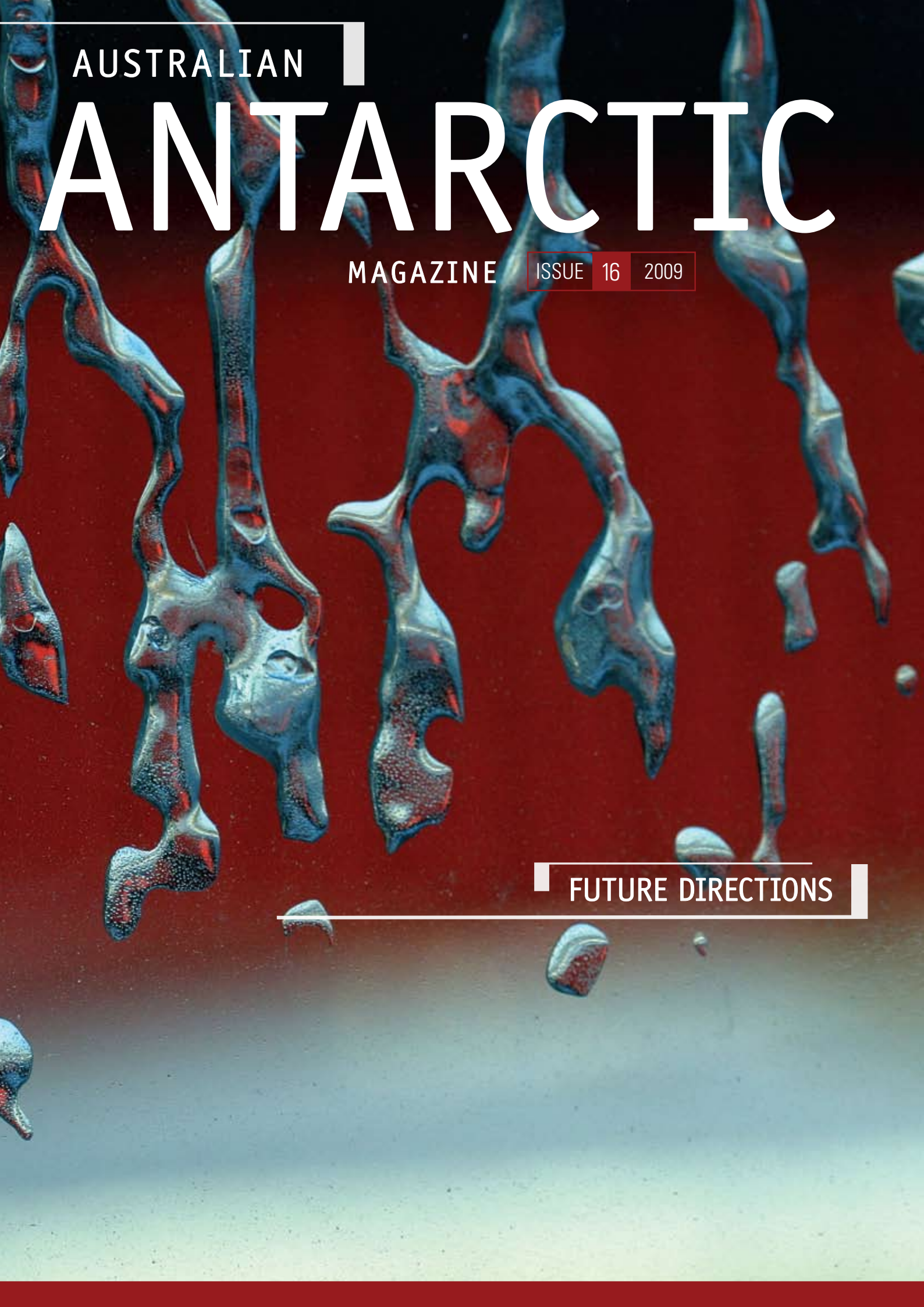

AUSTRALIAN ANTARCTIC MAGAZINE

ISSUE 16 2009

FUTURE DIRECTIONS

AUSTRALIAN
ANTARCTIC
MAGAZINE

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CONTENTS

The Australian Antarctic Division, a Division of the Department of the Environment, Water, Heritage and the Arts, leads Australia's Antarctic program and seeks to advance Australia's Antarctic interests in pursuit of its vision of having 'Antarctica valued, protected and understood'. It does this by managing Australian government activity in Antarctica, providing transport and logistic support to Australia's Antarctic research program, maintaining four permanent Australian research stations, and conducting scientific research programs both on land and in the Southern Ocean.

Australia's four Antarctic goals are:

- To maintain the Antarctic Treaty System and enhance Australia's influence in it;
- To protect the Antarctic environment;
- To understand the role of Antarctica in the global climate system; and
- To undertake scientific work of practical, economic and national significance.

Australian Antarctic Magazine seeks to inform the Australian and international Antarctic community about the activities of the Australian Antarctic program. Opinions expressed in *Australian Antarctic Magazine* do not necessarily represent the position of the Australian Government.

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FRONT COVER: GLENN BROWNING
Mawson Station Doctor, Glenn Browning, took this photo of condensation in the triple-glazed windows of the Red Shed. Glenn says: "Overnight, a small amount of moisture trapped between the layers freezes, forming ice crystals. As the sun hits the windows the crystals gradually melt, forming these trails of condensation which appear to be almost like mercury, backlit by the sun reflecting off the workshop."

TODOR TOLOVSKI

FUTURE DIRECTIONS

The Australian Antarctic Division, like Antarctica, is in a state of change, in terms of both our staff and our strategic direction. To help steer us through these changes is new Director, Lyn Maddock, and new Chief Scientist, John Gunn.

Among the challenges the Division faces is the development of a clear understanding of our priorities in Antarctica – given budget pressures, an increase in the number of nations active in Antarctica, the importance of climate change research, and changes in the way we operate in Antarctica. Within this context, our scientists are also working hard to develop a new science strategy that will guide research in Antarctica for the next five years.

This issue of the magazine introduces you to Lyn and John and what's at the top of their 'to do' lists. It also acknowledges the important contribution of three of our departing executives, who have helped shape our policy, scientific and operational priorities and activities for many years. Our former leaders reflect on their time with the Antarctic Division and their hopes for the future of Antarctica and the Australian Antarctic program.

Change is also afoot in Antarctica with the conclusion of the International Polar Year (IPY). One of the four key goals of the IPY was to leave a legacy of infrastructure and observational systems to support research into the future. For some countries this has meant the construction of new Antarctic stations in strategic locations for scientific research. For others it has meant new, enhanced, or automated observation systems that will continue the work begun during the IPY. More broadly it has also meant the collection of significant data sets, which will be shared amongst nations; establishment of new or improved international links between scientists and scientific institutions; and new opportunities for future polar scientists. These and other outcomes from the IPY set the stage for new ways of working in Antarctica that will strengthen our ability to answer scientific questions of global importance.

This year is also significant in marking the 50th anniversary of the signing of the Antarctic Treaty. In a speech to a joint meeting of Antarctic Treaty Parties and the Arctic Council, US Secretary of State, Hillary Clinton, reflected on the importance of the Treaty in ensuring international cooperation in Antarctica and its continued relevance today – both in Antarctica and as an example of the benefits of global cooperation generally.

Finally, this issue of the magazine updates you on some of the latest activities in polar science, medicine and art. These include the discovery of four new tick-borne viruses in penguins on Macquarie Island, and a policy-science collaboration looking at new remote monitoring technology to assist with our management responsibilities at Heard and McDonald islands. Enjoy your reading.

W. R. Pyper

WENDY PYPER
Editor

STEERING THE ANTARCTIC DIVI

Throughout her varied career Lyn Maddock has acquired skills and knowledge that, when viewed collectively, cut a logical path to the Director's seat at the Australian Antarctic Division.

After completing an economics degree at the University of Queensland, Lyn began her public sector career in the Australian Bureau of Statistics, and as a research economist at the Bureau of Roads. She then moved into a long career as a policy economist in the Prime Minister's Department, where she worked on microeconomic issues relating to transport, health and trade policy. She stepped into the private sector briefly, with a stint in government relations at Westpac, before moving back to the public sector in the Productivity Commission's new Melbourne office. Here she conducted research into restrictive practices in the labour market, competitive tendering by the public sector, the Australian gas market, and developing and reporting on comparative performance indicators for states in areas such as courts, prisons, child protection, education and health.

'My work at the Productivity Commission drove home the importance of ensuring that operating practices are sufficiently documented,' Lyn says.

'The new Melbourne office was expected to run in the same way as the Canberra office, but most of the organisation's policies and procedures were embedded in peoples' experience and passed down informally, so we often found ourselves reinventing practices we didn't need to.

'If you've got a high turnover of people, as the Antarctic Division has each summer with new expeditioners, it's important that processes and the things that drive an organisation's culture – which are often not written down – are managed or documented appropriately.'

In 1997 Lyn took a job as Deputy CEO of the National Occupational Health and Safety Commission, with responsibility for managing research, the occupational health and safety dataset, and the organisation's strategic and business planning.

In 2000 she was engaged as Deputy Chair of the Australian Broadcasting Authority (ABA), which led to her managing the ABA merger with the Australian Communications Authority and leading the new body, the Australian Communications and Media Authority.

'This was a fascinating and challenging experience which taught me a lot about managing difficult situations,' she says.

Lyn spent nine months in 2008 establishing Screen Australia, which included rethinking policies for film funding.

'All these skills – policy and research in the Prime Minister's Department, public relations from Westpac, policy and procedure implementation from the Productivity Commission, management and business planning from the safety commission, ambiguity and change management from the communications and broadcasting authorities, and the experience of working within and outside government – will be important in my role at the Antarctic Division,' Lyn says.

Lyn also brings experience as a player and coach of state level hockey, which she says taught her about management and delegation. And she has a (recently expired) pilot's licence.

'Flying is one of the few things in life where you're on your own and you have to make a decision. It gave me confidence in my judgement.'

Since she took up the directorship of the Division in February, Lyn has put her considerable energy and experience into obtaining the knowledge, advice and networks needed to address the challenges ahead for both the organisation and government.

'I've come to the Antarctic Division at a time when the skills I have to offer will be most useful,' she says.

