviour, fire weather, bushfire danger rating, smoke management and strategies for aerial and ground suppression.

A key feature of Program A has been its ability to use field-oriented, empirically based approaches to knowledge generation in combination with the development of decision support tools and techniques. The program has a strong collaborative working relationship with the operational fire and land management agencies in Australia and New Zealand. It has an underlying focus on risk-based decision making.

Research projects on weather and the behaviour of fire under different conditions, the effectiveness of aerial fire fighting (the year saw the release of an eagerly awaited research report) and the effects of different tactics used to put fires out – these are a few of the areas that scientists in Program A continue to study.

The development of Australia's first, holistic risk management model for bushfires is now well advanced. The resulting decision support system has been partially trialled, and its ability to assist fire and land management agencies, threatened communities, town planners, water catchment authorities and power companies has been advanced considerably. Program scientists are also addressing fuel dynamics and fire behaviour simulation modelling to fill the current gaps in our knowledge about bushfire behaviour and fuel management.

Program A is taking a strong leadership role in addressing key fire management issues through interdisciplinary, multi-agency initiatives in six sub-disciplines of bushfire research (fuel and fire behaviour modelling, remote sensing, fire weather and seasonal outlook, suppression technology, risk management and computer simulation). National and international collaboration, within the context of the Bushfire CRC's national and international goals, also continues.

The Program currently includes 23 researchers and post graduate scholars at seven establishments, who are involved, at least partly, in bushfire research. This report presents a brief overview of their major activities for the fiscal year 2006-07.

Four PhD projects are well advanced with field and laboratory experimental studies. One PhD project on predicting fuel moisture in varied heathland ecosystems is scheduled for completion in 2007. Two new PhD projects have commenced; one involving adult education programs and fire behaviour, while the other is investigating aspects of fuel consumption modelling.

A.1.1 Fire Behaviour Modelling

- Research continues on the development of a fire behaviour prediction system for heath shrubland fuels (Project FuSE). In cooperation with the Department of Environment and Heritage, South Australia, over 50 experiments were ignited to study fire propagation threshold and fire behaviour in heath and mallee fuel types. Wind profiles for fire behaviour modelling studies were included in these experiments. The final set of experimental burns are scheduled for the 2007/08 fire season. The proposed burning program to investigate the behaviour of shrubland fires on steep slopes in New Zealand was postponed due to wet summer weather and these experiments have been rescheduled for 2007/08.

- Researchers maintained a technology transfer program by providing course material and lectures on fire behaviour, prescribed burning and firefighter safety to fire and land managers.

- In response to the Bushfire CRC Third Year Review panel, this project (A1.1) will merge with the Fuel Assessment and Classification (Project A1.3). The combined project started operating on 1 July 2007 with the project name A1.1 *Fuel and Fire Behaviour Modelling.*

- A case study is underway into the fuel structure, fire behaviour and suppression evaluation of two recent major pine plantation fires (the Bilo Fire and the Mt David Fire) in New South Wales. This case study is being conducted in collaboration with Forests NSW, and with support from the Ministerial Council linked Forest Fire Management Group.

A1.3 Fuel Assessment and Classification

- Rating systems that assess the relative hazard of fuel factors and the way they affect fire behaviour and bushfire suppression difficulty represent a new approach to forest and woodland fuel assessment. This assessment emphasises the whole fuel complex by combining a hazard rating for each of the different fuel layers; bark, elevated and surface fuels using visual fuel characteristics.

- Project FuSE (see A1.1) is also examining what changes need to be made to the current fuel assessment and classification system for it to be applicable to mallee and heathland vegetation (for hazard rating and fire behaviour prediction). Fuels load are being quantified through a combination of destructive and non-destructive sampling, and visual systems for scoring structure and hazard are being developed. The fuel assessment will characterise the changes in the fuel complex with time and will compare and contrast the mallee and heathland fuel types.

A1.4 Grassland Curing

- This project is exploring new approaches to the assessment of grassland curing in different regions of Australia and New Zealand. Using remote sensing technologies the project is aimed at enhancing the current inputs to fire danger rating systems and fire behaviour models.

- Robust field procedures have been developed by researchers, and end users can now more effectively collate field data on grassland curing, leading to robust validation of remote sensing images. This project is also investigating the feasibility of using digital images and subsequent analysis as a ‘stand-alone’ method of assessing grassland curing.

A2.1 Fire weather

- Australia's first seasonal bushfire assessment workshop was held at the end of the last financial year. Considerable use of the workshop's products was made subsequently. In accordance with a decision of this first workshop, the first Northern Seasonal Bushfire Seasonal Assessment workshop was held in Darwin on 8 May, with 23 participants. A summary report is available on the Bushfire CRC website, and a full report is being reviewed by the participants before being placed online.

- A contract to revisit an earlier Bureau of Meteorology/Bushfire CRC/CSIRO assessment of likely changes in fire danger under climate change scenarios over southeastern Australia, to include observations up to the end of the 2006/07 fire season, and data from weather stations in South Australia and southern Queensland, was accepted from the Climate Institute (Australia) Ltd.

- In response to a contract from the Victorian Department of Sustainability and Environment, researchers are collaborating with the Desert Research Institute, University of Nevada (US), to deliver a high-resolution numerical weather prediction climatology based model for use in fire weather prediction in Victoria.

- Wind change studies have continued, with a paper describing the structure and evolution of the "Canberra easterly change" being accepted by the *Australian Meteorological Magazine*. The 'Wind Change Range Index', developed by XinMei Huang, has been applied to mesoscale numerical weather prediction model forecasts, and was so well-received by forecasters that the product has subsequently implemented operationally by the Bureau of Meteorology.

- Lectures and training in fire weather, and the results of the latest work on wind changes were delivered to visiting North American fire weather forecasters (who provided operational assistance to several agencies during the fire season), to Bureau Severe Weather Meteorologists, and to meteorologists and fire and land management agency staff in Western Australia, South Australia, Victoria, Tasmania, and the Northern Territory.

A3.1 Evaluation of Aerial Suppression Techniques and Guidelines

- Among a number of research-related highlights, the year has seen the release of Part 1 of an analysis of *The Effectiveness and Efficiency of Aerial Firefighting in Australia*. Given the escalating cost of fire suppression both at a national and international level, there is a need for considerable rigour in the on-going evaluation of both the effectiveness and efficiency of the various technologies, and particularly of aircraft.

- An earlier, interim copy of this report was provided to the National Aerial Firefighting Centre (NAFC) and to the Federal Department of Transport and Regional Services (DOTARs). NAFC subsequently secured additional funding support of $2.5m for the 2006/07 fire season. The report also played a critical role during subsequent negotiations regarding on-going federal support in this area.

- A research workshop was held that involved the AFAC 'Wildland Aerial Technical Group' and the 'National Aerial Firefighter Centre'. Its purpose was to identify, and to facilitate subsequent promotion of a future strategically-based follow-up research program. The agreed priority was the evaluation of the effectiveness of alternative suppression strategies through time, to meet fire and land management agencies suppression (fire management) goals and objectives.

- This project supported a visiting fellow, Rob McAlpine, from the Ontario Ministry of Natural Resources - Aviation, Flood and Fire Management Branch, who worked with the research team. McAlpine has assisted the Bushfire CRC researchers to plan the development of resource optimisation models for use in Australia.

A4.1 Bushfire Risk Management

- Australian and New Zealand governments spend hundreds of millions of dollars annually on the management of bushfires. Bushfire related losses occur in most years and a perennial challenge in the management of fire is to strike a balance between the relative costs of bushfire mitigation, and the related losses incurred by the community.

- In bushfire prone parts of the world models of the threat posed, under varying fire prevention and suppression regimes have been developing for some years. More recently, these models have sought to combine spatial and geographic data, with the available fire behaviour science and suppression capability information, in a way that assists both operational and strategic decision making.

- Since 2003 the Bushfire CRC has been undertaking work that is designed to further develop these earlier approaches. The work will contribute significantly to better day to day bushfire management.

- The first phase (mitigation) has seen the definition of a fire management business model and the development of a set of 'business rules' that indicate how decisions are made to meet management objectives. From these rules has come a mathematical definition of how these factors interact.

- The second phase of the project is developing a conceptual model to describe the likelihood of a fire with particular characteristics occurring in a particular space and time across the landscape. The resultant fire spread simulation model (known as Phoenix) contains essential components that are designed to describe the ignition and spread of fires across the landscape given particular management and weather scenarios.

- Finally, fire impact modelling (consequence) will define the potential impact of a fire. Economic values being calculated include that of houses, timber, water, scenic quality and public utility functions; social values include human life, trauma, human health and community function; environmental values include harm to local species and ecosystems, soil erosion, reduced water yield and quality, and atmospheric pollution.
- An inaugural training workshop, prior to the fire season, was held for end users in the running and evaluation of the PHOENIX program. The program was trialled operationally over the bushfire season and outcomes were subsequently used to further refine the program.

A.5 Computer Simulation Modelling

- This project, which is designed to produce bushfire simulation and animation technologies, has now developed irregular polygonal shaped cells that were demonstrated in the prototype simulator. It has adopted the more traditional propagation delay approach to simulate the spread of fire. The advantage of this approach is that the fire behaviour models developed can plug directly into the simulation engine. As a result there will not need to be a calibration step required, thus allowing the simulator to produce the same rate of spread as the currently used fire behaviour meter.

Project title	Project Leaders	Objective
A1.1 **Fire behaviour modelling**	Jim Gould, Wendy Anderson	To improve firefighter and community safety in the management of bushfires, by providing better knowledge and understanding of the interaction of fire, fuel, weather and topography across Australia.
A1.3 **Fuel classification and availability**	Peter Ellis	To develop a single fuel classification system in Australia to be used in smoke emission models, fire behaviour predictions and habitat modelling. To develop a model of fuel availability based on fuel, weather and fire behaviour characteristics.
A1.4 **Improved methods for the assessment and prediction of grassland curing**	Stuart Anderson	To develop improved methods for the assessment and prediction of grassland curing as an input into fire danger rating systems and fire behaviour models.
A2.1 **Fire weather and fire danger**	Graham Mills	To improve the operational utility of fire weather forecasts and outlooks by providing a better understanding of wind, temperature and humidity structures and distributions, on the very short-term (1-12 hours), short to medium term, and seasonal time scales.
A3.1 **Evaluation of suppression techniques and guidelines (aerial and ground)**	Jim Gould	To optimise the effectiveness and efficiency of aircraft use during firefighting operations.
A4.1 **Bushfire risk management**	Kevin Tolhurst	To develop a risk management decision support system for communities living in the rural/urban interface, town planners, power companies, firefighters and land managers.
A5.1 **Fire spread simulation**	George Milne	To develop a physically accurate modelling, simulation and animation toolset that will permit rapid execution of a model of a specific bushfire situation to permit the prediction of fire development and the effect of containment strategies.

Program B: Fire in the Landscape

End User Leader: **Ewan Waller, Victorian Department of Sustainability and Environment**
Program Leader: **Mark Adams, University of New South Wales**

Researchers within the Program are increasingly focussed on producing outputs from their research in ways that will benefit stakeholders. The features of this past year can be summarized as:

- More than 20 peer-reviewed journal papers and book chapters
- More than a dozen papers presented at major national and international conferences and forums. A number of Program researchers (including Andersen, Bradstock, Carey, Roxburgh and Adams) have given invited keynote lectures at a range of conferences. A few stand out for their significance. They include the Australasian Bushfire Conference 2006 (Brisbane), the Nature Conservation Council Bushfire Conference 2007 (Sydney), the International Wildland Fire Conference 2007 (Madrid, Spain), the North American Forest Ecology Workshop 2007 (Vancouver) and several climate change meetings in Canberra and Sydney. In all of these, lead researchers from Program B have featured prominently
- Providing assistance in the revamping of university subjects and courses to strengthen fire ecology and management components – (course revamps included those conducted at the University of Tasmania, Charles Darwin University, the University of Melbourne, the University of NSW, the University of Wollongong and at the Australian National University)
- A significant number of presentations by researchers at public meetings and forums throughout Australia. From Darwin to Paraburdoo, from Perth to Sydney, from Cooma to Manjimup, from Coffs Harbour to Hobart – a Program researcher has been provided to talk to local volunteers, to communicate with school groups or to meet and discuss the way forward with politicians and policy makers
- Program B researchers have also featured extensively in media appearances at both the regional and national level.

Program B researchers continue to be approached to participate in national policy forums and international conferences.

The research program has also benefitted from an expanding list of research grants, consultancies and contracts. Notable here are the successes of Cary, Bradstock *et al.* (AGO), Grierson, Adams *et al.* (ARC Linkage) and Andersen *et al.* Much of what is being done in these additional projects builds on research supported by the Bushfire CRC. This evolving aspect of the Program contributes to a key deliverable for the Bushfire CRC ("the production of the next generation of fire researchers; maintaining a viable fire research community"). In a similar fashion, PhD and other post-graduate students involved in Program B are making an increasingly valuable contribution to published scientific output.

The subject matter of the journal papers, book chapters and conference proceedings ranges widely, in accordance with the variety of research being conducted. While climate change is increasingly a dominant theme, other Program research themes range from "dry slots", "ants", "ectomycorrhizae", and "terpenes" to the more prosaic "litter mass", "fuel", "intensity", "water" and, of course, "fire". Program outputs appear in publications ranging from those associated with 'high science' to more publicly accessible magazines such as *Parkwatch*.