'The Division has entered a period of significant change that includes the effect of the new airlink, the need to rethink our shipping needs, an increased focus on national security, an increase in the number of nations active in Antarctica, the importance of climate change research, executive staffing changes and budget pressures. These have all occurred at once and I hope to be able to help the organisation find its path through and beyond these issues.'

In an organisation with multiple objectives – including science, policy and sovereignty –

MATHEW OAKES

Lyn recently hosted US Consulate General Principal Officer, Michael Thurston (left), and US Embassy Chargé d'Affaires, Dan Clune, during a tour of the Antarctic Division.

SION THROUGH THE PACK ICE

Lyn during her visit to Antarctica earlier this year. As Australian Antarctic Division Director, Lyn aims to help the Division find a new path 'through the pack ice'.

tradeoffs and tensions between these objectives are inevitable. Lyn is keen to ensure the organisation fully understands the implications and costs of decisions and consequent tradeoffs and can communicate this to government and others.

'My priority in the first six months is to make sure we've got all the management information we need to make sophisticated judgements and to make sure we're telling a sophisticated message to our audiences. To do this we need a clear understanding of what is core business and what isn't,' she says.

'We've got to understand the fundamentals of each of our objectives so we're not trading off essential business for non-essentials. And we need to know the full costs – financial and otherwise – so that we can understand the implications of the tradeoffs.'

Lyn and her executive team are developing policy advice on the critical issues for the Division – shipping, air support, endorsement of a new science strategy, and the organisation's budget – and decision options.

'I want to receive whole-of-government authority to proceed with these options according to an agreed timetable,' she says.

Lyn has also managed to fit in a trip to Antarctica on the airlink, where she experienced a night out in the field, kitchen duties at Casey station, and the difficulties of conducting science and logistical activities in the cold. She recently attended the 32nd Antarctic Treaty Consultative Meeting in the US to mark the 50th anniversary of the Treaty; and hosted the US Embassy Chargé d'Affaires, Dan Clune, and US Consulate General Principal Officer, Michael Thurston, during a tour of the Antarctic Division. Her infectious enthusiasm for her new role has also been captured on local television and demonstrated through her engagement with staff.

'This is a wonderful opportunity for me to be part of an organisation that is highly regarded for its operational and scientific prowess, that has a complex set of objectives to fulfil, and to be with people who have a passion for their work and for Antarctica,' she says.

'I look forward to building on the good work the Antarctic Division is already engaged in, to further develop an organisation that is open, confident, curious, rigorous, passionate and outcomes-focused.'

WENDY PYPER
Corporate Communications, AAD

GUNNING FOR SCIENCE

Who is the Australian Antarctic Division's new Chief Scientist, John Gunn, and what are his hopes and ambitions for the Antarctic science program? Wendy Pyper finds out.

What circumstances brought you to the Antarctic Division?

Having spent 29 enjoyable years at CSIRO, the last five as a Deputy Chief of Marine and Atmospheric Research, I was ready for a new challenge. A friend and mentor summarised the Chief Scientist position as a 'challenging but opportunity-rich role in which you could make a difference'. The opportunity to make a difference, lead a group of talented and committed scientists and be part of a new Executive team seemed too good to pass up!

What were your major career activities prior to joining the Antarctic Division?

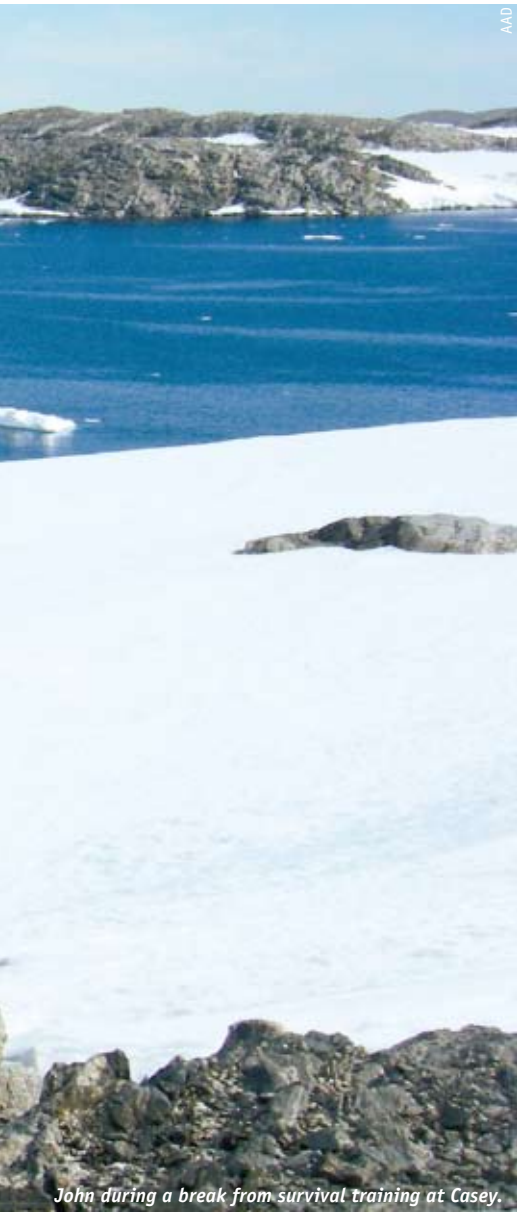
As a marine biologist I've spent a large part of my life conducting applied fisheries research on a range of species and fisheries. My interest in understanding the movements, behaviour and stock structure of highly migratory tunas and billfishes, as a way of improving the management of their (often overexploited) stocks, led to a range of rewarding research projects and collaborations around the globe.

As I grew more senior I became involved in the interface between science, resource management and development of national and international policy. It gave me a different perspective to the one I'd had in my early days at CSIRO, when the key driver was the science question. Clearly, at the Antarctic Division (and any government-funded research agency) one needs to nurture both excellence in asking and answering the right science questions, and the ability to engage with policy-makers and environmental managers, to understand and meet their needs. As both a scientist and a science leader I learned that it is possible to meet user demands and needs and continue to achieve scientific excellence.

Which of your skills will benefit the Antarctic Division and what do you hope to achieve as Chief Scientist?

My background in strategy development should prove useful, as the Antarctic Division and broader department determine the science directions for the next decade. I also hope that my experience leading a similar sized 'business' within CSIRO will assist the Executive. I have a strong background in stakeholder communication, which will help as the Division strengthens its links within government and with our key partners in industry, universities and internationally.

While at CSIRO I had the good fortune to work within and lead a number of world-leading multidisciplinary science teams. This taught me the benefit of scaling up science and involving people from outside the direct disciplinary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John during a break from survival training at Casey.


MARTIN BENAVENTE

John prepares to spend a night in his bivvy.

areas, to tackle the big issues. I hope this experience will help the Science Branch as we seek to provide support for evidence-based decisions on the big policy and environmental issues for government, such as reduction of and adaptation to climate change impacts, environmental protection and guidelines for Antarctica, and sustainable resource use.

I'd like to be able to play a significant role in guiding and supporting Australian science in Antarctica, ensure we continue to be relevant to Australia's needs, and build a group of young scientists willing and capable of leading Antarctic Division science into the future.

Are there any aspects of the job that you are most looking forward to?

As a marine biologist/fisheries scientist, getting to know more about the challenges of the Commission for the Conservation of Antarctic Marine Living Resources – supporting sustainable fisheries in an area of such immense conservation value as the Southern Ocean, is fascinating. However, I also enjoy learning about science areas that are new to me. Thus, developing a better understanding of our research on various components of the 'ice system', the unique atmospheric physics of the polar region, and the terrestrial systems of the continent and sub-Antarctic islands, are my brain food for the next few years.

What are your first impressions of the Australian Antarctic Division?

Across all parts of the Division, I was struck by the strong shared sense of 'why we are here' and 'tradition'. So many of the staff have been with the organisation for much of their working life, and this continuity provides a sense of common purpose that is difficult to generate when staff turnover is high. Clearly, the challenge for a new leadership is to harvest the best aspects of this sense of purpose without becoming a slave to the past. Science in Australia has changed significantly over the last decade, and we need to be clear and strong in purpose and strategy if we are to continue to receive support.

There is no doubt that the Executive has much to do in setting the Division's future directions and getting sign-on for these from government. We have spread ourselves thinly with a static resource base, and found it increasingly difficult to do all things to the standard we think necessary. However, the new Executive is well-equipped to tackle these challenges. I have enjoyed developing a relationship with this team, and think we have strong and complementary capabilities, and a shared commitment to seeing the job done effectively.

Describe your first trip to Antarctica?

I was lucky enough to spend my second week on the job down on the ice, based at Casey. Jumping on a jet and arriving at Wilkins ice aerodrome four hours later, Casey a few hours after that, and beginning work in Antarctica after lunch, was quite surreal. The sense of space – the 'big sky' feel – and wilderness, is never captured in photos. Away from the station the sense of quiet (when the wind wasn't blowing) was also quite fantastic. Lyn Maddock, Graham Cook (the Casey Station Leader) and I spent a night at Jack's Donga; a small hut 45 minutes hägglund drive away from Casey. In the morning we woke to snow on the ground, visibility of a few feet and zero wind. It was as if someone had put a thick white blanket over us, shielding all sound and sight.

The week at Casey included a wide range of activities: survival training; learning about the facilities and how the station runs; assisting with some of the resupply work, such as washing Antarctic soil and ice off shipping containers before they were returned to Hobart (voted second worst job after sewage maintenance); keeping icebergs clear of the fuel line while fuel was pumped on-shore from the supply vessel; and spending some time out on the water with some of the Human Impacts research team. We were there during the largest resupply ever and this dominated the time of just about everyone on station and the crew on board the *Amderma*. Everyone was working to a roster that ran around the clock, without complaining and often volunteering for extra work. This level of commitment and teamwork seemed to be the way of the station, and as an outsider it was impressive to see and participate in.

The wonderful history of the Australian National Antarctic Research Expedition(er)s provides everyone who goes to Antarctica with a strong base and rich context for being there. The new phenomenon of the fly-in expeditioner is clearly a departure from the tradition of sea voyages and extended stays. However, I'd hope that the sense of being part of the Antarctic Division community – mucking in whenever necessary – and commitment to the bigger goals of the organisation, guide all expeditioners, regardless of how long they might be there.

CHANGING OF THE GUARD

Three significant contributors to the Australian Antarctic program, and members of the Australian Antarctic Division's Executive, have recently or will soon 'retire'. Former General Manager of Policy, Andrew Jackson, former Chief Scientist, Michael Stoddart, and former Head of Operations, Kim Pitt, reflect on their time with the Division and what they hope for their future and that of Antarctica and the Australian Antarctic program.

HIGH SCHOOL RUSSIAN RAISES THE CURTAIN ON AN ANTARCTIC CAREER

In 1974 I won a university vacation position in the public service, assisting the Australian Antarctic Division translate the titles of a huge pile of Russian science publications (I studied Russian at school) the library had accumulated over many years. It took me two summers to get through them. Soon after I won a permanent job at the Antarctic Division because I had worked there before; then one door after another opened and I became immersed in the Antarctic business. It was a far cry from previous jobs stuffing teddy bears with crumbed foam in a long-gone toy factory in Melbourne, and teaching in Victoria, where I only lasted four terms.

When I joined the Division I wanted to learn as much as I could about Antarctica, and make a difference to how we did our business. I worked in many parts of the organisation – information services, science administration, international affairs, strategic planning and, finally, as a member of the Executive.

My main area of responsibility has been Antarctic policy. I came into the Antarctic Treaty family at the end of the debate on Antarctic minerals development and was closely involved in negotiating the environmental Protocol, which provides a long-lasting framework for Antarctica's future. It's been a privilege to help shape part of the globe's future. The shift from a resources view of Antarctica to an environment protection view is an important change in attitude in achieving a sustainable future.

Most recently, I worked with others on a project to define Australia's long-term strategic engagement with Antarctica. I hope that some of the vision we developed can be brought to reality. It's quite simple really – a future that protects Antarctica and the relationships between nations interested in the region; maximises the remarkable scientific opportunities so that the world can benefit; and gives us flexibility to pursue our national Antarctic interests. We need to protect the options for coming generations in the region.

I think it is a privilege to visit the Antarctic; even once. I made the journey 17 times between being a wide-eyed trainee to a Treaty inspector. But first impressions will never leave. I was in awe at having seen my first iceberg and then, at midnight, on one of those calm, silent Antarctic nights, when one feels infinitesimally small and insignificant, *Thala Dan's* bow slid into the pack ice. At the very moment we entered the pack the full moon rose directly astern along our arrow-straight track. We left the heaving sea behind and I passed through the ice barrier into another world.

Of course there were challenges in my work, but working on Antarctic issues is easy with so many experts around. That said, the 2001 Treaty meeting in St Petersburg let me dust off my Russian again, but with less impressive results. In charge of ordering meals in the local restaurant one evening, through some slip of mispronunciation, I succeeded in ordering cake and salad for the entire delegation. To my colleagues, I offer my sincerest apologies.

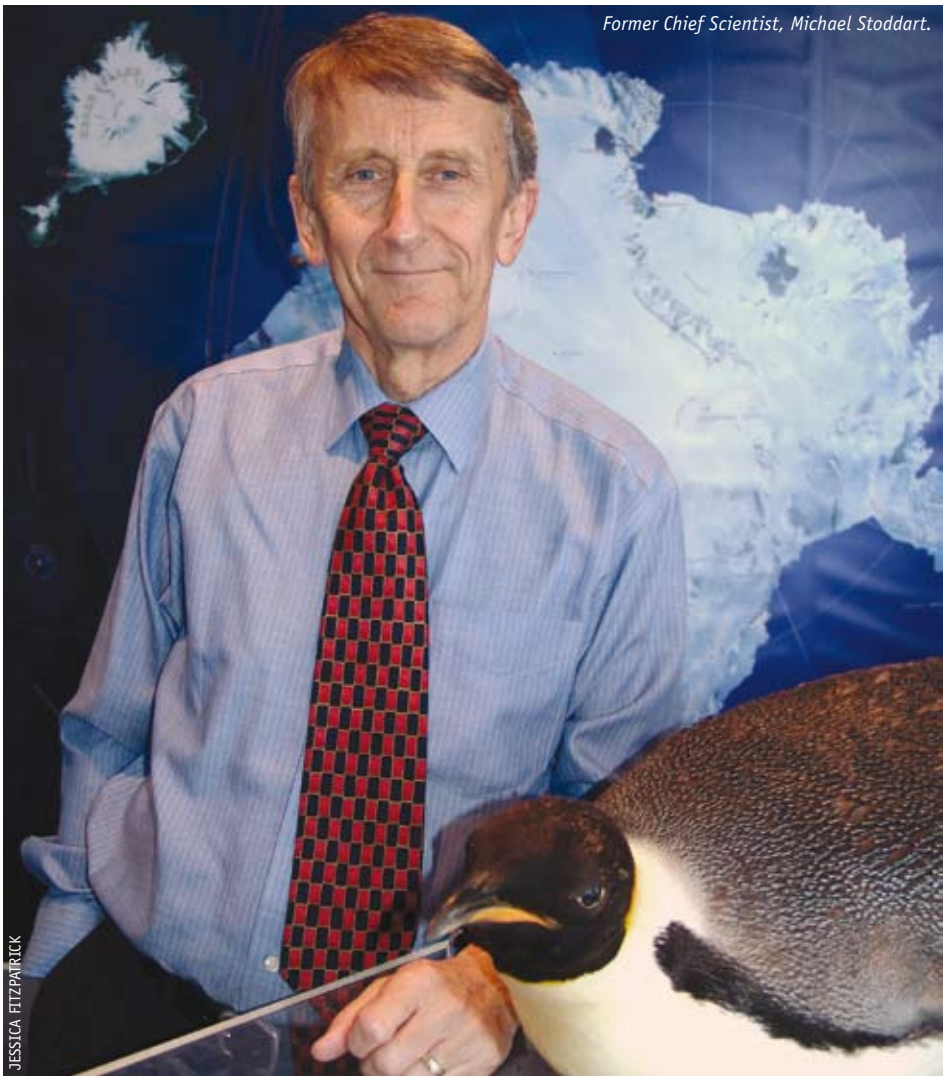
I have no specific plans on leaving the Antarctic Division, but I hope that whatever comes my way will provide some opportunities to keep me involved in Antarctic affairs.

ANDREW JACKSON
Former General Manager, Policy

Andrew at Mawson's Huts in 1981.

Building a proud reputation in Antarctic science

I started at the Australian Antarctic Division in December 1998, after a previous Director told me they were looking for a new Chief Scientist.



Former Chief Scientist, Michael Stoddart.

Prior to the Antarctic Division my work was entirely within the university system, both in the UK and Australia. This included positions as Lecturer in Zoology at King's College, London; Chair of Zoology at the University of Tasmania; foundation Chair of the Antarctic Animals Ethics Committee – during which time I conducted a short project on Macquarie Island; and Deputy Vice-Chancellor at the University of New England in Armidale, NSW.

When I arrived at the Antarctic Division I wanted to develop the science program into one which was even better acclaimed and more visible internationally than the one I inherited. Whether I achieved this will be for history to judge, but by external assessments and the expressed views of Antarctic colleagues from overseas, Australia stands with a proud reputation in Antarctic science. Our research staff and our many collaborators around Australia and internationally are of the highest calibre and it is their work which receives the accolades.

Through successive science strategies the science program is now far more focused on what the government wants than was previously the case. This has resulted in a 'program' structure very different from the discipline-based structure I inherited.

I went to Antarctica six times, including with a group of school children on a tourist vessel travelling down the Peninsula and on a couple of overflights – one with Croydon Travel over New Year's Eve, complete with a 747 jazz band. I spent a short summer at Davis in 2006 and I was fortunate to be on the first passenger flight in our very own A319 in February 2008. My first and lasting impression of Antarctica is its vastness and how small we humans are in the grand scheme of things.

One of my best experiences was being part of the team presenting Antarctic science to the Prime Minister's Science, Engineering and Innovation Council in 2005. I asked the PM and his colleagues to pick up glasses into which we had put glacial ice and water, and breathe air which had not seen the light of day since the human species evolved. Following this, we got the go-ahead for the airlink.

I hope that the governance system for Antarctica will endure the pressures of the 21st century. It may be creaky, but it works. It would be an appalling tragedy if Antarctica were to be exploited further. Climate change is creating new challenges for how tourism and research are to be managed, as well as marine exploitation, and I'd like to see the Antarctic Treaty Consultative Meeting continue to be responsive to what might turn out to be quite rapid change.

Australia's program must continue to focus on what the government wants; addressing the competing demands of science without boundaries and government constraints. If we can do this, our program will continue to grow in stature, relevance and quality.

I have no intention of 'retiring' in the sense of 'withdrawing into privacy or seclusion'. I will continue as coordinator of the Census of Antarctic Marine Life until its *Grande Finale* in 2010, and then in whatever new guise it adopts. I have recently been involved in developing a renewal bid for the Antarctic Climate and Ecosystems Cooperative Research Centre and organising the second sub-Antarctic forum in Hobart, and I will be delivering a plenary at SCAR Biology in Sapporo in July 2009. I will also have more time for music, family, boat building (model and real), travel and I don't know what all else!

MICHAEL STODDART
Former Chief Scientist

Kim stops at a 'popular tourist spot' on his way from Casey to visit the new Wilkins Runway in 2007.

MATT FILIPOWSKI

ADVANCING OPERATIONS

I joined the Royal Australian Naval College from school and spent more than 32 years in the operational arms of the Royal Australian Navy (RAN), mostly at sea in submarines but with career excursions into intelligence and logistics. During a six year exchange with the Royal Navy and the Royal Canadian Navy, I participated in Arctic operations and developed an interest in working in cold regions.

I left the RAN in October 1997 and two days later started at the Australian Antarctic Division; just in time to participate in the expeditioner field training program at Bronte Park.

When I started I wanted to ensure the (former) Operations Branch delivered a service that matched the needs and requirements of the organisation; to build even better relationships with our colleagues in science; and to take advantage of opportunities to advance Australia's interests internationally, at the operational level.

Accepting that there is much still to be done, I like to think that all of these personal objectives were progressed, and with some success. However, I realised early on that there also was an operational need to develop further the safety and environment culture of the Division. Happily I've been able to play a role in moving this forward.

Most years we managed to deliver significant realignments of our operations, logistics and engineering to keep pace with the dynamics of the changing scene; one example was finding the money to fund the introduction of ski-equipped aircraft from within the annual Operations Branch budget.