Program B is well on its way to meeting its overall Bushfire CRC contribution in terms of published output and in relation to successful PhD graduates. Notable here, publications-wise, are the continued strong contributions from Alan Andersen's northern Australia program (based with CSIRO Sustainable Ecosystems) and the significant numbers of PhD students involved in the

programs lead by Pauline Grierson at the University of Western Australia, and by Alan York and Tina Bell at the University of Melbourne.

Two of the newer projects within Program B are worthy of special mention. Firstly, the project on the role played by a lack of fire in tree decline is being led by Neil Davidson from University of Tasmania. Together with Dugald Close, Neil is working with a wide range of stakeholder agencies throughout Australia. Additional funding for this project, contributed through the Ministerial Council-linked 'Forest Fire Management Group' has helped the Bushfire CRC to mount a significant research effort. This effort has seen the production of the first two peer-reviewed publications in near-record time. The team has also worked effectively to get its message out to stakeholders, via local meetings and forums, and work is underway to establish collaboration with Dale Johnson from the University of Nevada (USA).

The second newer project, HighFire, is managed by Maria Taranto and incorporates research that includes meteorology and sociology as well as ecology and ecosystem management. This complex project has successfully established major field experiments in Victoria, New South Wales and the Australian Capital Territory. A full year's data on water and carbon balances has now been collected in the montane forests and sub-alpine woodlands of the Australian Alps. A grazing and fire interaction experiment is underway and the first experimental fire was conducted during summer. Mountain weather stations have been maintained in a range of locations, interviews with members of the general public who have been through both the 2003 and 2006/7 fires in the high country have been conducted, and research outputs are beginning to emerge with at least 10 journal papers expected in the coming 12 months.

Many elements associated with the study of 'Fire in the Landscape' are, of necessity, a long-term research proposition. The spectre of climate change has caused several original projects to expand their horizons and significant progress in a number of areas will require new sources of funding and/or support from a new CRC. The study of ecological processes is not always compatible with demands for results within a 3-5 year time frame. It is a testament to the commitment of the researchers involved that much of value has been achieved within the first five years of the life of the current Bushfire CRC.

Project title	Project Leader	Objective
B1.1 **Managing fires in forested landscapes in south-western Australia**	Lachlan McCaw	To identify patterns of change in the abundance and richness of biota as a result of different fire regimes in forested landscapes in south Western Australia.
B1.2 **Managing bushfire risk in a changing world**	Ross Bradstock	To provide optimal solutions for sustainable bushfire risk management, in differing ecosystem, management and global/climate change contexts.
B2.1 **Behaviour of smoke plumes and hazes**	Graham Mills	To assist in the reduction of impact of smoke from an urban or rural fire on community health and safety by predicting the transport, dispersion and concentrations of smoke particulates.
B2.2 **Smoke composition and impact on health and ecosystems**	Tina Bell	To identify and quantify the chemicals in smoke produced from biomass burning.
B3.1 **Effect of fire on ecosystem processes and biodiversity**	Alan York	To understand the interaction between fire, vegetation, invertebrates and soil organisms in carbon and nutrient cycling, and how this contributes to biodiversity conservation and ecosystem function.
B3.2 **Prescribed fire and biodiversity in northern Australia**	Alan Andersen	To enhance the effectiveness of fire management for biodiversity conservation in northern Australia.
B4.1 **Synthesis and integration**	Mark Adams	To synthesise existing data and integrate with world literature and produce plain language text on prescribed burning.
B4.2 **Multi-scale analysis of patterns in ecological processes in relation to fire regimes**	Pauline Grierson	To integrate ecological information derived at smaller scales with larger scale management perspectives.
B6 **HighFire: underpinning evidence-based policy for fire regimes and their management in the high country**	Maria Taranto, Mark Adams, John Handmer, Rick McRae, Rod Weber.	To contribute to the current evidence-base for fuels management, understanding and improving human resilience and managing bushfire risk in high country landscapes.

Program C: Community Self-Sufficiency for Fire Safety

End User Leader: **John Gledhill, Tasmania Fire Service**

Program Leader: **John Handmer, RMIT University**

The work of Program C has continued as planned, and is summarised below. As part of our commitment to making our research results accessible, we have compiled an interim report of key research in the Program. This material, together with the results of community safety research being conducted elsewhere in the Bushfire CRC is now with CSIRO for publishing as a commercially available book: *Community safety for bushfires*. This volume is the first collection of social science related research for bushfires or wildfires to be published internationally. We believe that this is a significant achievement, and positions the Bushfire CRC as a leader in this area.

In the final years of this CRC our efforts are turning increasingly towards the transfer of research results. All projects have contributed to the CSIRO volume, and all projects have material published or 'in press' in the scientific literature. Reports have also been produced targeting practitioners, either through the Bushfire CRC's *Fire Note* and *Fire Update* series, the monthly *Bushfire Arson Bulletins* or through detailed specific reports.

More 'hands-on' approaches are also being employed with workshops being conducted on economics, law, evaluation, community profiling and arson (including the running of a fire investigators' workshop). Discussions have also continued with user groups in relation to most projects, as has the testing or interactive application of initial research results in locations across Australia. In this aspect of our work we have been helped greatly by the 'user reference groups' for each project. These groups are coordinated by Damian Killalea of Tasmania Fire Service.

While our focus is predominately in the more settled areas in southern Australia, some of our work has been in the far north and much has been in rural areas. As an example, a community engagement workshop 'Weather matters in Indigenous communities' was held in Townsville in April 2007. Specialist meetings have also been a feature of this Program - for example, in October 2006 a 'roundtable' for arson investigators from police and fire agencies in Victoria, New South Wales and the ACT was held. It helped inform the research project and provided a valuable networking opportunity.

Where appropriate our work has also been publicised outside the fire and land management sectors. Again, and as examples, the Understanding Communities project contributed three chapters to the recently published Queensland-based Centre for Disaster Studies book *Communities Living with Hazards*; Alison Cottrell was a speaker at the Queensland Premier's Cyclone Summit; and John Handmer participated in the United Nation's 'Expert Working Group on Vulnerability' workshop in Prato, Italy in November 2006.

In line with the Bushfire CRC's performance indicator of international engagement, Program C has conducted seminars and workshops in the US and in Europe, where there is considerable interest in Australia's "Prepare stay and defend or leave early" policy for householder protection.

It is also important that politicians and the public 'at risk' understand how this work can help manage the bushfire threat. With this in mind Program C has taken part in a number of important public fora, including the National Bushfire Forum at Canberra's Parliament House in February and a related public forum at the State Library of Victoria in March. Through our participation in the HighFire project we have supported regional gatherings in the New South Wales and the Victorian high country.

This research into local knowledge and community resilience, and our work on the 'Prepare, stay and defend…' policy has attracted sustained media interest. This has enabled us to disseminate our research results widely, and to concurrently reinforce the fire agencies' community safety positions. The media exposure has also allowed us to promote the value of bushfire research. During the year the Program Leader (John Handmer) participated in a high profile ABC TV series on bushfires and bushfire management: *Bushfire Summer*.

Key research achievements:

In addition to the impacts and achievements set out above, a number of other achievements from across the Program are listed below:

The **Understanding Communities** project (C1) is well on the way to trialling its 'Community Profiling Framework' in all Australian States. This Framework was developed by the Project team and should enable an improved understanding of, and engagement with communities, from a fire point of view. The study of Sudanese Refugees and Fire Hazard (by Katie Glasgow) won the 'Emergency Management Australia' Safer Communities Award for Queensland in October 2006; category 'Community or Personal Safety Focus'.

The **Bushfire Arson** project (C3) completed a research project looking at juvenile arson intervention programs around Australia that was well received by the end users. A major report examining spatial and temporal trends in bushfires across Australian jurisdictions is nearing completion, and although not yet published, the analysis has already helped develop arson prevention strategies in a number of fire agencies.

The sub-project within the **Risk Communication** area (C4) on identifying factors influencing resilience following a recent fire in West Melton, New Zealand was completed. Research identifying predictors of the adoption of household preparedness is 50 per cent complete. Another sub-project, examining developmental changes in how children perceive bushfire risk is also half finished. Preliminary analyses indicate that risk perception is influenced by developmental stage of the child.

Working closely with Program A, the **Economics** project (C5) completed an assessment of the economics of aerial suppression. This supported the existing approach showing that smaller aerial appliances were cost-effective especially in initial bushfire attack, while large aircraft had a cost disadvantage. Other major projects included an attempt, with geospatial and information technology company Spatial Vision and others, to value all assets from a fire damage perspective apart from soil and air. We have also examined different approaches to valuing the contribution made by volunteers to bushfire management. The research shows that most current approaches seriously undervalue the volunteer effort. The project continues to work on valuing issues, and the development of a model for the economic analysis of the three fundamental approaches to fire risk management: prevention, suppression and community safety.

Our major project into the cornerstone of Australia's bushfire community safety, the "**Prepare, stay and defend or leave early"** policy (C6), compiled and published the evidence base for the approach. The project has shown that the legal framework is supportive, although some gaps have been identified. Preliminary results from analysis of a proprietary database from the 'Risk Frontiers' Group (which is based at Macquarie University) on bushfire related deaths over the last century support the analysis of published evidence. The aim so far has been to undertake a thorough policy analysis of the approach. This analysis has also included cases in California and southern France, where aspects of the Australian policy are in use. The project is working towards a decision-support framework for the approach. A comprehensive summary of the work to date was presented to the Emergency Management Australia meeting in February.

The **Evaluation** project (C7) has recently completed a review of community safety policy as articulated in six recent Commonwealth and State bushfire and natural hazards Inquiries. The report, by Kaye Stevens, is titled: *Improving the Bushfire Safety of Communities through Community Awareness, Education and Engagement: A Review of Policy Directions in Six Recent Australian Reports.* As well, an initial review of approximately 60 distinct bushfire community safety programs and activities currently implemented around Australia: *Community Education, Awareness and Engagement Programs for Bushfire: An Initial Assessment of Practices Across Australia*, by John Gilbert, has been published.

The Evaluation project team is also involved in several further specific projects including:

- An evaluation of the Tasmania Fire Service's *Prepare to Survive* DVD, which involves workshops and a survey mailed out to 1600 residents in north-east Tasmania
- Research into special needs groups in the Victorian Grampians Area in conjunction with local partner, Gilda McKechnie from RuralAccess (which is an initiative of the Victorian government's State Disability Plan)
- Collaborative research with the South Australia Country Fire Service in a number of location specific studies
- Collaborative research with the Fire and Emergency Services Authority (WA) studying the operation and effectiveness of its Bushfire Ready Action Groups.

Reasons for milestones not being reached

In one or two cases differing interpretations of project milestones have come from different agencies and/or sections of agencies. This has invariably come down to communication issues and to the need to continually expand the range of agency personnel we interact with. Our reference groups have been a great help with this and most matters have now been resolved. In one case, a project was been transferred to a different institution, which inevitably resulted in some delays.

Nature of major consultancies and their contribution to the Bushfire CRC

Program C researchers work with fire, emergency and land management agencies in a variety of ways both in their Bushfire CRC roles and, in some cases, through work not nominally associated with the Bushfire CRC. Generally however, this 'outside' work is closely aligned with Bushfire CRC priorities.

The Economics project (C5) played a major role in a consultancy on 'Wildfire asset identification and valuation for Victoria'. This project was undertaken in conjunction with the company Spatial Vision and it was funded by Office of the Emergency Services' Commissioner. The project attempted to value all assets in terms of their potential damage from wildfire. The Economics project (with C6) also led a project funded by Victoria's Department of Sustainability and Environment to develop 'Mappable vulnerability indicators for bushfire'. The outcomes from both these projects are potentially applicable nationally. The Evaluation project (C7) has been commissioned by the National Community Safety Working Group of the Australian Emergency Management Committee to conduct "a national review of community education, awareness and engagement programs designed to enhance community safety". The review will be conducted during the 2007/08 calendar years. This work will complement and inform the more specific and detailed evaluations of bushfire community safety programs being conducted under Project C7 for the Bushfire CRC.

Any changes proposed to future research directions.

No significant changes are proposed to the agreed work program. Changes are more likely to involve the better focusing of existing research and improving the accessibility and utility of results.

Project title	Project Leader	Objective
C1 **Understanding communities**	Alison Cottrell and Judy Newton	To contribute to the understanding of community needs, expectations, behaviours and attitudes to bushfire risk, response and recovery.
C.3 **Bushfire arson**	Matthew Willis, Toni Makkai and Derek Jory.	To reduce the impact of deliberate and negligent fire lighting in Australian bushland environments.
C4 **Effective risk communication**	Douglas Paton, Peter White and Peter Hughes	To investigate the factors in a risk communication program to promote readiness for bushfires and to respond effectively on receiving warnings.
C5 **Bushfire economic costs**	John Handmer	To coordinate research in Australia to increase the self-sufficiency of communities in managing the risk from bushfires.
C6 **Stay or go**	John Handmer	To identify impediments to the full implementation of the ‘‘Prepare, Stay and Defend or leave early’’ policy.
C7 **Development of an evaluation framework for community safety policy and programs for bushfire**	Gerald Elsworth	To develop an evaluation framework and associated methodology for the community safety approach to bushfire risk.

Program D: Protection of People and Property

End User Leader: **Naomi Brown, Country Fire Authority (until December 2006)**
Noreen Krusel, Country Fire Authority (December 2006 to end June 2007)

Program Leader: **Bob Leicester, CSIRO**

This program is examining methods to increase the safety at the interface between people, property and the natural bushland environment. It is focussed on the health and wellbeing of the community and of firefighters through research into building protection, and firefighter health and safety. Understanding the drivers of demographic and attitudinal changes affecting volunteerism is also a major focus of this program.