In addition, I think we achieved tremendous improvements by shifting the emphasis in expeditioner selection i.e. giving personal qualities an even higher priority. Working with the Station and Field section and the Army psychologists to experiment with, lobby for and introduce selection centre processes, is something I am proud of.

I visited each of our stations and a variety of field camps, as well as those of other nations, on four brief voyages on *Aurora Australis* and *Polar Bird*. These, coupled with flights into McMurdo and Scott Base, to Blue One, SANAE IV, Troll, Neumayer and the Dronning Maud Land drill sites, helped me to understand better the strengths and weaknesses of the Division's logistic and operations framework and how to work to improve our support systems.

I was proud of the Operations team's work on so many things including the Safety Management System and Environmental Management System; improving voyage planning and training regimes; implementing world-class energy reduction systems; general infrastructure initiatives and, most recently, the huge effort of everyone on stations and at head office to accommodate the integration of fixed wing air services.

I hope that the ground work of the past 12 years, to develop relationships with other nations operating in our vicinity, can be capitalised upon, and that a way is found to improve the efficiency and mutual benefit of logistics across the East Antarctic. We also need to act upon the lessons learned during the introduction of aircraft, to get the full benefit of our new operating system; and we need to ensure that the basic infrastructure is fit for purpose and able to fulfil its role, while managing the safety and environmental risks.

So what next? I hope to properly learn how to play the banjo, learn a language, work with the local community through Rotary, play a role in both the Submarine Association and Submarine Institute of Australia, spend more time with my family, avoid all attempts to sell my motorbike, potter with small boats, build stuff with wood, take my Land Rover 'Baldrick' off-road more often, and vicariously enjoy the successes of the Australian Antarctic program.

KIM PITT
Former Operations Branch Head

AUSTRALIA'S CONTRIBUTION TO THE INTERNATIONAL POLAR YEAR

Australian Antarctic scientists joined with polar researchers around the world to celebrate two years of intensive, internationally coordinated scientific research for the International Polar Year (2007–2009), on 25 February 2009.

A celebration was held in Geneva, Switzerland, coinciding with the release of the report, *The State of Polar Research*. This report provides an overview of the collective impact of international and interdisciplinary research conducted during the IPY, and the future of polar research.

During the IPY, five Australian-led research projects made significant advances in scientific understanding in Antarctica and the Southern Ocean (pages 9–13). Australia also contributed to many other international projects. For all projects, the IPY provided an opportunity to collaborate with scientists from different nations and different scientific disciplines, enabling research on a larger and more comprehensive scale than ever before.

Many of the projects gathered information which has been, or aims to be, stored in broadly accessible databases. These data are a key IPY legacy and will be invaluable for future research and, in some cases, will provide benchmark information against which environmental change can be observed. A number of observational systems and associated infrastructure were also established, and equipment installed, which will enable continued and long-term research. Some research has already instigated practical changes that will assist future conservation of the Antarctic environment.

As well as building relationships with new and existing scientists, science students and research institutions, Australian IPY scientists also engaged with the general public. A range of public outreach and education activities were conducted, including IPY days, school visits, and the creation of web blogs and educational and scientific websites.

Altogether, the success of the Australian projects in delivering on the four major goals of the IPY – advances in polar knowledge, a legacy of infrastructure and observational systems, inspiring a new generation of scientists, and public outreach – will ensure the scale, success and broad understanding of Antarctic research, made possible by the IPY, will continue.

Aliens in Antarctica

Aliens in Antarctica is the first major investigation into the effect of human activities in Antarctica on the invasion potential of alien (non-native) species. Over the 2007–08 summer an international team of scientists from nine nations, coordinated by the Australian Antarctic Division, investigated the likelihood of the introduction of non-native species across a wide range of national Antarctic programs and tourist operators.

Teams examined the type and number of 'propagules' (seeds, spores and eggs) that could be unintentionally imported into Antarctica on personal clothing and equipment, fresh food, cargo, and more than 40 ships and aircraft. Crews and passengers were also surveyed to ascertain the extent of travel that people had done before heading south, to identify the geographic range from which invasive species could be drawn.

The Australian team examined over 2000 items of fresh fruit and vegetables destined for Australian Antarctic stations and conducted laboratory-based simulations to look at seed dispersal and germination. Details of this work are described in *Australian Antarctic Magazine* 14: 28, 2008). As a result of this research the scientists recommended that certain produce should not be accepted within the Australian Antarctic program in future.

Data and information gathered during the project are now being analysed and will be reported at Antarctic Treaty meetings; at the Scientific Committee on Antarctic Research Biology symposium; and through the scientific literature. Ultimately, the information will be used to improve conservation and protection practices in the Antarctic region and other sensitive areas around the world.


DANA BERGSTROM


DANA BERGSTROM

Most (89%) fresh fruit and vegetables examined by the Australian team were clear of propagules. The remaining items, such as these pears and onions, were either infected with fungi (9%) or had evidence of the presence of insects (2%).

Sea Ice Physics and Ecosystem eXperiment

The Sea Ice Physics and Ecosystem eXperiment (SIPEX), involving 45 scientists from 12 countries, has improved scientists' understanding of the relationship between sea ice physical processes and the biological environment within and under the ice. The program, led by the Australian Antarctic Division and the Antarctic Climate and Ecosystems Cooperative Research Centre, was conducted on a 55-day multi-disciplinary sea ice voyage, at a time of maximum sea ice extent in East Antarctica. During this time scientists took a series of measurements at 15 'ice stations', to characterise the sea ice environment (*Australian Antarctic Magazine* 14: 14–19, 2008).

SIPEX was conducted as part of a larger IPY project titled 'Antarctic Sea Ice in the IPY' which drew together research programs across many countries. The US-led Sea Ice Mass Balance in the Antarctic (SIMBA) program, for example, aimed to characterise the sea ice environment of West Antarctica. It investigated sea ice thickness, extent and physical and biogeochemical properties, the interaction between the ocean, atmosphere and ice, and the biology of the sea ice, among other things. Together, SIPEX and SIMBA formed a major, simultaneous study of much of the Antarctic sea ice zone.

During SIPEX, field measurements of snow properties as well as sled-based radar measurements provided valuable insights into 'radar returns' (returning signals) from the snow surface, ice/snow interface and intermediate layers within the snow pack. This allowed scientists to identify the snow layers that most affect the reflection of a radar signal and to estimate snow thickness. Coupled with airborne radar and laser altimetry measurements, this information will play a pivotal role in the interpretation of satellite altimetry data and the development of global ice and snow thickness maps.

SANDY ZICUS, ACE CRC

A sled-based radar provided information on the structure of the snow surface, ice/snow interface and intermediate layers within the snow pack.

To understand linked physical-biological sea ice processes, detailed measurements were made of ice properties, including ice structure, inorganic nutrient concentrations, trace elements (such as iron), and biological parameters such as ice algal biomass and species composition. In addition, Antarctic krill was sampled using trawls and camera systems lowered under the ice.

The combined data show a strong increase in biological production (such as algal growth and krill growth and reproduction) during the latter half of the research voyage, indicating that the voyage captured the onset of biological activity during the winter-spring transition.

A number of new technologies were used, adapted and deployed as part of the program, including the Surface and Under Ice Trawl, used to sample krill immediately under the ice; airborne laser and radar altimetry for measuring sea ice 'freeboard' (height of ice above the water) and snow cover over tens to hundreds of kilometres; and instrumentation on a Remotely Operated Vehicle for exploring the presence of algae and krill immediately under the ice. These technologies will be further developed for future research campaigns and have established the Australian Antarctic program as a key centre for conducting high quality, innovative field work in the Antarctic sea ice zone.

ACE CRC

A scientist pours orange dye into sea ice blocks to study how fluids, such as seawater, move up and down through the sea ice. The speed with which the dye percolates through the ice shows how porous it is. Porosity depends on the temperature and salinity of the ice, with warmer ice being more porous. The dye also highlights channels in the ice, providing information about its structure.

SIPEX involved scientists from many different countries, a number of which now have improved research links and capabilities with Australia. This is particularly true of the Japanese program with which Australia is now engaging in closer ties on climate change research, and with European collaborators on calibration and validation efforts on the new CryoSat-2 altimetry satellite, which will be launched in November 2009. The voyage also resulted in a new collaboration with researchers from the Netherlands (Wageningen IMARES) and strengthened existing collaboration with German and Norwegian colleagues.

A great deal of airborne data was collected during SIPEX, including aerial photographs over sea ice. This will be archived with images from other field campaigns, as well as biological data, at the Australian Antarctic Data Centre. The laser and radar altimetry, once fully processed, will provide a reference to regional sea ice and snow thickness in the study region.

A workshop held in Italy in March 2009, brought together the participants from different programs, including SIPEX and SIMBA, to explore synergies in terms of data analysis and joint or complementary publications. The workshop selected 43 papers for publication in a special volume of *Deep Sea Research II*, which will be published in 2010. More information is available at: www.sipex.aq

RAE

Russian scientist, Evgeny Gruzinov, runs and services the scientific equipment at Vostok.

Solar Linkages to Atmospheric Processes

During the IPY the Solar Linkages to Atmospheric Processes (SLAP) investigated the links between changes in solar output and weather and climate.

Meteorological and solar variability influences on the 'atmospheric electric circuit' (a current that flows around the world, between the ground and lower reaches of the ionosphere) are well-established. The unanswered question is whether the electric circuit actively links solar variability and weather, or if it responds passively to both meteorological and solar variations. Understanding this interaction is important because changes in the global electric circuit, caused by solar variability, could alter the conditions under which thunderstorms develop.

Through the SLAP project, scientists from the Australian Antarctic Division and the Arctic and Antarctic Research Institute in Russia, measured the atmospheric circuit high on the Antarctic plateau at Vostok, near the centre of East Antarctica. Instruments were also deployed at three sites in West Antarctica by the British Antarctic Survey and at the French-Italian station, Concordia (at Dome C), by international collaboration.

The project scientists recently published evidence supporting a day-to-day meteorological variation linked to solar activity, and showing that the process operates via the atmospheric electric circuit – i.e. there is an active link between the electric circuit, solar variability and weather. This supports a new link between solar variability and climate in addition to solar irradiance and UV ozone modulation described in the Intergovernmental Panel on Climate Change Fourth Assessment Report.