Program D comprises several apparently discrete Projects. However, one of the features of the projects during the past year has been an increasing level of interaction between the various researchers. As an example, the demographics of volunteers is relevant to research related to fire-fighter performance, and research related to heat stress and the toxicity of smoke has some relevance to research related to unsafe decisions on the fire-ground. Interaction with researchers of Programs A and C is also occurring on an increasingly regular basis.

Most of the Projects took advantage of the fire season to make many useful field measurements. Two Projects that were late starters in this Program, D2.1 (Fire Fighter Health and Safety) and D5 (Incident Management Teams), are now well developed and producing exciting results. The Program has also benefitted from supplementary funding that was obtained for specific projects from BlueScope Steel and from the NSW Rural Fire Service. With respect to the relevant Bushfire CRC milestones, all Projects are effectively ‘on track’.

For all Projects, technology transfer is now the major challenge. End user groups to assist in the transfer of research findings into practical application are being set up. In relation to this task considerable assistance is being provided by members of the various AFAC sub-committees. Several Project teams (D1, D2.1, D2.2, and D2.3) were invited by FESA to present extended workshops in Western Australia and this provided an opportunity to develop an effective element in the technology transfer process. Several Projects are also benefitting through the use of interstate fire agency personnel to undertaking field measurements in a range of situations and at a variety of locations.

Justin Leonard of CSIRO is now an ‘invited’ member of Paradox, a European-based consortium set up to action research on wildfires. Claire Johnson, a La Trobe University PhD student in Project D2.3, was awarded an overseas Best Student Paper award by the company Aptima, for her paper on ‘The Use of Worst Case Scenarios in Decision Making by Bushfire Fighters’. A paper by Sean Cowlishaw and Jim McLennan (Project D3) on the impact of volunteerism on families is now a required reading text at Deakin University.

The following are brief comments on specific projects:

D1 Protection of Property and People
Within this project, Justin Leonard of CSIRO has now completed an extensive set of experimental studies to measure the combustion characteristics of building elements that occur within the rural-urban interface zone. These include wooden decks of houses, glazing, water tanks, and fences. This information will be used in the development of a risk model to assess the effectiveness of building regulations that are designed to mitigate the impacts of wildfires. Another significant component of the risk model has been the development of a 3-D spatial model to be used in the assessment of the radiation risk. Work is now underway to tie this model in with the fire-spread/risk management model developed by Kevin Tolhurst as part of Program A4.1.

Leonard has also recently completed some 33 combustion tests on a range of cars to assess their potential as people refuges during a bushfire attack.

D2.1 Fire-Fighter Health, Safety and Well-being on the Fireground
This Project, under the leadership of David Nichols (CFA – Victoria)), has a well developed program of both laboratory and field measurements on the work demands of fire-fighting under Australian practice and conditions. During the fire season, 42 volunteer fire-fighters were monitored during their field duties. An experimental laboratory has been established at the CFA training ground at Fiskville.

D.2.2 Management of Air Toxics Exposure
The Project team, led by Mick Meyer of CSIRO, was involved in monitoring the smoke exposure of fire-fighters involved in various activities on 20 prescribed burns and two wildfires. Some of the prescribed burns also provided information on community exposure. In addition, a series of laboratory measurements have been made on several types of fuel to obtain an indication of their smoke composition. Future work will include investigations on the particle size distribution and chemistry of smoke. However, the primary focus will be on the creation of a tool-kit of information for use in the management of fire-fighter exposure to bushfire smoke.

D2.3 Understanding and Reducing Unsafe Decisions
The team, led by Mary Omodei (La Trobe University), continues to use information obtained from a 'Human Factors Interview Protocol' that was applied to interviews with 120 fire-fighters who were involved in field operations. The information obtained is being used to refine a software program ('Networked Fire-Chief'). The program is then being used to examine the decision making of firefighters in controlling computer-generated fires. Both of these tools have proven to be so effective that some fire agencies have expressed an interest in using them for projects outside the current scope of Project D2.3. A recent Project innovation has been the incorporation of 'lessons learned' from 'near miss' incidents at actual bushfires.

During the past year, the Project has identified a number of aspects of both individual and group behaviour that may lead to unsafe decisions. Training, operational procedures and incident investigations to reduce the frequency of such decisions have been developed.

D3 Recruitment and Retention of Volunteers
Project D3, managed by Jim McLennan (LaTrobe University), continued the use of general and longitudinal surveys to enhance its already considerable data on the recruitment and retention of volunteer fire-fighters. Research themes include the potential roles for women, the demographics of future volunteer recruits, the influence of employers and the interactions between volunteerism and family life.

D5 Information Flow in Multi-Agency Incident Management Teams
During the fire season the Project team, led by Christine Owen (University of Tasmania) collected data at a number of Incident Management Team centres. Data was collected at 12 real time wildfire incidents and at five computer based training sessions. Information collected included details of available work space, spatial flow of information, the inter-personnel route of this flow and the hardware used to support the management team were recorded, and assessed for its effectiveness. The team also reviewed existing documentation on the flow of information both between relevant agencies and within an agency, and to the public during critical incidents. The findings from this research will be used to develop improved operational procedures for Incident Management Teams.

Project title	Project leader	Objective
D1.1 **Building and occupant protection**	Justin Leonard	To improve awareness and understanding of the issues surrounding building loss in bushfires, through research, communication and education.
D 2.1 **Fire fighter health and safety**	David Nichols	To improve the safety, health and general well-being of volunteer and career fire fighters in their fire fighting duties.
D 2.2 **Personal exposure of firefighters to air toxics and OHS risk management strategies**	Steve Brown (until December 2005), Donavan Marney (from January 2006)	To develop and apply capabilities for measuring the personal exposures of bushfire fighters to a wide range of air toxics in different fire scenarios.
D2.3 **Safety in decision-making and behaviour**	Mary Omodei	To identify the human factors that lead bushfire fighters to make decisions that place themselves or others at risk.
D2.4 **Safe, cost-effective equipment for reduced firefighting risks to firefighters**	David Nichols	To increase the safety of firefighters through improvements in equipment, vehicles and processes.
D3 **Enhancing volunteer recruitment and retention**	Mary Omodei (Manager: Jim McLennan)	To carry out joint research with fire agencies that will assist them to maintain sufficient numbers of volunteers and brigades to meet community needs.
D4 **Respiratory health of firefighters**	Phil Weinstein, Angus Cook, Phil Thompson, Brian Devine	To investigate the respiratory health effects of occupational exposure to combustion products from bushfires as well as the efficacy of the protective filters on firefighters' masks.
D 5 **Optimising information flow through collaborative work performance: Enhancing emergency incident management team effectiveness and organisational learning**	Christine Owen	To improve teamwork effectiveness and subsequent organisational and cross-organisational learning.

Program E – See section on Education and Training

Program F – Community Outreach

The Bushfire CRC's Community Outreach program has achieved considerable success during the year in promoting the Bushfire CRC's work and raising awareness of the science of bushfire research outcomes to the broader community, and fire and land management personnel. A variety of briefings, public forums, seminars and media initiatives have been conducted across metropolitan and regional Australia that provided opportunities to connect community, researchers and the fire industry in the exchange and sharing of information and experience.

The Community Outreach program (Program F) complements the activities of the Bushfire CRC's Education and Training program (Program E). The Education and Training program emphasises vigorous, proactive, targeted efforts to encourage adoption by CRC end user partner agencies of the specific results from new research. This is supported by the Community Outreach program through its emphasis on improved access to, and communication of, bushfire science more generally. Both programs are key features of the Bushfire CRC communication strategy.

The Fire Knowledge Network
A service of the Bushfire CRC, the Fire Knowledge Network is providing a focal point for access to leading national and international fire research and knowledge. It gives unprecedented access to various forms of fire-related knowledge by drawing on research from a range of recognised organisations such as Bushfire CRC, AFAC, CSIRO, other CRC's, universities, international fire research agencies and experts.

During the year the Fire Knowledge Network brand was launched. The Network logo now appears on all knowledge transfer initiatives from the CRC including information products, events and communications. This has led to increased recognition and visibility of the Network as well as providing the opportunity to engage with stakeholders in the promotion of Bushfire CRC research learnings.

Highlights of this year's program include:

- Completion of extensive stakeholder engagement, online survey and user needs analysis that built an understanding of the information and knowledge requirements of the fire industry in Australia and New Zealand
- Launch of the Fire Knowledge Network brand with a series of Executive Briefings with international guest speakers and Public Events across Australia demonstrating the value of the Networks ability to connect people and offer opportunities for exchange of information and experience
- "Are Big Fires Inevitable?" – A National Bushfire Forum held at Parliament House in Canberra provided a platform to hear the views of practitioners, politicians, policy advisors and researchers to further our understanding of large bushfires in populated areas of southern Australia
- Significant collaboration with the fire industry's peak body, the Australasian Fire Authorities Council (AFAC) aimed at supporting the industry's knowledge management initiatives. This has resulted in engagement of industry representatives in providing content and resources for the Network
- Fire Knowledge Network prototype web site developed for pilot testing prior to full technical design, build and launch. Key features of the Network website will be the ability for the general public to access research about Bushfires and a secure *agency*CONNECT extranet

that will enable fire and land management agencies across Australia to easily share learnings and experiences.

Bushfire CRC Forums

Aligned with the knowledge transfer activities of the Bushfire CRC's Education and Training Program the Community Outreach program has successfully engaged with a significant number of community groups and government agencies, including: Federal and State government ministers, politicians, local government, community interest groups, volunteer associations, students, researchers, fire and land management agencies and local residents.

Highlights of this year's program include:

- A series of Executive Briefings were conducted around Australia in 2006 and 2007 on the 'Mega-fire Phenomenon'. International expert Jerry Williams from the Brookings Institution presented on the US experience and the lessons for Australia. These briefings received significant media coverage
- The HighFire research site was launched by the Federal Member for Indi, Mrs Sophie Mirabella at Howmans Gap in north east Victoria in June
- Free public forums have been held in various states of Australia in metropolitan and regional areas. These events were well received by the general community. The aim of the events was to showcase Bushfire CRC research and its relevance to the local communities. The Federal Member for Eden-Monaro, Mr Gary Nairn, MP attended and presented at a public forum held in Cooma in April.

Future developments

The Fire Knowledge Networks new website will be launched in late 2007. Initial focus will be on design and building knowledge repositories of bushfire research and lessons learnt material that can be accessed and shared as a valued resource.

The CRC continues to work closely with its industry to align its Community Outreach and Fire Knowledge Network initiatives with the industry's organisational goals and objectives.

Research Collaborations

During the year the Bushfire CRC continued to build on formal and informal research collaborations both nationally and internationally. The Bushfire CRC has built upon established links with other CRCs including its Memorandum of Understanding with Spatial Information CRC, which was signed in 2004. It has also jointly funded an education project with Tropical Savannas CRC and has jointly funded a research fellow and PhD student with Desert Knowledge CRC. It has several students in common with the CRC for Sustainable Forestry and the Asthma CRC.

The Bushfire CRC continued to build its international standing and credibility with formal agreements including a Memorandum of Understanding with:

- University of California, Berkeley
- US Department of Agriculture, Forest Service
- University of Coimbra, Portugal

More informal relationships exist with a number of the research laboratories of the US Department of Agriculture, Forest Service in Riverside California, Firelab in Montana, and the Rocky Mountain Research Station. Discussions are now underway to formalise the relationships. The Bushfire CRC, as part of the HighFire project, has developed a large number of research connections including the Valles Caldera National Preserve in New Mexico, and Fraunhofer Institute for Atmospheric Research, Garmisch, Germany.

During 2006-07 the Bushfire CRC enhanced its links with North American research institutions with visits from senior personnel:

- Rob McAlpine, from the Ontario Ministry of Natural Resources, Aviation, Flood and Fire Management Branch worked closely with Program A researchers on a suppression resource analysis tool he has developed for operational use in Canada.

- Jerry Williams from the Brookings Institution, visited in August 2006 and March 2007 to conduct several executive briefings for end user staff, participate in public forums, and deliver the keynote address to the National Bushfire Forum at Parliament House Canberra.

- Scott Stephens and Max Moritz fro the University of Berkeley participated in the Fire Manager's Research Workshop at Wollongong in July and finalised the MOU between their institution and the Bushfire CRC.

- The Fire Manager's Research Workshop also featured presentations on bushfire research from William Bond, from the University of Cape Town, and Tara McGee, from the University of Alberta.

The Bushfire CRC has also developed close links with the Fire Paradox Project currently being undertaken by the European Union with researchers Jim Gould and Justin Leonard participating in the Steering Committee and Technical advisory committees respectively.