A model of the global electric circuit has been developed by collaborators at the University of Texas, incorporating variations in cosmic rays, energetic particles, natural radioactivity and aerosols. Outputs from the model will be compared with measured atmospheric circuit responses to these variations, to refine understanding of the processes involved.

The Vostok and Concordia data sets will ultimately reside in the Australian Antarctic Data Centre and the Global Circuit Project of the University of Houston. Data from the West Antarctic deployments will be available via the British Antarctic Survey Data Access and Browsing System. Scientists will continue collecting data over at least the next two years to address their research goals. Updates are available through the SLAP website (http://globalcircuit.phys.uh.edu/SLAP/index.htm).

Census of Antarctic Marine Life

The Census of Antarctic Marine Life (CAML) and its north polar counterpart, the Arctic Ocean Diversity project, have pioneered new understandings of the evolution and diversity of life.


J.GUTT, ALFRED WEGENER INSTITUTE, 2007

These solitary sea-squirts (ascidians) stand up to half a metre high on the sea bed, providing a platform for other filter feeding animals and the brittle stars in the foreground. These sea squirts were found in sediments at Larsen A and off Terre Adélie.

Led by the Australian Antarctic Division, CAML (www.caml.aq) coordinated 18 major research voyages to Antarctica and the Southern Ocean during the IPY. Australian scientists participated in three CAML voyages focusing on waters adjacent to East Antarctica – known as the Collaborative East Antarctic Marine Census. These voyages studied sea-bed communities and the deep pelagic (open ocean) zone of the region adjacent to Terre Adélie and George V Land (*Australian Antarctic Magazine* 14: 2–13, 2008). The work led to two areas of the Southern Ocean being declared Vulnerable Marine Ecosystems by the Commission for the Conservation of Antarctic Marine Living Resources in 2008 (*Australian Antarctic Magazine* 15: 19, 2008). This declaration ensures that these unique areas will not be damaged by indiscriminate fishing practices.

Altogether, CAML revealed that Antarctica is a single bioregion united by the Antarctic Circumpolar Current. The region is unexpectedly rich in species diversity, and molecular techniques show Antarctica to be the birthplace of many species, driven by glacial cycles over millions of years. For example, eight genera of octopus were in Antarctica 30 million years ago – about the time that the polar continent separated from South America. Since then, different octopus types have repeatedly colonised the deep sea, radiating northwards when the ice retreats. Similar patterns are expected with other species, including isopods (crustaceans related to shrimp and crabs) and sea spiders.

The major legacy of CAML is the SCAR-MarBIN (Scientific Committee on Antarctic Research Marine Biodiversity Network) dataportal, which contains data collected on some 14 000 species (www.scarmarbin.be) – a benchmark against which future change in marine communities around Antarctica can be assessed.

In partnership with Canada's Guelph University, CAML is 'barcoding' (analysing DNA sequences) for some 3000 Antarctic species, with SCAR-MarBIN creating related data storage, analysis and visualization tools. Analysis of genetic variation across Antarctica, across different depths and/or between sub-Antarctic islands will then be possible. This work will help identify new species and 'cryptic' species (species that are difficult to distinguish from each other). Eventually, the information will be integrated with the Barcode of Life data system.

The Census of Marine Life program will end in 2010. The international network of researchers in marine biodiversity will continue under the auspices of the Scientific Committee on Antarctic Research.


CAML

The Census of Antarctic Marine Life (CAML) recently received an award for 'overall excellence' from its parent program, the Census of Marine Life (COML), which coordinates 14 international field projects. CAML leader, Professor Michael Stoddart (centre), of the Australian Antarctic Division, said the award recognised CAML's approach to and success in science, educational and outreach activities and cooperation and collaboration.

The illustration on the award received by the CAML project detailing an ornate wrasse (left) and saddled bream. From the Dictionnaire des Sciences Naturelles Planches. Zoologie: Poissons et Reptiles. *F.G. Levrault, Paris, 1816–1830.*

Climate of Antarctica and the Southern Ocean

The Climate of Antarctica and the Southern Ocean (CASO) program, led by the Antarctic Climate and Ecosystems Cooperative Research Centre and CSIRO Marine and Atmospheric Research, is working towards obtaining a circumpolar snapshot of the physical environment of the Southern Ocean.

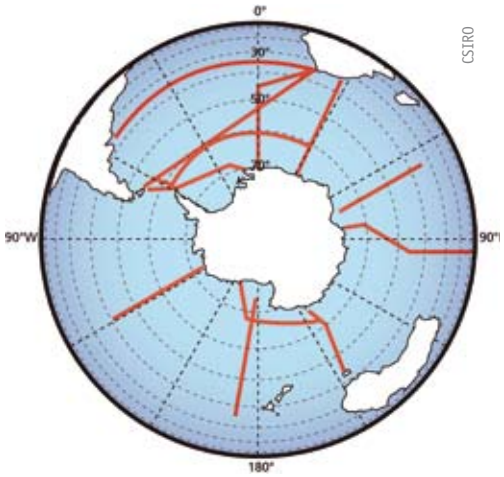
This snapshot will enhance scientists' understanding of the role of the Southern Ocean in past, present and future climate, and improve climate predictions from models that incorporate a better understanding of southern polar processes.

CASO consists of 25 individual projects involving scientists from 18 nations. It links with other IPY projects, including studies of ocean circulation and ocean-ice interaction near the Antarctic margin, biogeochemistry, meteorology, ecology and paleoclimate.

During the IPY, CASO, in collaboration with other IPY programs, measured a wide range of physical, chemical and biological properties of the Southern Ocean. The measurements covered the circumpolar extent of the Southern Ocean, from the surface to the sea floor and from the Antarctic continental shelf to the Subtropical Front. Scientists used a wide variety of tools, including ship transects, profiling floats, satellites, moorings and oceanographic sensors attached to marine mammals. The integrated, multi-disciplinary observations made with these tools, provide a 'proof of concept' for the long-term Southern Ocean Observing System presently under development by the international community.

The Australian CASO team deployed 30 ocean profiling ('Argo') floats throughout the Australian sector of the Southern Ocean, to measure temperature and salinity in the upper 2000 m of the ocean. These floats contribute to a network of over 3000 existing floats deployed throughout the world's oceans. Small oceanographic sensors were also deployed on seals, to take the first measurements of ocean conditions around Antarctica during winter. Observations from these, and other instruments, will be integrated with a range of modelling studies.

Australian scientists also conducted an oceanographic transect across the Antarctic Circumpolar Current, to understand the current's interaction with the Southern Ocean overturning circulation, which regulates the heat and carbon stored by the ocean. Using instruments lowered from the ship, scientists measured temperature, salinity and oxygen concentrations, while water samples were collected from various depths and analysed for nutrients, carbon dioxide, chlorofluorocarbons, phytoplankton pigments and oxygen isotopes. Acoustic instruments were used to measure currents, and moorings were deployed to collect year-long records of water velocity and properties.



CSIRO

Voyage transects for the CASO program provide a synoptic circumpolar snapshot of the physical environment of the Southern Ocean.

The observations showed that water sinking from the surface to the deep ocean near Antarctica is becoming fresher and less dense, demonstrating that changes in high latitude climate are being communicated rapidly to the deep ocean.

Preliminary work during a survey of Antarctic continental shelf waters, suggests that the ocean circulation patterns influence the distribution of benthic (bottom-dwelling) organisms. The oceanographic observations also showed that dense Antarctic Bottom Water was escaping from the continental shelf and sinking to the deep sea in this area, even during the summer.

The data collected during the CASO voyages has been archived in the international hydrographic data archive – the CLIVAR & Carbon Hydrographic Data Office. More information is available on the CASO website: www.clivar.org/organization/southern/CASO/index.htm


ALICIA NAVIDAD, CSIRO

One of 30 Argo floats is deployed in the Australian sector of the Southern Ocean during the International Polar Year. The floats join a network of 3000 around the globe measuring temperature and salinity in the upper 2000 m of the world's oceans.

Herder Piotr Terent'ev drives a team of reindeer for the NOMAD project, which studied the interactions between people and migrating reindeer herds in the subarctic in a time of socio-economic and climate change.

INTERNATIONAL POLAR SNAPSHOT

At the end of the International Polar Year (IPY), evidence of the widespread effects of global warming in the polar regions is mounting.

According to the report, *The State of Polar Research*, released by the World Meteorological Organisation and the International Council for Science on 25 February 2009, the evidence includes:

- satellite measurements showing that the Greenland and Antarctic ice sheets are losing mass and contributing to sea level rise, and that the rate of ice loss from Greenland is growing;
- new data confirming that warming in Antarctica is more widespread than previously thought;
- a decrease in the summer minimum extent of Arctic perennial sea ice by roughly one million square kilometres;
- an unprecedented rate of ice drift across the Arctic basin, indicating changes in the Arctic ice-ocean-atmosphere system;
- oceanographic measurements showing the southern flank of the Antarctic Circumpolar Current has warmed more rapidly than the global ocean average;
- freshening of dense bottom water in some locations in Antarctica – consistent with the increased melt from Antarctic ice shelves and ice sheet;
- substantial changes in the type and extent of vegetation in the Arctic due to global warming, including transitions from grasses to shrubs, and shifts in tree lines related to an alteration in patterns and timing of snowfall.

As well as climate change-related findings, IPY research has also:

- uncovered a rich, colourful and complex range of life in the Southern Ocean;
- found that some microbial species occur in nearly identical form in both Arctic and Antarctic ecosystems;
- shown that storm systems in the North Atlantic are a major source of heat and moisture in the Arctic – this knowledge will improve forecasting the paths and intensities of storms;
- identified large pools of carbon stored in permafrost, which are likely to contribute to greenhouse gases as the permafrost melts;
- begun to look at human health issues in the Arctic.

These wide-ranging IPY findings come from more than 160 endorsed science projects assembled from researchers in more than 60 countries. One third of the IPY projects took place in and around Antarctica.

But the work is not over yet. As well as scientific and social research, the IPY enabled an expansion of observational systems, facilities and infrastructure at the poles, for collecting data and monitoring change into the future. These include establishment of a number of new Antarctic stations and steps toward development of sustained, multidisciplinary and integrated environmental observing systems in both polar regions.