Table 3: Research Outputs and/or Milestones

3.1 Research Programme A: Safe Prevention, Preparation and Suppression

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
OUTCOME 1: IMPROVED FIRE FIGHTER AND COMMUNITY BUSHFIRE SAFETY FROM BETTER UNDERSTANDING OF FIRE BEHAVIOUR RELATING TO FUEL, WEATHER AND TOPOGRAPHY FACTORS ACROSS AUSTRALIA.					
Output 1.1	**Improved Fire Danger Rating System**				
Milestone 1.1.1	Current fire danger rating systems assessed	30/06/2005	Yes		
Milestone 1.1.2	Improved inputs (including on curing, drought, weather) defined for fire danger rating system	30/06/2007	Yes		
Output 1.2	**Implementation of a National Fire Behaviour Prediction System**				
Milestone 1.2.1	Bushfire behaviour observation handbook available	30/06/2004	No	This has been replaced by a new field handbook to be released in November 2007.	To be released November 2007.
Milestone 1.2.2	Validation of the revised fire behaviour prediction systems in different forest types of both fuel structure and age in the eastern states forests.	30/06/2006	Yes		
Milestone 1.2.3	Behaviour prediction in heath land, shrub land and woodlands based on experimental fires and other observations	30/06/2007	Yes		
Output 1.3	**Prescribed Burning Guidelines for the major south-eastern fuel types.**				

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 1.3.1	Guidelines available for Sydney region with fuels, moisture and heat transfer incorporated into fire behaviour models	30/06/2006	Yes		
Milestone 1.3.2	Burning guidelines for selected hardwood forest plantations	30/06/2007	Yes		
Output 1.4 **A single Fuel Classification System based on plant species and on fuel age, structure, quantity and weather factors** *Project Vesta, which is to be publicly released on 2 Nov 2007, will incorporate a new Fuels Assessment guide that utilises this work*					
Milestone 1.4.1	Review of pasture fuel models and databases and a draft classification framework available.	30/06/2004	Yes		
Milestone 1.4.2	Fuel availability and combustion rate models for different fuel strata	30/06/2005	Yes		
Milestone 1.4.3	Results available of study of fuel moisture relationships in current fire prediction indices	30/06/2005	Yes		
OUTCOME 2: IMPROVED USEFULNESS OF FIRE WEATHER FORECASTS FOR COMMUNITY AND FIRE SERVICES MANAGEMENT OF BUSHFIRE RISKS					
Output 2.1 **Improved forecasts of wind changes and conditions**					
There are no milestones for this output deliverable in 2006/07					
OUTCOME 3: IMPROVED UNDERSTANDING AND SELECTION OF SUPPRESSION STRATEGIES					
Output 3.1 **Evaluation of the relative effectiveness of suppression techniques including aircraft, burning, water additives**					

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 3.1.1	Review of current suppression tactics, evaluation of selected aircraft in different fuel types and fire intensities and the results of pilot field trials available	30/06/2006	Yes		
OUTCOME 4: BUSHFIRE RISK MANAGEMENT MODEL OF FIRE MITIGATION, PROBABILITY, SOCIAL, ENVIRONMENTAL AND ECONOMIC FACTORS FOR USE BY COMMUNITIES, TOWN PLANNERS AND AGENCIES					
Output 4.1	**Component Models developed**				
Milestone 4.1.2	Fire Occurrence and Spread Models available based on analysis of historical data and fire behaviour.	30/06/2007	Yes		
Output 4.2	**Bushfire Risk Management Model available**				
Milestone 4.2.2	Initial model available and tested for tactical use in risk management decision making.	30/12/2007	Yes		
OUTCOME 5: SIMULATION, MODELLING AND ANIMATION TOOLS FOR REAL-TIME PREDICTION OF FIRE DEVELOPMENT AND FOR TRAINING					
Output 5.1	**Simulation and animation tools for fire development**				
Milestone 5.1.3	Validation of macro-model completed using existing fire dynamic models and input from fire experts.	30/12/2006	Yes		
Milestone 5.1.4	Graphics and control interfaces incorporated into simulation package.	30/06/2007	Yes		
Output 5.2	**Simulation and animation tools refined for use in real-time options analysis and in training**				

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 5.1.4	Prototype simulator demonstrated in training environment	30/06/2005	Yes		

3.2 Research Programme B Prescribed Fire in the Landscape

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
OUTCOME 6: MANAGEMENT OF FIRE REGIMES AT THE LANDSCAPE LEVEL FOR OPTIMUM HUMAN PROTECTION AND BIODIVERSITY OUTCOMES					
Output 6.1	**Decision tools for use by fire managers in planning effective and ecologically sustainable fire management regimes in south west Australia.**				
No deliverables for this outcome for the current period.					
Output 6.2	Landscape Model for the appropriate mix of management actions for optimum human protection and biodiversity maintenance in varying ecosystems.				
Milestone 6.2.1	Literature review of landscape management factors completed and report published	30/06/2005	Yes		
Milestone 6.2.1	Field surveys and construction of model of fire regime, biodiversity and human protection.	30/12/2006	Yes		
OUTCOME 7: REDUCED IMPACT OF SMOKE FROM PRESCRIBED FUEL REDUCTION BURNS AND WILDFIRES ON COMMUNITY HEALTH AND SAFETY					
Output 7.1	**Smoke Management Advice Model to predict movement and particulate concentrations from rural or urban fires.**				
No deliverables for this outcome for the current period.					
Output 7.2	Tools to quantify the effects of prescribed and wild fires on human health and the environment				
Milestone 7.2.2	Environmental and human health effects of smoke exposure defined.	30/06/2007	Yes		
OUTCOME 8: IMPROVED UNDERSTANDING OF THE IMPACTS OF FIRE AND VEGETATION ON BIODIVERSITY IN A RANGE OF ECOSYSTEMS					
Output 8.1	**Information on fire impacts in eastern Australia ecosystems as a science-base for land management strategies.**				

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 8.1.1	Report available on literature review of role of invertebrates and fungi in ecosystem processes.	30/06/2004	No	Outstanding due to resignation of Post Doctoral Fellow.	Draft report has been prepared and will be updated as CRC Report in late 2007
Milestone 8.1.2	Consolidation of database at five existing experimental sites completed.	30/06/2005	Yes		
Output 8.2	Improved understanding of the impact of fire management options on Biodiversity and Carbon Sequestration in northern tropical savannas.				
Milestone 8.2.2	Results available of seed and seedling dynamics experiments	30/06/2005	Yes		
Milestone 8.2.3	Models published of fire impacts on vegetation dynamics and carbon sequestration (Dec 2006).	30/12/2006	Yes		
Milestone 8.2.4	Prescribed burning protocols for biodiversity conservation in northern Australia available	30/12/2007	Yes (ahead of schedule)		
Milestone 8.2.5	Community Awareness kit available on fire and biodiversity in northern Australia	30/12/2007	Yes (ahead of schedule)		
OUTCOME 9: PREDICTIVE MODELS FOR THE IMPACTS OF PRESCRIBED BURNING BASED ON INTEGRATION AND SCALE-UP OF NATIONAL EXPERIMENTS					
Output 9.1	**Practical overall Prescribed Burning Tool for Land Managers based on results of all Program B trials and models**				
Milestone 9.1.1	Data sets collated from the existing trial sites and gaps in biodiversity and ecosystem processes defined	30/06/2004	No	This work has been refocused by the end users and will now be presented as a book on Prescribed Burning. First draft of this book completed.	This work is redirected, and a modification of the Commonwealth Agreement Milestones will be sought.

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 9.1.2	Gap filling experimentation completed	30/06/2006	No	This work has been refocused by the end users and will now be presented as a book on Prescribed Burning. First draft of this book completed.	This work is redirected, and a modification of the Commonwealth Agreement Milestones will be sought.
Output 9.2 Model of Ecological Processes and Fire Regimes based on multi-scale pattern analyses of field data.					
No deliverables for this outcome for the current period.					
OUTCOME 20: MANAGEMENT OF FIRE REGIMES IN THE ALPINE ECOSYSTEMS FOR OPTIMUM HUMAN AND INFRASTRUCTURE PROTECTION, WATER CATCHMENTS, CARBON FLUX AND BIODIVERSITY OUTCOMES					
Output 20.1 National fire related and GIS-interpretable database on litter and biomass for the Australian high country					
Milestone 20.1.1	Negotiation of data exchange contracts with state agencies	30/04/2005	Yes		
Milestone 20.1.2	Modeller to gather data and create the database	30/07/2005	No	Suitable student was not identified in the target timeframe.	Student has been identified and work will commence once scholarship arrangements have been finalised.
Milestone 20.1.3	Completed database	30/10/2005	No	Suitable student was not identified in the target timeframe.	Student has been identified and work will commence once scholarship arrangements have been finalised.
Output 20.2 Definition of fire prevention and suppression activities and strategies to achieve a desired range of management objectives. These strategies will largely be based on evidence from the 2002/2003 fires.					

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 20.2.1	Analysis of the relationships between the distribution of fire severity classes of the 2002/2003 alpine fires and geographic information	30/12/2005	Yes		
Output 20.3 Identification of sensitivity of shrub abundance to land-use management					
Milestone 20.3.1	Development of a research plan based on the current state of knowledge	30/06/2005	Yes		
Milestone 20.3.2	Selection of study sites	30/05/2005	Yes		
Milestone 20.3.3	Implementation of experiments	30/07/2005	Yes		
Milestone 20.3.4	Publication of results	30/06/2005	No	Access to experimental sites was limited and equipment was damaged during the 2006/07fires	An additional season of data is being collected prior to publication.
Output 20.5 Co-operation and integrated management strategies among state agencies					
Milestone 20.5.1	Organise inter-agency working groups	30/05/2005	Yes		
Milestone 20.5.2	Define agency objectives	30/07/2005	Yes		

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 20.5.3	Develop an effective strategy of land management to satisfy agency objectives	30/07/2006	No	See Milestone 20.3.4	See Milestone 20.3.4
Milestone 20.5.4	Provision of inter-agency strategy	30/06/2007	No	See Milestone 20.3.4	See Milestone 20.3.4
Output 20.6 Comprehensive systems of monitoring for outcomes, adaptive management					
Milestone 20.6.1	Review state of knowledge	30/09/2005	Yes		
Milestone 20.6.2	Employ staff	30/05/2005	Yes	Completed – but delayed by 12 months with impact on subsequent deliverables	
Milestone 20.6.3	Purchase field and laboratory equipment	30/05/2005	Yes		
Milestone 20.6.4	Establish monitoring systems within LTER	30/06/2005	Yes		
Milestone 20.6.5	Monitor and data collection	30/04/2007	No	Delayed due to late appointment of staff.	
Milestone 20.6.7	Publication	30/06/2007	Yes		
Output 20.7 Build long-term ecological research (LTER) sites and add value to existing experiments					
Milestone 20.7.1	Catalogue research sites in the Australian high country	30/03/2005	Yes		

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestone 20.7.2	Select site locations	30/05/2005	Yes		
Milestone 20.7.3	Establish LTER sites for the high country project	30/05/2006	Yes		

3.3 Research Programme C: Community Self Sufficiency for Fire Safety

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
OUTCOME 10: UNDERSTANDING OF COMMUNITY NEEDS, PERCEPTIONS AND ATTITUDES TO BUSHFIRE RISK MANAGEMENT					
Output 10.1 Framework and methodology for definition of Community Needs and Attitudes toward Bushfire Risk Management					
Milestones 10.1.1	Systematic classification available of bushfire areas and potentially affected communities. (June 2004).	30/06/2004	Yes		
Milestones 10.1.2	Framework and methodology to understand community needs and decision-making available (June 2005).	30/06/2005	Yes		
Milestones 10.1.3	Draft guidelines available for assessing agency expectations of communities (June 2005).	30/06/2005	Yes		
Output 10.2 Validation and implementation of methodology with Selected Communities and Agencies					
Milestones 10.2.1	Results of surveys / interviews using the draft tools above available (June 2006).	30/06/2006	Yes		
OUTCOME 11: APPROACHES DEFINED FOR EFFECTIVE COMMUNITY ENGAGEMENT *This outcome was not funded at the request of end users. It was determined not to be a major priority when compared with other research activities. In addition it was identified that researchers were not in a position to deliver against the required work program.*					
OUTCOME 12:					
Output 12 1 Documentation of methods to reduce deliberate and negligent ignitions.					

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
Milestones 12.1.1	Review and assessment available of current arson prevention practices (June 2005).	30/06/2005	Yes		
OUTCOME 13: IMPROVED SAFETY FOR PEOPLE AT RISK AND REDUCTION IN LOSSES THROUGH IMPROVED RISK COMMUNICATION AND WARNINGS					
Output 13 1 Best practice procedures and parameters for effective Bushfire Warnings defined					
Milestones 13.1.1	Community information needs identified for periods before, during and after a bushfire emergency (June 2005).	30/06/2005	Yes		
Milestones 13.1.2	Collection, review and analysis of current practices completed (June 2005).	30/06/2005	Yes		
Milestones 13.1.3	Trials and evaluation of preferred options completed and information flows assessed (June 2007).	30/06/2007	No	Due to ongoing discussions with end user agencies on directions of the trials.	Ongoing discussions on the impact of trials on community safety. This may delay this milestone further.
Output 13 2 Best practice Guidelines on Risk Communication for use by Fire Services					
No deliverables for this outcome for the current period.					