According to *The State of Polar Research* report, the IPY also offered an opportunity to hundreds of graduate students and post-doctoral researchers in many specialties to be trained to meet new polar challenges. The Association of Polar Early Career Scientists was formed, offering and promoting career development, collaboration, leadership and education and outreach tools and opportunities. Arctic residents, indigenous peoples, and their organisations, were also involved as partners and leaders in international IPY projects, providing a foundation for their future engagement.

The task ahead will be to translate observations into more reliable predictions. However, a functioning data archive that will allow scientists around the world to access all data and observations collected during the IPY is not yet in place. The IPY data-management committee is working on options for setting up a data-sharing system.

In the next two to four years the focus will be on integrating IPY research into the upcoming assessments of the Intergovernmental Panel on Climate Change and the deliberations of the United Nations Framework Convention on Climate Change. Major IPY conferences in 2010 (Norway) and 2012 (Canada) will ensure further assessment and reporting of IPY results to shape the future directions of polar research.

To read *The State of Polar Research* report see: www.ipy.org/index.php?/ipy/detail/state_of_polar_research

IAN ALLISON
Co-Chair, Joint Committee for the IPY

NEW ANTARCTIC STATIONS

China's Kunlun Station opens at Dome A


XIA LIMIN, CHINARE

China's s third Antarctic station, constructed at Dome Argus (Dome A) in the Australian Antarctic Territory, officially began operation on 2 February 2009. Kunlun Station, part of China's International Polar Year legacy, is intended to have a life span of 25 years and will accommodate up to 25 people. Situated at the highest point on the Antarctic ice sheet (4093 m), Kunlun will initially only operate in summer, but over the next decade additional facilities, including a solar-panel array, will enable it to operate year-round.

Research at the station will include the exploration of deep glacier ice cores and mountains under the Antarctic ice, astronomical and terrestrial magnetic observations, and studying the effects of extreme weather on human psychology and physiology. In 2008 Australia coordinated the international review, by the Antarctic Treaty's Committee for Environmental Protection, of China's Comprehensive Environmental Evaluation report for Kunlun Station. Read more about Kunlun and the 25th Chinese Antarctic Expedition at: www.polarfoundation.org/index.php?s=3&rs=home&uid=809

First 'zero emission' Antarctic station


© INTERNATIONAL POLAR FOUNDATION

Belgium opened the world's first 'zero emission' polar science station in Antarctica on February 15 this year as part of its International Polar Year legacy. The Princess Elisabeth Station – an octagonal, steel structure on stilts, which sits on a ridge just north of the Sør Rondane Mountains, in Dronning Maud Land, East Antarctica – is energy self-sufficient and does not emit any carbon dioxide. Its roof is covered by solar panels, designed to provide one-third of the energy needed to run the isolated post, while the rest will come from large wind turbines. The station also uses bioreactors, based on technology developed by the space industry, to recycle 100% of its wastewater up to five times, before disposal.

The station's expected lifespan is 25 years. It will provide a base for research into climatology, glaciology, microbiology, geology, astronomy, gravimetry and more. Scientists from around the world have already used the station during the 2008–09 Antarctic season. Conceived and built by the International Polar Foundation (IPF), the station will be run by a Polar Secretariat, a public-private partnership between the IPF and the Belgian Government. Read more at: www.antarcticstation.org/.

Declaration on the International Polar Year and polar science

Participants in the joint meeting of the Antarctic Treaty Parties and the Arctic Council, in Washington in April this year (see pages 19–20), released a declaration on the International Polar Year and polar science, acknowledging the work that was done and highlighting the scientific research and collaboration that must continue. Ten future goals were noted for states, national and international scientific bodies, and other interested parties in the Antarctic and Arctic:

- Continued cooperation to deliver a lasting legacy from the IPY, and to support appropriate infrastructures to achieve this.
- Using science to help inform the cooperative development of measures to address the threats to the polar regions.
- Making data available in an open and timely manner.
- Strengthening international cooperation at all levels in polar regions in areas such as educational outreach, human and ecosystem health, environmental protection, and scholarships for young scientists.
- Development of coordinated research and scientific observations at both poles to compare the current dynamics of polar areas and their contributions to the Earth's processes and changes.
- Continued government support to create and link observational systems to improve the modeling and prediction of climate change on both regional and temporal scales.
- Using the scientific understandings derived from IPY research to support efforts to protect the environment in the polar regions.
- Providing scientific data and information collected from the polar regions for future assessments by the Intergovernmental Panel on Climate Change, and other efforts to address climate change and future Arctic Council assessments.
- Continued engagement of states, organisations, scientists, and other stakeholders with young people, to cultivate the next generation of polar scientists, and communication with the general public to develop an awareness of the importance of polar research for life in all regions of the world.
- Affirming the value of collaboration and coordination between states and Arctic residents, including indigenous peoples, for the benefit of polar research.

Read the full declaration at www.scar.org/ipy/

MOUNTAINS UNEARTHED IN THE

Until this year Dome Argus, the summit of the colossal East Antarctic plateau, remained one of the least-explored places on Earth.

The Australian contingent of the AGAP-North operations team (l–r): Field Leader Eric Philips, Senior Aviation Ground Support Officer, Sharon Labudda, and mechanic, Scott Adam.

It is remote, bitterly cold and towers four kilometres above sea level. To the uninitiated its surface appears like any other part of the austere and lifeless interior, but underneath lies one of our planet's greatest enigmas – a hidden mountain range that defies all tectonic reasoning.

Using rudimentary gravity instruments, the Gamburtsev subglacial mountain range and its overlying ice dome, the size of a small country, were discovered by the Third Soviet Antarctic Expedition during its International Geophysical Year traverse of East Antarctica in 1958. The topographic nature and location of the foothills of these subglacial mountains were subsequently identified during Australia's 2002–03 Prince Charles Mountains Expedition of Germany and Australia (PCMEGA). During the 2007–09 International Polar Year, a team of scientists from around the world sought to expand this knowledge using a host of hi-tech instruments, including ice-penetrating radar, gravimeters, magnetometers, seismometers, lasers and GPS, revealing a jagged landscape the size of the European Alps.

'AGAP', Antarctica's Gamburtsev Province, was a multinational collaborative project involving many agencies; primarily the Australian Antarctic Division, British Antarctic Survey (BAS), United States Antarctic Program, Chinese National Antarctic Research Expedition (CHINARE), Germany's Alfred Wegener Institute (AWI) and the Japanese Antarctic Research Expedition. To combat the complexities of aerial surveying over 20 per cent of East Antarctica in a single season, two temporary airfields were established on the flanks of Dome A: AGAP South, operated by the United States, and the Australian-run AGAP North. From these bases Twin Otter aircraft, racked to the wingtips with sensors and computers, flew 120 000 linear kilometres of survey lines over the buried range – a distance of three times around the Earth.

Planning for AGAP began in earnest at a meeting of collaborators in May 2007, with Operations Planning Manager, Robb Clifton, shaping the Australian Antarctic Division contribution for 18 months.

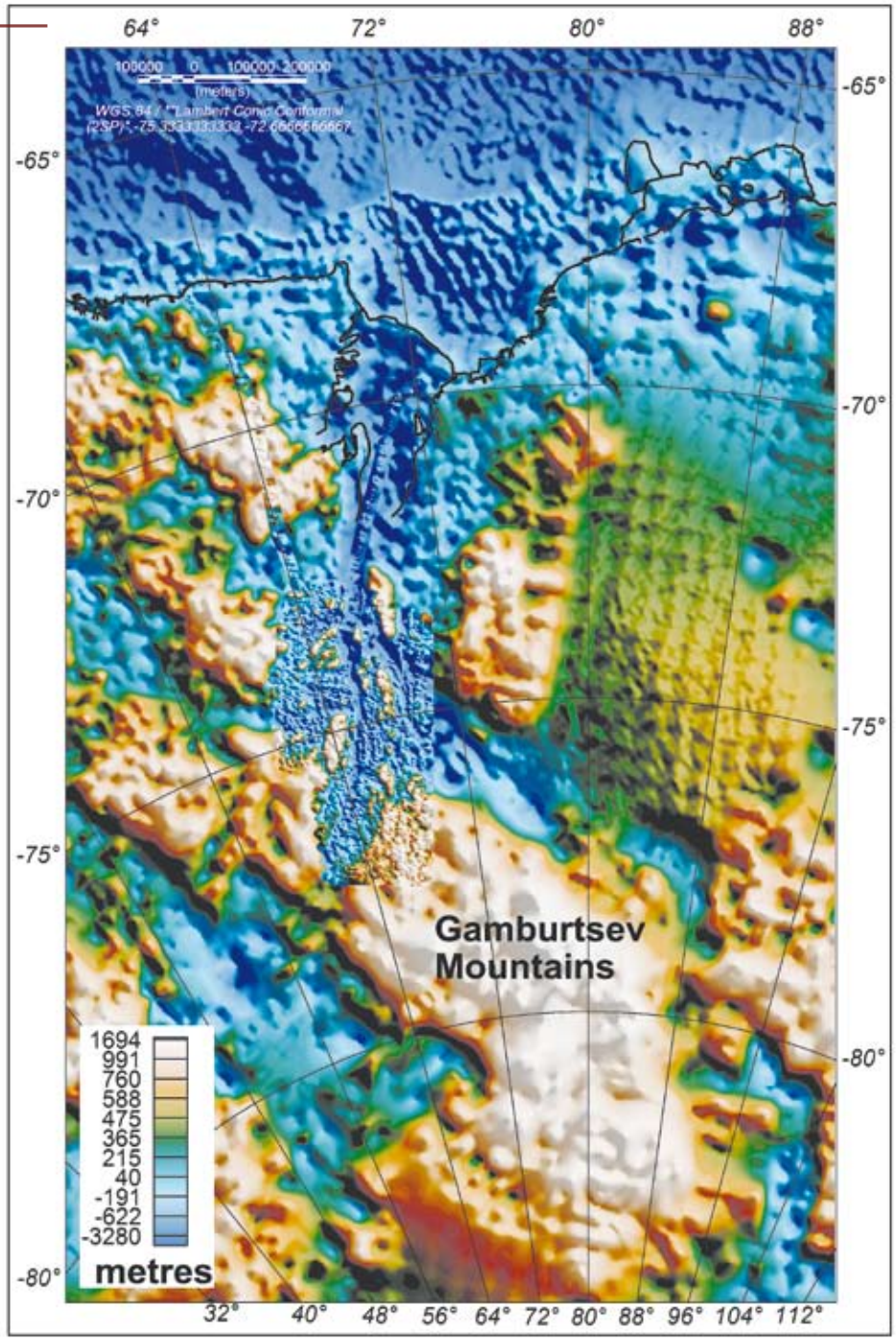
Learning of the program in July 2008, I was immediately captured by the adventurous nature of AGAP and agreed to lead the Australian field component. Many months of planning and preparation, including input from the Antarctic Division's operations, polar medicine, engineering, communications, aviation and multimedia departments, gave shape to AGAP North. With 10 aircraft involved in the broader operations, the aviation component of AGAP North was tailor-made for Senior Aviation Ground Support Officer, Sharon Labudda, a veteran of eight Antarctic seasons. Also indispensable was our fix-anything mechanic, Scott Adam, who had just completed a winter at Davis station. The fourth member of our operations team was Catrin Thomas from BAS. An experienced field guide and Jill-of-all-trades, she was also the link to BAS's six-strong team of pilots, air mechanic, engineer and geophysicists.