OUTCOME 14: RELIABLE ASSESSMENT METHODS FOR THE TOTAL COSTS OF BUSHFIRES AND THE BENEFITS OF MITIGATION						
Output 14.1	**Comprehensive estimates of the social, economic and environmental Costs of Bushfires**					
Milestones	14.1.	Methodology validated in real or hypothetical bushfire case studies (June 2007).	30/06/2007	Yes		
Output 14.1	Methodologies and credible assessments of the Benefits of Bushfire Risk Treatments					
No deliverables for this outcome for the current period.						
OUTCOME 15: VALUE AND VIABILITY ESTABLISHED OF A "STAY OR GO" POLICY AS A TREATMENT FOR BUSHFIRE RISK.						
Output 15.1	**Review of current "Stay Or Go" Policy use across Australia**					
Milestones 15.1.2		Results of surveys and case studies of the "Stay or Go" issue available (Dec 2006).	30/12/2006	Yes		
Output 15.2	Defined content and implementation plans for the "Stay Or Go" Policy or other prefered option					
No deliverables for this outcome for the current period.						
OUTCOME 16: EVALUATION OF THE EFFECTIVENESS OF BUSHFIRE RISK MANAGEMENT POLICIES, PROGRAMS AND STRATEGIES FOR COMMUNITY SAFETY						
Output 16.1	**Methodology for evaluation of the effectiveness of Bushfire Strategies for Community Safety**					
No deliverables for this outcome for the current period.						
Output 16.2	**Analysis of the success of past and current Bushfire Community Safety Approaches**					
Milestones 16.2.1		Initial assessment of current practices across Australia available (June 2006).	30/06/2006	Yes		

3.4 Research Programme D: Protection of People and Property

OUTCOME 17: REDUCED BUILDING LOSSES AND INJURIES TO OCCUPANTS DUE TO BUSHFIRES					
Output 17.1 A risk-based model of the factors influencing the result of bushfire attack on Buildings and Occupants.					
No deliverables for this outcome for the current period.					
Output 17.2 A risk-based model of the factors influencing the result of bushfire attack on Buildings and Occupants.					
Milestones 17.2.1	Provide recommendations on changes to Reg AS3959. Building in fire prone areas (Dec 2005 and Dec 2007)	30/12/2005	Yes and ongoing		
Output 17.3 A risk-based model of the factors influencing the result of bushfire attack on Buildings and Occupants.					
Milestones 17.3.1	Information package on methods for reducing the risk of building ignition	30/12/2005	Yes and ongoing		
OUTCOME 18: INCREASED FIRE FIGHTER HEALTH, SAFETY AND WELL-BEING					
Output 18.1 Management guidelines for improved fire fighter safety on the bushfire ground					
No deliverables for this outcome for the current period.					
Output 18.2 Capabilities for measurement and control of the exposure of fire fighters to Air Toxics					
Milestones 18.2.2	Annual reports of exposure measurements and data analysis for each fire season from 2005 to 2008 (June each year)	30/06/2007	Yes		

Output 18.3 Guidelines for enhanced Fire Fighter Safety in Decision Making and Safe Behaviours
No deliverables for this outcome for the current period.

Output 18.4 Improved fire fighter protection during wildfire burnovers by safe, cost-effective equipment to reduce inherent bushfire risks. *This project has now been stopped. Alternative Research works has been identified and a variation to the Commonwealth Agreement will be sought.*					
Milestones 18.4.1	Results available of laboratory and field trials of preferred vehicle design for crew protection (March 2005).	30/03/2005	Yes		
Milestones 18.4.2	Reports on trials of protection equipment items to be specified by users (one per year in 2006 to 2009).	30/06/2007	No	Project Stopped.	Alternative research outputs to be identified and variation to commonwealth Agreement will be sought.

OUTCOME 19 RECRUITMENT AND RETENTION OF ADEQUATE LEVELS OF APPROPRIATELY TRAINED VOLUNTEER FIRE FIGHTERS
Output 19.1 National profile of the Demographics and Needs of rural Fire Service Volunteers
All deliverables for this outcome have been completed prior to the reporting period
Output 19.2 Guidelines for Fire Services to ensure Sustainable Volunteerism
No deliverables for this outcome for the reporting period

3.5 Program E: Education and Training

Type of Milestone and/or Output	Description of all 2006-07 milestones and/or outputs incl. past milestones which have not been met (and date)	Achieved	If achieved, progress during 06-07 and planned activities in 07-08	Reasons why milestones and/or outputs have not been achieved	Strategies to achieve milestones which have not been met
Outcome E1:	**WELL QUALIFIED, INTEGRATED AND SELF-RENEWING FIRE RESEARCH COMMUNITY**				
Output E1.1	**Thirty PhD Qualified researchers created by 2010**				
Milestones E1.1.1	Thirty post-graduate scholarships established across all 19 Research Sub-Programs (March 2006).	Achieved	32 PhD students and 5 Masters currently enrolled. Total of 41 scholarships. 5 students have completed, 2 of the 3 PhDs have gained employment within the industry with one on extended leave.		
Output E1.2	**Exposure of researchers to leading national and international researchers and programs**				
Milestones E1.2.1	Participation of all post-graduate scholarship holders in annual Bushfire CRC conferences and workshops and some post-doctoral researchers in overseas collaborations (Each Year).	Achieved	All students participated in BCRC sponsored Fire Managers Research Workshop, University of Wollongong, July 2006 as well as Bushfire CRC/AFAC Conference in August 2006.		
OUTCOME E2:	**AUSTRALIA RECOGNISED AS ONE OF THE THREE LEADING COUNTRIES IN BUSHFIRE RESEARCH**				
Output E2.1	**Annual CRC Conferences and one International Bushfire Conference**				
Milestones E2.1.1	Bushfire CRC Conferences in conjunction with AFAC or Ausfire Conferences held annually and one major global bushfire conference convened (March 2008).	Achieved	Conference held in Melbourne August 2006. Planning underway for 2007 conference in Hobart and 2008 International conference in Adelaide		
	Regular International Research				

Type of Milestone and/or Output	Description of all 2006-07 milestones and/or outputs incl. past milestones which have not been met (and date)	Achieved	If achieved, progress during 06-07 and planned activities in 07-08	Reasons why milestones and/or outputs have not been achieved	Strategies to achieve milestones which have not been met
Output E2.2	**Collaboration Assignments and Conference Participation / Papers to identify emerging trends or themes**				
Milestones E2.2.1	Two international research collaboration assignments (Each Year)	Achieved	2 visits were made by researchers to meet with Fire Paradox project - EU One researcher visited Berkeley UC and Riverside Lab – US Forestry 2 researchers visited US Fire Lessons Learnt Centre		
Milestones E2.2.2	Five participants and papers given at international conferences (Each Year).	Achieved	Wildland Fire Conference, Spain 6 participants – 3 papers presented Forest Fire Research Conference, Portugal - 9 participants attended – 2 students and 6 researchers presented papers. International Fire Ecology and Management Congress (US) Nov 2006 – 4 participated including 1 paper presented Evaluation 2006 Conference, US – 1 student presented a paper European Geoscience Union conference, Vienna – 1 researcher participated		
Milestones E2.2.3	Support provided by senior researchers to the post-doctoral researchers working on international collaboration assignments.	Achieved	As above		
OUTCOME E3:	**FIRE SERVICES AND COMMUNITIES AWARE AND TRAINED IN THEIR RELEVANT BUSHFIRE RISK MANAGEMENT ELEMENT**				

Type of Milestone and/or Output	Description of all 2006-07 milestones and/or outputs incl. past milestones which have not been met (and date)	Achieved	If achieved, progress during 06-07 and planned activities in 07-08	Reasons why milestones and/or outputs have not been achieved	Strategies to achieve milestones which have not been met
Output E3.1	**Appropriate Training Courses developed and in place**				
Milestones E3.1.1	Three short courses developed for Fire Services personnel in response to priority agency needs (each year).	Achieved	Multiple workshops held during 2006-2007 and further planned.		
Milestones E3.1.2	Community education materials or courses developed on priority topics identified by the CRC and/or agencies (One per year).	Achieved	*The Day the Flames Came – a DVD documentary on the lessons learnt from the 1961 bushfires in Dwellingup, Western Australia. Produced in conjunction with Bushfire CRC partners the Dept of Environment and Conservation and the Fire and Emergency Services Authority. Distributed widely to staff in WA as a learning support tool and launched to broader industry at Bushfire CRC annual conference.*		
Output E3.2	**Effective technology transfer to the main Bushfire CRC End Users**				
Milestone E3.2.1	Technology Transfer Officers in place to translate research outputs into practical usable materials [this is no longer being pursued but other strategies are in its place]	In-part	Strategies implemented: Range of publications Workshop program: including two research seminars in Perth Conferences	Research Adoption and Education Manager position was vacant for 4 months	A research adoption strategic plan is being developed with a suite of strategies to best fit for fire agencies

3.6 Research Programme F: Community Outreach

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
OUTCOME F1	**REGIONAL AND LOCAL COMMUNITIES' RELEVANT POLICY AND DECISION MAKERS AWARE OF THE BUSHFIRE CRC, MORE INFORMED ON FIRE SCIENCE, AND MORE ENGAGED IN SHARING FIRE KNOWLEDGE.**				
Output F1.1	*The Fire Knowledge Network developed and operating effectively*				
Milestone F1.1.1	Initial survey of stakeholders and scoping exercise on the concept and operation of the Fire Knowledge Network completed	April 2005	Yes		
Milestone F1.1.2	Initial network meetings with researchers, end users, community groups and policy makers	October 2005	Yes		
Milestone F1.1.3	Modified Bushfire CRC web site to reflect Fire Knowledge Network initiative and provide architectural framework for a dedicated new site on Fire Knowledge	June 2005	Yes		
Milestone F1.1.4	Two year program of 16 regional Fire Knowledge Network meetings	June 2007	70% complete	Program was delayed due to late appointment of Project Manager. Executive briefings and workshops held in Western Australia, South Australia, Victoria, Tasmania, New South Wales, Canberra and Brisbane. In particular a National Bushfire Forum was held in Canberra in February 2007	Similar workshops and forums planned for the next 12 months
Output F1.2	*Community forums on bushfire knowledge and CRC research and key themes/issues concerning bushfire science.*				
Milestone F1.2.1	Bushfire CRC community forums conducted across Australia, 20 over three years	June 2007	55% complete	Program was delayed due to late appointment of Project Manager.	Similar program of events and community awareness initiatives

Output / Milestone Number	Description	Contracted Achievement Date	Achieved (Yes or No)	Reasons why not achieved (if applicable)	Strategies to achieve unmet milestones
				Extensive community awareness about the science of bushfires has been undertaken with public forums in capital cities and regional areas, research site launches, Bushfire CRC involvement ABC TV *Bushfire Summer* Series and a National Media Briefing on Bushfires held in conjunction with the Australian Media Science Centre.	planned for 2007/08

COMMERCIALISATION AND UTILISATION

Commercialisation and Utilisation Strategies and Activities

The detail of the commercialisation and utilisation strategies can be found in the Commercialisation and Utilisation Strategy modified and submitted to DEST in April 2007.

A copy of this can be found at http://www.bushfirecrc.com/members/downloads/Bushfire-CRC-Commercialisation-and-Utilisation-plan-ammended-april-2007.pdf

Table 4: Commercialisation and Utilisation Outputs and/or Milestones

These are detailed in Table 3

INTELLECTUAL PROPERTY MANAGEMENT

Refer to the detailed Bushfire CRC Commercialisation and Utilisation Plan.

COMMUNICATIONS STRATEGY

The communications strategy promotes the research and activities of the Bushfire CRC amongst stakeholders and to the broader community. The strategy complements the communication's objectives of all the stakeholder agencies. One of the main priorities is to build close working relationships at all levels within these organisations.

Progress continues on a range of communications activities that are aligned to the strategic direction of the Bushfire CRC. To enable the CRC to better communicate with its partners, government and the wider community the activities are focussed on priority areas including online communications, publications, media, events and branding.

Online Communications

The Bushfire CRC website is a prime communications tool for both internal and external audiences. It received a steady increase in hits over the year with demand particularly strong around major activities and bushfire events, and with the launch of new research.

New design

A new-look Bushfire CRC website was launched in early 2007 with the key areas of Research, Fire Knowledge Network, Events and Education & Research Adoption given more prominence. Navigation is quicker and easier to the member's area, recent research reports, news, and major events including the annual conference and the National Bushfires Forum. The font size and colours have also been changed so the content appears clearer and condensed and, therefore, easier to read.

Publications

A **corporate brochure** for the Bushfire CRC was produced to coincide with the annual Bushfire CRC/Australasian Fire Authorities Council conference in August. The 16 page booklet is a snapshot of the work of the CRC and was distributed at the Bushfire CRC exhibition stand and posted to all CRC partners. Stakeholders are encouraged to distribute the corporate brochure as broadly as they wish.

The *Fire Australia* journal continues to provide a vehicle for the promotion of Bushfire CRC research and activities to the broader fire industry. The journal is a joint publication of the Bushfire CRC, Australasian Fire Authorities Council, Fire Protection Association Australia and the Institution of Fire Engineers Australia. *Fire Australia* is published four times a year with a distribution list of 5500 that includes all Bushfire CRC researchers and end-users, AFAC members, the fire protection industry, academic libraries, and selected local, state and federal members of parliament.

One-page Bushfire CRC *Fire Updates* and four-page *Fire Notes* on research projects were emailed to end-users and researchers on a regular basis throughout the year. The *Fire Updates* serve as a brief summary of the project designed to keep all Bushfire CRC members abreast of current developments while the *Fire Notes* are more in-depth summaries of issues important to the industry. These publications are also available online.

Media

An early start to the bushfire season provoked an unprecedented amount of media interest from across south-eastern Australia and New Zealand from mid-September. The media requests came from major cities and from regional areas in Western Australia, South Australia, Tasmania, Victoria, New South Wales and New Zealand.

Highlights in media coverage include:

- The Bushfire CRC was approached for expert comment many times over the December to February period as bushfires burnt across southern Australia. CEO Kevin O'Loughlin and our researchers contributed to many print articles and interviews on radio and television.

- The National Bushfire Forum on 27 February was covered widely by the media. The coverage was extremely positive and the media took up the link between bushfires and the broader discussions on drought, climate change and water management. ABC Local Radio provided live crosses to newsrooms and programs around the nation and had two journalists continually uploading content online.(http://abc.net.au/canberra/bigfire). A total of 12 media attended the Forum. A further 11 reported conducted interviews by telephone on the day. ABC TV *Four Corners* based a program on the issue.

- The Bushfire CRC and the Australian Science Media Centre co-organised a national media briefing on bushfires in mid-October. With an emphasis on the "Prepare, Stay and Defend or Leave Early" policy, three Bushfire CRC researchers spoke about how their work impacted on different aspects of this issue. The briefing attracted six journalists from the national media and a further 15 phone requests for interviews by both radio and newspapers. Many of the reports were syndicated around Australia. A summary of the briefing and audio files of the speakers are available at: www.aussmc.org

- The ABC television series *Bushfire Summer* was screened over four weeks in January. The Bushfire CRC and its many researchers played a highly visible role in this production and were acknowledged in the credits.

- The companion *Bushfire Summer* website is at: http://abc.net.au/nature/bushfire/default.htm

- During the summer bushfires ABC online provided strong, up to the minute news coverage of each bushfire. Each news page also contained links to important bushfire organisations – the Bushfire CRC website was featured as one of these links.
- The community events in north-east Victoria attracted local coverage including pre-event publicity in the *Wangaratta Chronicle, the Border Mail, the Euroa Gazette, the Weekly Times,* and WIN TV, and live radio interviews with ABC Radio Murray Goulburn, Radio 3NE, and Radio National *The Bush Telegraph*.
- Annemarie De Vos, Bushfire CRC PhD student, showcased her research as an early career scientist at the CRC Association conference in Perth in May. Her research into the performance of various smoke masks was reported in the *West Australian* and the *Weekly Times*, and she was interviewed by ABC Radio Hobart and ABC Radio Riverina.
- Bushfire CRC research into how cars burn under bushfire conditions was featured on the ABC TV *Catalyst* program in April. Researchers based at CSRIO were filmed at the RFS Hot Fire Facility at Mogo in New South Wales.
- BBC Worldwide broadcasted a 23 minute radio documentary that prominently featured the Bushfire CRC's work.
- An approach by the Bushfire CRC to Rural Press for support resulted in a six page research feature in the February edition of *Australian Farm Journal,* a nationally distributed farm business magazine. The articles featured CRC research on aerial suppression, watertanks and fences, and volunteers.
- In January *The Canberra Times* ran a front page story "Threat to Bushfire Research" highlighting the issue of funding for the Bushfire CRC that was due to expire at the end of its seven-year life. A follow-up letter to the editor by the CEO clarified some of these issues. The original article prompted several many radio and print interviews across Australia.
- *Issues*, a national publication for secondary school students, produced an edition on *Disasters* with the cover story on bushfires written by the Bushfire CRC.

Events

Conferences and Workshops

Communications support was provided at numerous workshops and seminars at both a CRC-wide level and at program level. This included support in media liaison, speaker presentations, research poster coordination and display, event branding, photography, online promotion and archiving, and conference booth design, setup and attendance.

The major events were:

- A Bushfire CRC Fire Managers' Research Workshop at the University of Wollongong in July, that had 200 agency fire managers, researchers and students in attendance
- The annual joint AFAC / Bushfire CRC conference in Melbourne in August attended by around 1300 national and international delegates from 26 countries with 110 trade exhibits, including a Bushfire CRC booth
- A one day forum at Parliament House Canberra in March 2007 on *Are Big Fires Inevitable?* The forum, which was attended by around 150 invited participants and several federal politicians, was supported by extensive media coverage and remains an online resource of presentations (text and audio files) and photographs.

Community Forums

Community forums were held in line with the Federal Government's requirements for Program F: Community Outreach and for the Fire Knowledge Network.

- Cooma, 12 April – this event attracted more than 30 people, mostly fire and land agency staff and volunteers. It was held with the assistance of the Cooma RFS and co-hosted by the Hon Gary Nairn, Federal Member for Eden-Monaro.
- Howman's Gap, 5 June – a launch of the HighFire project in north-east Victoria, 20 invited guests from local fire and land agencies and other related industries including forestry and tourism. It was held with the assistance of the office of Mrs Sophie Mirabella, Federal Member for Indi. The event included a walk to nearby research sites.
- Wangaratta, 6 June – a public forum that attracted 90 people to the Playhouse Theatre to hear presentations of Bushfire CRC research, with an emphasis on the HighFire project and other research relevant to north-east Victoria.
- Other community forums were held to capitalise on the visit of Jerry Williams in February. Bushfire CRC partners RMIT University and the Australian National University hosted public forums that attracted around 60 people at each event.

Science Event

The Bushfire CRC took a high profile at the World Science Journalists' Conference in Melbourne from 16-20 April 2007. The event attracted almost 500 science journalists and communicators from around the world. The Bushfire CRC coordinated a session on climate change and wildfire with CSIRO Sustainable Ecosystems and hosted a tour for 20 journalists to a recently burnt bushfire area (Anakie, south-west of Melbourne) where they heard about the current state of bushfire research. The Bushfire CRC also shared a display booth at the conference venue with other CRCs to maintain visibility throughout the event.

Branding

New templates for Power Point slides and poster presentations were developed as the first step in ensuring a consistent and functional design across all Bushfire CRC products. Guidelines on the best use of the templates have also been distributed. This consistent design is now being progressively applied to research and technical reports, the Bushfire CRC website, handbook, newsletters and other communications tools.

Table 5: End-user Involvement and CRC Impact on End-users

End user name	Relationship with CRC *(e.g. Industry, Participant, International)*	Type of activity and end user location	Nature / scale of benefits to end user *(e.g. exports increase, productivity, employment)*	Actual or expected benefit to end user *($ terms)*
ACT Emergency Services Authority	Industry Participant	Research Utilisation (ACT)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community	Significant but not able to be assessed at this level.
Country Fire Authority of Victoria	Industry Participant	Research Utilisation (Victoria)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
Fire and Emergency Services Authority of Western Australia	Industry Participant	Research Utilisation (Western Australia)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
Metropolitan Fire and Emergency Services Board (Melbourne)	Industry Participant	Research Utilisation (Victoria)	Research outputs expected to be extrapolated to an urban environment and used in improving effectiveness	Significant but not able to be assessed at this level

			and efficiency of programs across the business focusing on improved outcomes for the community.	

New South Wales Fire Brigades	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
New South Wales National Parks and Wildlife	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objective and particularly in the interaction between fire and the environment.	Significant but not able to be assessed at this level
New South Wales Rural Fire Service	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
Queensland Fire and Rescue Service	Industry Participant	Research Utilisation (Queensland)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level

South Australian Country Fire Service	Industry Participant	Research Utilisation (South Australia))	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community.	Significant but not able to be assessed at this level
South Australian Department of Environment and Heritage	Industry Participant	Research Utilisation (South Australia))	Research outputs expected to be used in understanding the interaction between fire and the environment	Significant but not able to be assessed at this level
State Forests of New South Wales	Industry Participant	Research Utilisation (New South Wales)	Research outputs expected to be used in improving management of fire in the forest environment	Significant but not able to be assessed at this level
Tasmanian Fire Service	Industry Participant	Research Utilisation (Tasmania)	Research outputs expected to be used in improving effectiveness and efficiency of programs across the business focusing on improved outcomes for the community	Significant but not able to be assessed at this level
Forestry Tasmania	Industry Participant	Research Utilisation (Tasmania)	Research outputs expected to be used in improving management of fire in the forest environment	Significant but not able to be assessed at this level
Tasmania Parks and Wildlife Service	Industry Participant	Research Utilisation (Tasmania)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objectives and particularly in the interaction of fire and the environment	Significant but not able to be assessed at this level

Department of Sustainability and Environment Victoria	Industry Participant	Research Utilisation (Victoria)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objectives, particularly in the interaction of fire and the environment	Significant but not able to be assessed at this level
Department of Conservation and Land Management, Western Australia	Industry Participant	Research Utilisation (Western Australia)	Research outputs expected to be used in improving effectiveness and efficiency of programs in maintaining and supporting organisational objective and particularly in the interaction between fire and the environment	Significant but not able to be assessed at this level

EDUCATION AND TRAINING

Overview - Developing a new generation of bushfire researchers for Australia

This year has seen a continuation of activity in the Bushfire CRC's Education Program with a stronger focus on research adoption. The Bushfire CRC is well positioned to achieve its target of achieving 30 PhD qualified researchers with a current total of 32 PhD students in the program and 5 Masters. All students work with a team comprising an academic supervisor and an end user (industry) support leader. All scholarships must be sponsored by an industry agency and have regular contact with end users to ensure the research meets targeted industry needs.

Bushfire CRC Students 2006 / 2007	
PhD Students	32
Masters Students	5
Honours Students	2
Vacation Students	2
Total	**41**

During 2006-7 an improved reporting process was implemented through an updated annual reporting system for all post-graduate scholarships. In addition, the Bushfire CRC sponsored a student workshop on career planning, where students interacted with five senior members of the industry to discuss the future of the industry and career options. Twenty four students participated in the workshop.

There have been five post-graduate completions to date, three of which were PhDs. Of the completed PhDs one researcher has accepted a position with the University of Western Australia, another a position with the Federal Department of Agriculture, Fisheries and Forests and the remaining PhD is on an extended overseas holiday.

During 2006-2007 the Education Manager and the Program Leader worked with the Australasian Fire Authorities Council (AFAC) Strategic Initiatives Group to develop a policy to support transition for post-graduate scholarship holders to full employment within the industry following graduation.

Students have been actively engaged in Bushfire CRC workshops and events and have regularly participated in project level activities.

A complete list of Bushfire CRC students supported throughout 2006/2007 is included in the following pages.

Knowledge transfer – facilitating adoption of research outcomes

Central to the program in 2006-2007 has been the development of a framework comprising four key activity areas for the adoption of research:

1. Fact sheets and publications – such as *FireNote*.
2. Workshops and road shows – showcasing research outcomes and their implementation with agencies, across Australia.
3. Short courses – working with agencies to incorporate new research into existing training programs.
4. Higher degree courses – working with partner universities to incorporate Bushfire CRC research into existing courses and working to fill identified gaps.

In 2007-2008 a strategic plan for research adoption will be developed to include a suite of strategies to build the capacity of the industry to implement research. At the same time providing

professional development activities to increase the employment potential of students and retain skills within the fire and land management industry.

Highlights of the year's program include:

- **Annual conference** held in conjunction with AFAC in Melbourne in August. The conference showcased research presentations and more than 60 research posters. These posters were packaged together and distributed as a compendium of current Bushfire CRC research activities to CEOs and senior staff from fire and land management agencies. The posters are also available for general access download from the Bushfire CRC website.
- **Fire Managers Research Workshop** held in July at the University of Wollongong. Post-workshop feedback indicated a high level of satisfaction with the workshop from industry members and researchers alike. During the workshop 60 posters from Bushfire CRC research projects and student activities were displayed, with many of these also delivered as presentations to industry attendees.
- ***The Day the Flames Came*****.** A short educational documentary DVD on the lessons learnt from 1961 fires in the small town of Dwellingup, Western Australia. Produced by the Bushfire CRC and Western Australian partners, the Department of Conservation and Environment, and the Fire and Emergency Services Authority. The DVD was launched at the Melbourne annual conference and was distributed widely to fire managers.

Table 6: Education and Training Outputs and/or Milestones

This information is included in **Table 3**

BUSHFIRE CRC POSTGRADUATE STUDENTS 2006/2007

	STUDENT NAME	AWARD	STUDENT PROJECT TITLE	PROJECT LINK	SUPERVISOR	AGENCY LINKS	
1	**Brendan Pippen, UNSW**	PhD	Predicting factors affecting fire behaviour in heathland vegetation	A 1.1	Dr Wendy Anderson (UNSW ADFA)	NSWNPWS
2	**Phil Lacy, UNSW**	PhD	Burning under young eucalypts	A 1.2	Professor Rodney Weber (UNSW ADFA) and Jim Gould (CSIRO)	NSW Forests
3	**Bobby Chu, UWA**	PhD	Modelling and simulation of bushfire sensor networks	A 5.1	Professor George Milne (UWA)	FESA WA
4	**Danielle Martin**	PhD	Development of satellite vegetation indices to assess grassland curing across Australia and New Zealand	A 1.4	Dr Ian Grant (BOM) and Dr Simon Jones (RMIT)	Bureau of Meteorology
5	**Ken Scott, CDU**	PhD	Fire & savannah grass ecology	B 3.2	Dr Alan Anderson (CSIRO) & Dr Sam Setterfield (CDU)	Bushfires NT
6	**Phil Zylstra, UNSW**	PhD	Plant species contributions to fire intensity – towards a total fuels model	B 1.2	Professor Rod Weber (UNSW), Dr Ross Bradstock (NSW NPWS), Dr Geoff Cary (ANU) & Dr Malcolm Gill (CSIRO)	NSW NPWS
7	**Bevan McBeth, SCU**	PhD	Soil, fire and physiological processes & dieback in coastal eucalypt forests.	B	Associate Professor Alison Specht (SCU) and Professor Mark Adams (UNSW)	Forests NSW and NSW NPWS
8	**Rohan Sadler, UWA**	PhD	Long term monitoring & modelling in quantifying the role of fire in grasslands	B 4.2	Dr Pauline Grierson and Dr Matthias Boer (UWA)	CALM WA
9	**Adam Levesley, ANU**	PhD	Impact of fire mosaic on birds in mulga woodlands of central Australia.	B 1.2	Dr Malcolm Gill (CSIRO), Dr Geoff Cary (ANU) and Dr Ross Bradstock (NWS NPWS)	Bushfires NT & Desert Knowledge CRC
10	**Alison O'Donnell, UWA**	PhD	Fire patterns and vegetation structure in semi-arid south-east western Australia	B 1.1 & B 4.2	Dr Lachie McCaw & Dr Li Shu (CALM), Dr Pauline Grierson and Dr Matthias Boer (UWA)	CALM WA
11	**Jaymie Norris, UWA**	PhD	Microbial clues for ecological sustainable management of fire prone landscapes.	B 4.2	Dr Pauline Grierson, Dr Matthias Boer and Dr Richard Cookson (UWA)	CALM WA
12	**Madeline Osborn, Uni Melb**	PhD	The role of fungi in fire prone forest communities	B 3.1	Dr Tina Bell and Dr Cassandra McLean (Uni Melb)	Forests NSW
13	**Rowena Morris, Adelaide Uni**	PhD	The effect of prescribed burning on sediment movement in the Mt Lofty Ranges	B 3.1	Dr Meredith Henderson (SA DEH)	SA DEH
14	**Anne Miehs, Uni Melb**	PhD	The role of coarse woody debris in fire-prone forests: Achieving both fire management and conservation objectives.	B 3.1	Dr Alan York and Dr Tina Bell (Uni Melb)	DSE Victoria & Forestry Tasmania
15	**Francesca Harris-Spence, UWA/Adel Uni**	PhD	Catchment management groups - volunteer community organisations and bushfire management	C	Dr Marcus Lane (Uni Adelaide)	SA CFS and FESA
16	**Josh Whittaker, RMIT**	PhD	Adaptive capacity and social resilience to bushfires in Southeast Australia	C6	Professor John Handmer (RMIT)	CFA
17	**Laura Kelly, UTAS/Canterbury**	Masters	Community resilience to and recovery from wildfire in New Zealand.	C1 & C4	Professor Douglas Paton (UTAS), Dr Lisa Langer (ENSIS) and Dr Richard Vokes (Canterbury)	CFA & TFS