Following three weeks of final preparations at Davis, supported by the innovative team of expeditioners stationed there, our two utility planes and their crews arrived from across Antarctica – a BAS Twin Otter and an AWI Basler. Call-signed *FAZ* and *Polar 5*, these proven Antarctic aircraft began ferrying personnel and almost 10 tonnes of food and equipment at the end of November to our staging camp at the scenic Grove Mountains, equidistant between Davis and AGAP North. Catrin, assisted by team members from Davis, managed this hellishly windy camp – used as a refuel stop, ferry station and acclimatisation camp – for two weeks, as we headed south.

On December 9, after two nights at the Groves, Sharon and I flew with *FAZ* to the AGAP N location (S77.18, E77.01), almost 1000 km inland of Davis and about 3000 m above sea level. The

British Antarctic Survey Twin Otters FBL *and* FAZ. *Loaded with scientific instruments,* FBL *was used to survey the Gamburtsev subglacial mountain range.*

WILD HEART OF ANTARCTICA



A portion of the Gamburtsev Mountains identified during the 2002–03 PCMEGA airborne geophysical survey. This survey acquired gravity, magnetic and ice-penetrating radar data, which enabled scientists to map the shape and distribution of the subglacial mountains and bedrock geology. The legend shows metres above (and below) sea level.

Image courtesy of Mark McLean and Chris Wilson, School of Earth Sciences, University of Melbourne.

site, littered with fields of sastrugi, had been cast in ice a fortnight earlier, with the airdrop by a US Air Force C17 *Globemaster* of 112 drums of aviation fuel and unleaded petrol. Two subsequent drops of another 224 drums of fuel saw the icescape strewn with fuel bundles and parachutes. A final drop spewed from the back of the C17 an hour after our arrival.

Our temporary camp erected, we wasted no time in surveying a skiway site that Sharon would groom in preparation for the multitude of aircraft that were due to arrive. Slowly, we built a basic yet functional aerodrome and camp, which comfortably accommodated up to 12 people and enabled us to refuel planes, monitor their flights, house science stations, operate and tune vehicles and generators, and maintain communication with the outside world. By December 18 we were fully operational and began surveying the Gamburtsev Mountains that lay frozen beneath our camp.

Over the next 24 days life at AGAP North fell into a routine of eat, sleep and work. A single day routine went something like: breakfast; air mechanic Kyle Hegadus preps the Otter; geophysicist and instrument operator Tom Jordan cranks up the on-board computers; pilot Doug Cochrane warms up the Otter and tests the satellite phone and VHF radio, while I monitor the communications console in the Polarhaven tent. After take-off, Doug and Tom fly a predetermined series of unwavering lines over the icecap, while the instruments obtain data from the array of receivers. Every hour Doug calls me on the Iridium to confirm their status and get a weather update. On the ground, Scott, Sharon and Catrin work hard in the cold, rarefied air, deconstructing the fuel bundles, digging drums and parachutes from the snow and transporting fuel to the taxiway for refuelling and bundling to the waste cache. Head scientist, Fausto Ferraciolli, taps away at his laptop in the science tent, converting data to tangible pictures and working on tomorrow's flight lines.

After three hours the survey Otter returns and Tom dashes across to the science tent with a hard drive to begin processing. The Otter is refuelled by Kyle and the seven spent drums are squashed in the pneumatic drum crusher and transported to the waste cache. Second pilot, Ian Potten, takes over the next flight with science engineer Carl Robinson. Catrin takes my place behind the phone and off we go again, sometimes three times per day, towards a grand total of 54 flights in just over three weeks.

December 31 saw the CHINARE tractor traverse grace our humble camp. Originating from ZhongShan, the traverse was en route to the summit of Dome Argus to build a summer base, and it was an astonishing sight to see 28 expeditioners and over 500 tonnes of machinery and equipment rumble to a halt. There were brief tours of our respective operations and an eye cast over the airdrop waste we had cached so far; the Chinese would collect this load on their return for shipping back to

Fremantle. This brief but exciting visit typified the spirit of international cooperation common across both government and non-government operations in Antarctica.

With the days becoming noticeably cooler we closed the camp on January 10 and bid farewell to our BAS colleagues. With over six terabytes of data logged they would now begin the laborious task of processing the information and publishing their results. The end product, a virtual unearthing of the Gamburtsev Mountains, together with insights into their formation and where the world's oldest ice might lie, will be the disclosure of one of Antarctica's greatest secrets.

A week later AGAP North was dismantled and we returned to Davis. At the time of writing the bulk of the waste had been picked up by the Chinese (the balance to be collected next year) and the site has otherwise reverted to its natural state.

Many stars aligned in order to see AGAP come to fruition. The International Polar Year shone the brightest in the constellation and the afterglow will be felt for some time. The resourcing capability of multinational collaborations, coupled with the success of AGAP, could see an increase in the scientific study of Antarctica's vast interior and what lies below her hostile cap. Yet despite this immensity, AGAP North's minimalistic paradigm worked a treat and the Australian Antarctic Division may have laid a blueprint for future alliances into the wild heart of Antarctica.

ERIC PHILIPS
Director, Icetrek Expeditions


ERIC PHILIPS

The science tent (foreground) and living quarters at the AGAP North camp site.


ERIC PHILIPS

Fuel drums dropped by the US Air Force C17 Globemaster *are extracted from the snow with a quad bike.*


ERIC PHILIPS

The Alfred Wegener Institute's Basler, Polar 5, *was used to ferry food and equipment to the AGAP-North acclimatization and refuelling camp in the Grove Mountains.*


ERIC PHILIPS

Lead scientist, Fausto Ferraciolli, from the British Antarctic Survey, in the science tent.

ANTARCTIC TREATY MEETING FOCUSES ON THE ENVIRONMENT

World attention turned to the 50th anniversary of the signing of the Antarctic Treaty, during a meeting of ministers in Washington D.C. in April.


ROBYN MUNDY

Australia's efforts to finalise amendments to a section of the Environmental Protocol will establish more stringent arrangements to protect Antarctic flora and fauna.

The meeting celebrated the success of the Antarctic Treaty in promoting peaceful and cooperative governance of the Antarctic region and facilitating globally significant science (see page 20). Australia's Minister for the Environment, Heritage and the Arts, the Hon Peter Garrett AM, MP, reinforced Australia's commitment to continue to work closely with the other Antarctic Treaty Parties to maintain and enhance the Antarctic Treaty system and to respond to improved knowledge and emerging challenges.

The work didn't end, however, when the ministers left. Several hundred representatives from the 47 Antarctic Treaty Parties, plus invited observers and experts, travelled from Washington to Baltimore for two weeks of negotiations on a broad range of topics at the 32nd Antarctic Treaty Consultative Meeting (ATCM) and the 12th meeting of the Committee for Environmental Protection (CEP).

These meetings are the principal international forums for advancing Australia's Antarctic policy interests. Several Australian Antarctic Division officers are on the Australian delegation to these meetings, including Antarctic Division Director Lyn Maddock, Policy Branch Manager Tom Maggs, Chief Scientist John Gunn, and senior policy advisors Phillip Tracey and Ewan McIvor. The delegation also includes representatives from the Department of Foreign Affairs and Attorney General's Department, and advisors from the academic and conservation communities, and a representative of the state governments.


STEPHEN POWELL

The number of tourists setting foot on the Antarctic continent will be restricted to a maximum of 100 at a time at each landing site.

Australia played an active leadership role in the meetings. Among other things, delegates from the Antarctic Division led Australia's participation in the CEP, presenting several proposals for enhancing measures to protect the Antarctic environment, and in ATCM discussions of tourism management, science and operations.

Highlights of the meetings include:

- Building on the positive response to Australia's proposal at the 31st ATCM in 2008, Australia led the meeting to finalise amendments of a key section of the Protocol on Environmental Protection to the Antarctic Treaty – Annex II on Conservation of Antarctic Fauna and Flora.

These amendments establish more stringent arrangements to protect Antarctic flora and fauna, including measures to minimise the introduction of non-native species, and to afford special protection to threatened species.

- With climate warming and the increasing number of visitors to Antarctica, addressing the risks to Antarctic biodiversity from non-native species is high on the Parties' list of priorities. The CEP endorsed a proposal by Australia, France and New Zealand to develop practical measures to prevent such unwanted introductions.
- The CEP agreed to develop a strategy, working closely with the Commission for the Conservation of Antarctic Marine Living Resources, towards the establishment of Southern Ocean marine protected areas in the next three years.
- The Parties acknowledged the need to consider the implications of climate change for the management and governance of the Antarctic region and Norway offered to host a formal Antarctic Treaty Meeting of Experts (ATME) on the topic in early 2009. New Zealand will host another ATME on ship-based tourism in December 2009, to consider ways to improve shipping safety and incident response.
- The number of tourists visiting Antarctica in the 2008–09 season was slightly lower than the previous year, but tourism issues were again a key topic of discussion. The meeting adopted legally binding rules about how tour operators manage visits ashore from ships. For safety and environmental reasons, large ships carrying more than 500 passengers will not be allowed to land people ashore. No more than 100 passengers will be allowed ashore at a time at each landing site, and one guide per 20 passengers will be required.
- The ATCM adopted new guidelines for seven sites used by visitors, adding to a suite of existing guidelines intended to help visitors minimise their impacts.
- The Parties agreed with another proposal by Australia, France and New Zealand that the CEP should conduct a comprehensive study into the environmental aspects and impacts of Antarctic tourism, to provide a basis for future discussions of tourism and its management.