18	**Alan Rhodes, RMIT**	PhD	Evaluation of the stay or go policy and community preparedness	C7 & C6	Professor Gerry Elsworth (RMIT)	CFA
19	**Tim Prior, UTAS**	PhD	Community responses to bushfire threat	C4 & C1	Professor Douglas Paton (UTAS) and Dr Alison Cottrell (JCU)	TFS
20	**Briony Towers, UTAS**	PhD	Developmental perspective on bushfire risk communication	C4 & C1	Professor Douglas Paton (UTAS)	CFA & TFS
21	**Mae Proudley, RMIT**	Masters	Reducing bushfire risk through improved household decision making.	C6	Professor John Handmer (RMIT) and Dr Helen Goodman (RMIT)	CFA & CFS
22	**Luke Balcombe, JCU**	Masters	The perceptions of bushfire hazard in urban fringe areas of tropical Australia.	C1	Dr Alison Cottrell (JCU)	QFRS
23	**Matt Phillips, Uni Melb**	PhD	Physiological demands of Australian volunteer fire-fighters during bushfire suppression	D 2.1	Dr Glenn Mc Connell (Uni Melb) and Dr Brad Aisbett (Uni Melb)	CFA
24	**Sean Cowlishaw, La Trobe**	PhD	Effects of Fire Service Volunteering on families of volunteers	D3	Dr Jim McLennan (La Trobe)	CFA
25	**Annemarie De Vos, UWA**	PhD	Health effects of occupational exposure to bushfire smoke in WA	D4	Professor Phil Weinstein and Dr Angus Cook (UWA)	FESA
26	**Yih-Pyng Lee, UWA**	Masters	Community asthma and bushfires in Western Australia	D4	Professor Phil Weinstein and Dr Angus Cook (UWA)	FESA & CALM
27	**Clare Johnston, La Trobe**	PhD	Worst Case Scenarios: their role in safe decision making in bushfire fighting.	D 2.3	Professor Geoff Cummings and Dr Mary Omodei (La Trobe)	CFA & RFS
28	**Dane Hansen, RMIT**	PhD	Characterization of the volatile organic components adsorbed to particulates generated in bushfires	D 2.2	Dr Nichola Porter (RMIT), Dr Fabienne Reisen (CSIRO) and Mr Terry Elms (RMIT)	CFA
29	**Ian Dwyer, UTAS**	PhD	Communication strategies and collaborative work practices in high-reliability workplaces: A study of coordination centres.	D5	Dr Christine Owen and Ross Brooker (UTAS)	CFA, RFS & TFS
30	**Paul Fox Hughes, UTAS**	Masters	A meteorological investigation of the 'springtime bump' an early season peak in the fire danger experienced in Tasmania	A2	Dr Graham Mills, BOM	BOM
31	**Greg Hickey, UTAS**	PhD	Enhancing effective multi agency operations	D5	Dr Christine Owen (UTAS)	CFA, DSE &TFS
32	**Karyn Bosomworth, RMIT**	PhD	Does current bushfire risk management policy and practice support community and natural resource resilience to climate change?	C	Prof John Handmer and Noreen Krusel CFA	DSE, CFA & TFS
33	**Annette Salter, UTAS**	PhD	Applications of multi media education strategies in fire behaviour	A & E	Dr Christine Owen (UTAS) Dr Jim Gould (CSIRO)	Forest NSW & DSE
34	**Femina Metcalf, UWA**	PhD	Spatially explicit modelling of fire mosaics in south-west Western Australia forest ecosystems	A & B	Dr Pauline Grierson UWA, Drs Lachie McCaw and Neil Burrows DEC	DEC
35	**Kerryn McTaggert, Uni Melb**	PhD	The effect of fire on soil microbial populations and their processes in Australian alpine ecosystems	B6	Dr Tina Bell, Uni Melbourne	DSE & TFS
36	**Andrew Edwards, CDU**	PhD	An alogorithm for mapping burn severity from satellite remote sensing: tropical savannahs, Northern Australia	B3.2	Dr Lindsay Hutley, CDU	QFRS, FESA
37	**Meaghan Jenkins, UNSW**	PhD	Carbon budgets and implications for fuel load and flammability of shrub dominated ecosystems in the high country	B6	Prof Mark Adams, UNSW and Dr Maria Taranto Bushfire CRC	

BUSHFIRE CRC VACATION & HONOURS STUDENTS 2006/2007

	STUDENT	AWARD	ORGANISATION	PROJECT TITLE	PROJECT	SUPERVISOR
VACATION STUDENTS						
1	Ryan Burrows	Honours	UWA	Retrospective measures of fire intensity using epicormic sprouting and sapling frequency in the jarrah forest of south-western Australia	B 1.2	Dr Roy Wittkuhn, Dept Conservation & Environment, WA
2	Felix Lipkin	Honours	CSIRO	Urban design risk model prototype	D1.1	Dr Fabienne Reisen, CSIRO
HONOURS STUDENTS						
1	Kate Lawry	Honours	RMIT	Community expectations: an investigation into support services provided to bushfire affected communities	C1	Dr Dave Mercer RMIT Prof John Handmer RMIT
2	Amy Davidson	Honours	ANU	Key determinants of fire frequency in the Sydney basin region, Australia	B1.2	Dr Geoffrey Cary ANU

THIRD YEAR REVIEW

The Bushfire CRC conducted its Third Year Review over the period August to December 2006 in accordance with DEST guidelines. As part of this process a survey of end users was conducted in early August 2006.

An independent review Panel was established in consultation with DEST with the following members:

- Mr Barry Carbon, AM, FTSE (Chairman), former CEO of the New Zealand Ministry for the Environment;
- Mr Jerry Williams, former Director of Fire Management and Aviation, US Department of Agriculture Forest Service;
- Dr Glen Kile, Executive Director of the Forest and Wood Products R&D Corporation;
- Prof Graeme Hugo, Federation Fellow, Director of the National Centre for Social Applications of GIS (GISCA), DEST nominee, from the CRC Appraisal Panel; and
- Dr Michael Blyth, Director, Four Scenes Pty Ltd (responsible for coordination of the Panel's work and much of the preparation of the report).

The DEST coordinator for the review was Mr Harvey Perkins of the CRC Programme Office.

The Bushfire CRC Board accepted all four of the key recommendations of the Panel's report. Implementation action is underway.

Recommendation 1. The fostering of constructive interaction and the stimulation of new people and new energy, and providing local, national and international links should continue as a key objective of the CRC.

The collaborative framework of the Bushfire CRC provides an ideal structure for such a complex and varied issue as the management of all aspects of bushfire, which is both a natural hazard and important element of our ecosystems. The acceleration of knowledge transfer needed over the next three years will take place through an enhanced level of activity of workshops, seminars, and other training activities. The CRC will continue to hold its major annual conference in conjunction with the AFAC industry conference, and a major international fire research conference is planned for the latter half of 2008. The CRC will also continue to develop links with other CRCs working in complementary areas, and with other research institutions.

The CRC has already commenced examining ways of sustaining research capability and retaining the younger researchers and scholarship holders who are new to the industry.

The issue of sustainability is a particular concern to industry partners who are keen to ensure the research capability developed through the Bushfire CRC can be maintained.

Recommendation 2. The direction and programs are set and the Bushfire CRC may now concentrate on leadership; directional leadership from the Board, stable and supportive leadership from the senior staff, and research leadership at the programme level.

At this stage of the Bushfire CRC's life leadership initiatives focus on developing stakeholder relationships to ensure translation of the planned research outputs improved policies and practices.

Directional leadership is also clearly demonstrated in the lead role the Bushfire CRC is taking to ensure sustainability of research in the industry into the future. The Bushfire CRC is currently engaged in extensive consultation with stakeholder partners on both the short and medium-term (1-3 years) in respect of the research matching industry needs, and the longer term (3+ years) in

respect of sustaining an industry and national research capability for the future. In doing this, the Bushfire CRC Board is working with Program Research Leaders, End User Leaders and the Bushfire CRC Management to articulate more clearly the key themes addressed by the diverse portfolio of projects. It is also looking at how best to address some of the major issues that have emerged recently, such as the impact of climate change and the relationship between fire and management of natural resources such as water and forestry.

Recommendation 3. The senior management should devise and implement mechanisms to bolster leadership at program and project levels to give themselves the space to focus at a higher level.

The Bushfire CRC Board and management team has commenced steps to address this issue. The Bushfire CRC management team has completed an internal review of the project portfolio and the process to accelerate knowledge transfer from current research.

Options are being examined for strengthening the involvement of program and project leaders. Increased emphasis is being placed on leadership opportunities at the program and project level particularly in the engagement with end users. Given the importance of knowledge transfer a deputy user leader has been assigned to each program. The Bushfire CRC management team has been working with end user agencies to increase the number of end users involved in both end user leadership and research adoption.

The CRC intends to hold a leadership workshop in late 2007 to further these initiatives.

Recommendation 4. The Board should capitalise on its unique place to promote discussion and policy support for big picture issues like the appropriate balance between fire prevention and fire fighting.

The Bushfire CRC has identified many opportunities arising out of this recommendation. It has begun to capitalise on its recognition at state, national and international level of its capability to contribute to debate on major issues due to its expertise in this area.

The Bushfire CRC hosted a national bushfire forum, at Parliament House Canberra in April 2007, to generate discussion on the relationship between fire, the latest research, and major issues such as the management of water, forestry and other natural resources asking the question – Are big fires inevitable?

The Bushfire CRC continues to work with AFAC, the industry body to ensure the research outcomes are integrated into the major policy debates.

PERFORMANCE MEASURES

Table 7: Progress on Performance Measures (2002 Round CRCs)

PERFORMANCE MEASURE	2005-06 PROGRESS / ACHIEVEMENT	2006-07 PROGRESS / ACHIEVEMENT
CRC Programme Objective 1: ***To enhance the contribution of long-term scientific and technological research and innovation to Australia's sustainable economic and social development***		
Centre Objective 1.1: Achievement of and delivery of research outcomes		
Develop at least four new technological breakthroughs	On Track	Programs are being developed and rolled out in cooperation with industry partners.
Centre Objective 1.2: Seminars, workshops and presentations		
More than five seminars, workshops and public forums each year	Achieved	Annual conference in partnership with Australasian Fire Authorities Council attracted 1300 participants from across the fire industry. August, Melbourne. 2nd fire managers research forum in Wollongong in July. The Bushfire CRC's National Bushfire Forum at Parliament House Canberra in March 2007 attracted 150 invited guests. A range of community forums with venues in towns including Canberra, Melbourne, Cooma, Wangaratta , Bendigo and Perth.
Centre Objective 1.3: Centre publications transferring R&D outcomes and technology to end users and the public		

PERFORMANCE MEASURE	2005-06 PROGRESS / ACHIEVEMENT	2006-07 PROGRESS / ACHIEVEMENT
At least 50 end user focused publications and reports	On track	On track. A wide range of end user publications and reports have been completed for each program. Most publications are on the Bushfire CRC website.
Centre Objective 1.4: Scientific status and end user satisfaction		
Demonstrated leading edge research and development quality through peer review processes	Planning underway for research review and third year review will help in ensuring this is achieved	Third year review confirmed the focus and application of current activities. International collaborations confirm the high standing of research activities.
Centre Objective 1.5: International interest in research		
Collaboration with at least four overseas groups	Formal collaboration with University California Berkeley, and USDA-FS. Informal collaboration is active with research groups in US, Canada, Portugal, and Germany. Two CRC researchers are on international advisory panel for European Union's Project Paradox.	Formal and informal collaboration is continuing. Partnership is currently being established between the Bushfire CRC's Fire Knowledge Network and the US Wildland Fire Lessons Learned Centre. Ongoing collaboration with the European Union's Paradox Project.
Centre Objective 1.6: Scientific Status		
Rated world class in its activities by an independent international review board	Will be partially assessed by the third year review panel.	Independent third year review and. International collaborations confirm the high standing of research activities.
Centre Objective 1.7: Project Reviews		
Regular meetings of a Users, Researchers and Technical committee Regular project reviews held by Project Leaders	There are many ongoing meetings between the researchers and end users. The research sub-committee of the board	Periodic and ongoing project reviews have been undertaken through regular meetings between researchers and end users. Major Bushfire CRC research workshop with

PERFORMANCE MEASURE	2005-06 PROGRESS / ACHIEVEMENT	2006-07 PROGRESS / ACHIEVEMENT
	assess the funding of each project	researchers and end users held at Wollongong in July. Annual conference in Melbourne in August with 100 researchers and 1200 fire industry participants. Formal project reviews were conducted as part of the 3 Year Review. Variations to the Commonwealth Agreement are being prepared to reflect changes arising from these processes.

CRC Programme Objective 2: **To enhance the transfer of research outputs into commercial or other outcomes of economic, environmental or social benefit to Australia**		
Centre Objective 2.1: Economic Benefit to Australia		
Actual and future benefits > 3 times the Commonwealth Grant through cost benefit analysis.	A specific investigation of this is underway. Initial indications are that return is likely to be high.	Preliminary investigations confirm the expected outcomes to be much greater than 3x Commonwealth contribution. Details being validated with end users.
Centre Objective 2.2: Economic benefit to Centre		
Economic benefit to Centre. Additional income through contracts and consultancy: $2M	Increased contract research funding has been received from both our existing partners and external organisations	Whilst not the primary focus of the centre, contact research and consultancy work continue.
Centre Objective 2.3: Research Publications		
10 Book chapters 2 Books 25 refereed Journals per annum	On track	On track

30 refereed conference papers per annum		
Centre Objective 2.4: Patents		
5 Patents	None planned at this stage	None planned at this stage
Centre Objective 2.5: Achievement of and delivery of research outcomes		
Develop at least four new technological breakthroughs	In progress.	In progress.
Centre Objective 2.6: Financial return to the Centre		
Exceed budget plan	On target	On target
Centre Objective 2.7: Adoption of the research outputs by End Users		
Greater than 60 percent of the know-how and research deliverables adopted by end users	In progress. A technology transfer strategy is being developed to help ensure that the research is transformed into outcomes for the industry and community.	Implementation of the technology transfer programs are continuing with a range of initiatives linking researchers and end users across all programs. Target utilisation is expected to be achieved.
Centre Objective 2.8: IP Review Intellectual Property		
Intellectual Property Reviews to be held once a year	Completed	Completed

CRC Programme Objective 3: **To enhance the value to Australia of graduate researchers**		
Centre Objective 3.1: Placement of Centre trained students and researchers into industry		
10 PhD's fully employed by User Groups	Not yet applicable	Not yet applicable
Centre Objective 3.2: Staff/Student exchange		

At least one student and one postdoctoral fellow per annum on an exchange program	In progress.	Under review
Centre Objective 3.3: Postgraduate students trained to become the future leaders in Australia in the design, research and management of bushfire management		
At least 20 fully funded PhD students graduated with further training in research management and all employed within three months of graduation	Not yet applicable	Not yet applicable
Centre Objective 3.4: Industry training		
All students to undergo an industry/end user induction	All students have been offered and most have undertaken training on fire ground safety, presentation and media skills.	Ongoing opportunities exist for students to participate in industry training initiatives relevant to their areas of investigation.
Centre Objective 3.5: PhD Degrees Awarded		
Greater than 90% of students completing postgraduate studies	Not yet applicable	Not yet applicable
Centre Objective 3.6: Health and Safety		
Zero lost time injuries	Zero	Zero

CRC Programme Objective 4: **To enhance collaboration among researchers, between researchers and industry or other users, and to improve efficiency in the use of intellectual and other research resources**		
Centre Objective 4.1 Frequency of interchange of personnel between participating organisations between participating organisations		
At least one student and one postdoctoral fellow per annum on an exchange program.	Under review	Under review
Centre Objective 4.2: Projects involving end user participants		

60 percent of projects to involve end user participants	All projects have active involvement of end-users. All projects are linked to an end user "sponsor" or steering group.	All projects have active involvement of end-users. All projects are linked to an end user "sponsor" or steering group.
Centre Objective 4.3: Extent of participation by each participant in research and support programs		
Participants involved in research and support programs	All Bushfire CRC participants are actively involved in the activities of the Bushfire CRC.	All Bushfire CRC participants are actively involved in the activities of the Bushfire CRC.
Centre Objective 4.4 Time commitment of researchers		
Less than 10% with 20% of time or less	Will be considered in response to Third Year Review. All employed post-docs are 100%. Many researchers involved in projects <20%.	Identified as an issue during Third Year Review process – strategies being developed to address
Centre Objective 4.5 Degree of consultation between research providers and end users		
Research reviews at least twice a year between research providers and end users	All projects have established steering groups from the end user agencies that oversee the direction, performance and relevance of the research program. Regular program meetings also take place	Established steering committees and user engagement continues to be an effective consultation mechanism.
Centre Objective 4.6 The extent of participation by each participant in research and support programs		
All participants to be involved in active and proposed research projects	All Bushfire CRC participants are actively involved in the activities of the Bushfire CRC.	All Bushfire CRC participants are actively involved in the activities of the Bushfire CRC.
Centre Objective 4.7 Communication to Users		
At least 50 newsletters to all Core and Associate Participants .	Regular Bushfire CRC newsletters from CEO. Development of *FireNotes*. Circulation of Research Updates throughout the Bushfire CRC and AFAC	Regular Bushfire CRC newsletters from CEO. Circulation of Research Updates throughout the Bushfire CRC and AFAC Regular meetings with end user agency

		representatives at all levels
Centre Objective 4.8 Evidence of collaboration between participants		
Active integration with more than 90% of Bushfire CRC projects to involve more than two participants	In progress	On target
User participants to have contributed the equivalent of one person year of in-kind from their organisation over the life of the Bushfire CRC	In progress	On target
Centre Objective 4.9 Collaboration with other research groups within Australia		
At least three formal collaborative associations with other CRCs	Formal engagement of Spatial CRC in the form of an MOU and jointly funded projects with Tropical Savannas and Desert Knowledge CRC. Informal contacts with Sustainable Forestry.	Formal relationship with the Spatial CRC Tropical Savannas and Desert Knowledge CRC and informal contacts with the Sustainable Forestry CRC continue.

PITCHER PARTNERS

AUDITORS REPORT TO THE COOPERATIVE RESEARCH CENTRES PROGRAM DEPARTMENT OF EDUCATION, SCIENCE AND TRAINING REPRESENTING THE COMMONWEALTH IN RESPECT OF THE BUSHFIRE CRC

FINANCIAL INFORMATION FOR THE YEAR ENDED 30 JUNE 2007

Scope

We have audited the financial information of the Bushfire CRC as set out in Tables 1 to 3 of the Annual Report for the financial year ended 30 June 2007. The parties to the Cooperative Research Centre are responsible for the preparation and presentation of the financial information. We have conducted an independent audit of the financial information in order to express an opinion on it to the parties to the Bushfire Cooperative Research Centre.

The financial information has been prepared on a cash basis for the parties to the Bushfire Cooperative Research Centre for the purposes of fulfilling their annual reporting obligations under clause 13 (2) of the Commonwealth Agreement and for distribution to the Cooperative Research Centres Program, Department of Education, Science and Training, representing the Commonwealth of Australia. We disclaim any assumption of responsibility for any reliance on this report or on the financial information to which it relates to any person other than those mentioned above, or for any purpose other than that for which it was prepared.

Our audit has been conducted in accordance with Australian Auditing Standards to provide reasonable assurance as to whether the financial information is free of material misstatement. Our procedures include examination, on a test basis, of evidence supporting the amounts and other disclosures in the financial information, and the evaluation of accounting policies and significant accounting estimates. These procedures have been undertaken to form an opinion as to whether, in all material respects, the financial information is presented fairly in accordance with Australian accounting concepts and standards and requirements of the Commonwealth Agreement in terms of Clauses 4 (Contributions), 5(1), 5(2), 5(3) (Application of the Grant and Contributions), 9(1), 9(5) (Intellectual Property), and 7(1), 7(2), 7(3) (Financial Provisions), so as to present a view of the sources of funding and the application of funding of the Bushfire CRC, and the application of which is consistent with our understanding of its financial activities during the year and its financial position.

While we have not performed any procedures upon the estimates for the next period and do not express any opinion, thereon, we ascertained that they have been formally approved by the Commonwealth as required under the Agreement.

The audit opinion expressed in this report has been formed on the above basis.

Audit Opinion

1. The multipliers adopted by the Centre to value in-kind contributions other than salary costs have a sound and reasonable basis and each partner's component of the Researcher's Contributions for the year under report has been provided at least to the value for that year committed in the Budget as specified in the Agreement, with the following exceptions:

Organisation	**Amount Committed ($'000s)**	**Amount Provided ($'000s)**
In Kind Contributions		
Core Participants		
Emergency Management Australia	186.0	105.0
Forest and Ecosystem Science Institute	1,653.0	838.0
Melbourne Metropolitan Fire & Emergency	477.0	113.0
NSW Fire Department of Environment & Climate Change	92.0	0.0
Queensland Fire & Rescue	128.0	85.0
Tasmanian Government	181.0	111.0
WA Fire & Emergency Service	175.0	173.0

Supporting Participants

ACT Emergency Services Bureau	33.0	0.0
Forest Research New Zealand	345.0	31.0
La Trobe University	797.0	478.0
SA Metropolitan Fire Service	65.0	0.0

2. The total value of all Contributions for the year under report equalled or exceeded the amount of grant paid during the year (not including advances).

3. The Researcher has used the Grant and the Researcher's Contributions for the Activities of the Centre and in my professional opinion there appear to be no material reporting irregularities.

4. The Researcher's allocations of the budgetary resources between Heads of Expenditure that has been lower or higher than the allocation in the budget by $100,000 or 20% (whichever is the greater amount) without prior approval by the Commonwealth are detailed below.

Organisation	**Amount Committed ($'000s)**	**Amount Provided ($'000s)**
Bureau of Meteorology		
- Salaries	336.0	463.0
- Other	213.0	564.0
CSIRO		
- Salaries	372.0	478.0
- Other	793.0	1,421.0
Forest and Ecosystem Science Institute		
- Salaries	357.0	162.0
- Other	1,296.0	676.0
Melbourne Metropolitan Fire and Emergency Services Board		
- Salaries	265.0	44.0
- Other	212.0	69.0
NSW Rural Fire Authority		
- Salaries	102.0	161.0
- Other	77.0	143.0

University of Tasmania		
- Salaries	76.0	131.0
- Other	211.0	287.0
University of Western Australia		
- Salaries	109.0	113.0
- Other	349.0	517.0
VIC Department of Sustainability and Environment		
- Salaries	35.0	78.0
- Other	27.0	134.0
WA Department of Conservation and Land Management		
- Salaries	134.0	148.0
- Other	265.0	388.0
<u>Supporting Participants</u>		
Charles Darwin University		
- Salaries	16.0	27.0
- Other	25.0	128.0
Country Fire Services of South Australia		
- Salaries	0.0	38.0
- Other	0.0	70.0
Forest Research New Zealand		
- Salaries	125.0	20.0
- Other	220.0	11.0
La Trobe University		
- Salaries	71.0	0.0
- Other	726.0	478.0
Royal Melbourne Institute of Technology		
- Salaries	79.0	185.0
- Other	359.0	1057.0
The ACT Department of Justice and Community Safety		
- Salaries	13.0	58.0
- Other	7.0	81.0
The University of New South Wales		
- Salaries	73.0	83.0
- Other	110.0	474.0

5. Capital Items acquired from the Grant and Researcher's Contributions are vested as provided in the Agreement.

6. Intellectual Property in all Contract Material is vested as provided in the Agreement and no Intellectual Property has been assigned or licensed without the prior approval of the Commonwealth.

7. Proper accounting standards and controls have been exercised in respect of the Grant and Researcher's Contributions and income and expenditure in relation to the Activities of the Centre have been recorded separately from other transactions of the Researcher.

8. The Annual Report is prepared on a cash basis.

Dated at Melbourne this 28 day of September 2007

Pitcher Partners

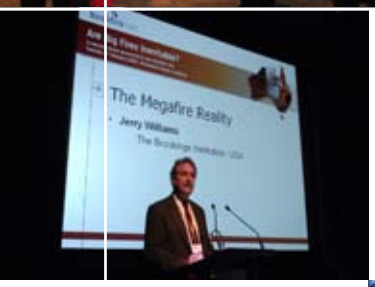
PITCHER PARTNERS

G E WALSH
Partner

GLOSSARY OF TERMS

Glossary of Terms used

ACTEW	ACT energy, water and wastewater services
ADFA	Australian Defence Force Academy
AFAC	Australasian Fire Authorities Council
AIC	Australian Institute of Criminology
ANU	Australian National University
BOM	Bureau of Meteorology
CALM	Department of Conservation and Land Management WA
CFA	Country Fire Authority Victoria
CFS	Country Fire Service South Australia
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific Industrial Research Organisation
DEC	Department of Environment and Conservation NSW
DSE	Department of Sustainability and Environment Victoria
EMA	Emergency Management Australia
ESA	ACT Emergency Services Agency
FESA	Fire and Emergency Services Authority WA
FFDI	Forest Fire Danger Index
FuSE	Fire, u = wind, Shrubland Experiments
GIS	Geographic Information System
IMAP	Project management system
IMT	Incident Management Team
IP	Intellectual Property
JCU	James Cook University
LTER	Long term ecological research
MOU	Memorandum of Understanding
NPWS	National Parks and Wildlife Service NSW
RFS	Rural Fire Service NSW
RMIT	RMIT University
SCU	Southern Cross University
SDI	Soil Dryness Index
TFS	Tasmania Fire Service
USDA-FS	US Department of Agriculture – Forest Service
UWA	University of Western Australia



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