Papers and reports from the meetings are available from the website of the Secretariat to the Antarctic Treaty (www.ats.aq). Next year's meetings will be held from 5–14 April in Punta del Este, Uruguay.

EWAN MCIVOR and PHILLIP TRACEY
Policy Branch, AAD

The spirit of peace and cooperation between nations active in Antarctica during the 1958 International Geophysical Year (IGY) formed the cornerstone of the Antarctic Treaty subsequently negotiated in 1959. This poster – one of six produced by the National Academy of Sciences IGY Committee in 1958 – illustrates the collaborative research opportunities made possible by the philosophies underlying the Antarctic Treaty. The continued relevance and strength of the Treaty was most recently demonstrated during the International Polar Year 2007–09.

Antarctic Treaty turns 50

This year the 32nd Antarctic Treaty Consultative Meeting celebrated the 50th anniversary of the signing of the Treaty – on December 1, 1959.

To mark the occasion, ministers and officials from around the world gathered in Washington D.C., USA, at a special event hosted by US Secretary of State Hillary Clinton. During her speech, Secretary Clinton reflected on the significance of the Antarctic Treaty.

'[The Treaty] stands as an example of how agreements, created for one age, can serve the world in another, and how when nations work together at their best, the benefits are felt not only by their own people, but by all people and by succeeding generations,' she said.

'The Treaty is a blueprint for the kind of international cooperation that will be needed more and more to address the challenges of the 21st century, and it is an example of smart power at its best. Governments coming together around a common interest and citizens, scientists, and institutions from different countries, joined in scientific collaboration to advance peace and understanding.'

Representing Australia at the event, Minister for the Environment, Heritage and the Arts, the Hon Peter Garrett AM, MP, reiterated Australia's commitment to the Antarctic Treaty, as the assembled Ministers adopted a declaration recognising the key role of the Treaty in protecting the Antarctic environment and supporting cooperative scientific research.

'Australia was one of the 12 original signatories to the Antarctic Treaty, signed here 50 years ago,' Mr Garrett said.

'Since then 35 other countries have signed this historic agreement – a testament to its importance.'

Foreign Minister Stephen Smith said that since its inception, the Treaty had been bolstered by associated agreements, including the Convention on the Conservation of Antarctic Marine Living Resources, and the Protocol on Environmental Protection to the Antarctic Treaty, which provides for the comprehensive environmental protection of Antarctica and a ban on mining.

'Australia is proud of the leading role it took in ensuring that Antarctica's environmental values are properly protected, and we continue to regard Antarctic environmental protection as one of our highest priorities,' Mr Smith said.

Minister for the Environment, Heritage and the Arts, the Hon Peter Garrett AM, MP, represented Australia at the ministerial gathering to celebrate the 50th anniversary of the signing of the Antarctic Treaty in Washington.

Minister Garrett also announced that Australia will host the 35th Antarctic Treaty Consultative Meeting in 2012. Australia hosted the first Treaty meeting at Parliament House in Canberra in 1961 and the 12th meeting in 1983.

To read the Ministerial Declaration on the Antarctic Treaty and Hillary Clinton's entire speech see www.state.gov/secretary/rm/2009a/04/121314.htm

CORPORATE COMMUNICATIONS, AAD

CLEANING UP FUEL SPILLS ON MACQUARIE ISLAND

Fuel spills have occurred at three sites on Macquarie Island, resulting in soil and groundwater contamination with petroleum hydrocarbons from Special Antarctic Blend, diesel and heavy lube oils.

The Risk and Remediation group at the Australian Antarctic Division aim to clean up ('remediate') these sites by 2014 using a number of low-risk, low-cost, on-site remediation techniques. These techniques harness the natural microbes in the soil to break down petroleum hydrocarbons into carbon dioxide and water.

Between 2003 and 2008 the location and extent of fuel contamination at the three sites were precisely defined using soil sampling test pits, piezometers (sampling tubes) and mini-piezometers. The test pits enabled soil to be taken for laboratory analysis of metals, nutrients and total petroleum hydrocarbons. Piezometers allowed sampling of groundwater (for hydrocarbon contamination) and oxygen levels at different depths throughout the soil profile.

Laboratory studies by the team have shown that maximum microbial activity, and therefore biodegradation of fuel contaminants in the soil, occurs with the addition of nitrogen to a concentration of 600–1200 mg of nitrogen per kilogram of soil water. The addition of 10% oxygen to Macquarie Island's relatively waterlogged soil also enhances hydrocarbon degradation.

In the 2008–09 Antarctic season the team began aerating and adding nutrients to contaminated soil at all sites – two areas around the Main Power House, and the eastern side of the Fuel Farm. The initial focus of the work is on the areas of highest hydrocarbon concentration (>4000 mg/kg soil), to reduce both the concentration of hydrocarbons and further movement through the soil.

The bioremediation process is being monitored and optimised where necessary, using oxygen sensors, piezometers and mini-piezometers (to sample water), through soil sampling, by measuring carbon dioxide and volatile organic compounds, and by examining changes in soil microbial communities and chemical processes in the soil.

As there are no locally derived national guidelines for the concentration of petroleum hydrocarbons at which management intervention should begin, the team has also been developing risk assessment guidelines and target hydrocarbon levels, for remediation. In most countries the presence of fuel or oil floating on surface water is a trigger for remediation. However, the Risk and Remediation team is using modelling to identify precautionary hydrocarbon target levels for different soil types found on Macquarie Island, which will prevent the occurrence of visible, free-floating hydrocarbon. An experiment has also been set up to examine the effect of hydrocarbons on native soil microbes and invertebrates, to identify toxicity thresholds for these organisms.

WENDY PYPER
Corporate Communications, AAD

Sites near the Fuel Farm and Main Power House on Macquarie Island are contaminated with petroleum hydrocarbons.

This mini-piezometer, with an oxygen sensor attached, is used to take water samples to measure groundwater chemistry.

What microbes eat oil?

Soil microbes are important in breaking down and recycling nutrients such as carbon, nitrogen, sulphur and phosphorous, and making these nutrients available to plants. As petroleum hydrocarbons can only be used as an energy source by certain microbial groups, fuel or oil contamination leads to a change in the composition of the microbial community – an increase in hydrocarbon degrading organisms such as *Rhodococcus*, *Sphingomonas* and *Pseudomonas* species.

It is likely that on Macquarie Island the microbes work together as a community to degrade hydrocarbons, in a process with many steps. Some use oxygen to do this and, when the oxygen is low, other species use nitrate or ammonia instead. Other microbes known as 'autotrophs', use the carbon dioxide produced by the hydrocarbon-degrading microbes as an energy source.

Similar types of microbes are found in ordinary garden soil, where they are involved in the process of decomposition. The ability to degrade petroleum hydrocarbons is surprisingly widespread in the environment and may be related to the fact that some plants and algae produce similar complex compounds.

SHANE POWELL
Environmental Protection and Change program, AAD

MONITORING HEARD

Research on sub-Antarctic Heard Island, 4000 km south-west of Western Australia, has shown that local climatic conditions are continuing to change.

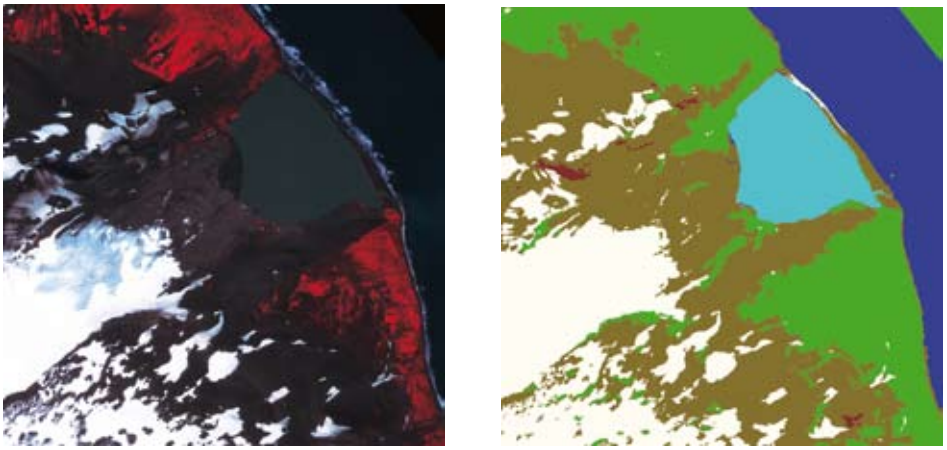


Figure 1: *This small portion of a 60 cm resolution QuickBird image of Brown Lagoon, acquired on 30 January 2006, was used for testing automated feature extraction. The image on the left is a false colour composite highlighting vegetated areas in red. The image on the right is the result of object-based image analysis, which aims to simulate human vision. The first step is to identify image objects that correspond to real-world features (snow patches, lagoon, vegetation patches, etc.). The objects are then classified into land cover classes, resulting in a thematic map with information that can be integrated with an existing GIS database. This automated analysis allows for more efficient feature extraction than manual digitisation techniques.*

These changes, in turn, are having an effect on the island's environment. Between 2000 and 2004, for example, Brown Glacier on the island's east coast lost 8 million cubic metres of ice a year, compared to the 50 year average of 3 million cubic metres a year (*Australian Antarctic Magazine* 7: 9, 2004). In some coastal areas that were previously ice-covered, there are now large areas of bare ground and lagoons.

The Australian Antarctic Division manages the World Heritage listed Territory of Heard Island and McDonald Islands (HIMI) and the HIMI Marine Reserve. Part of this role includes monitoring and reporting on changes to the environment and conservation values, and pursuing necessary management actions. However, the cost and logistical challenges of getting to Heard Island preclude regular on-site monitoring. These practical constraints are acknowledged in the *Heard Island and McDonald Islands Marine Reserve Management Plan*, which promotes the development of practical, cost-effective and low-impact remote monitoring techniques.

Accordingly, the Australian Antarctic Division has recently initiated a project to develop techniques to use satellite imagery to detect change in features on Heard Island. The project is led by the Antarctic Division's Policy Branch, which administers the HIMI Territory and Marine Reserve, and involves a team of scientific and technical experts from the Australian Antarctic Data Centre (AADC) and the University of Tasmania.

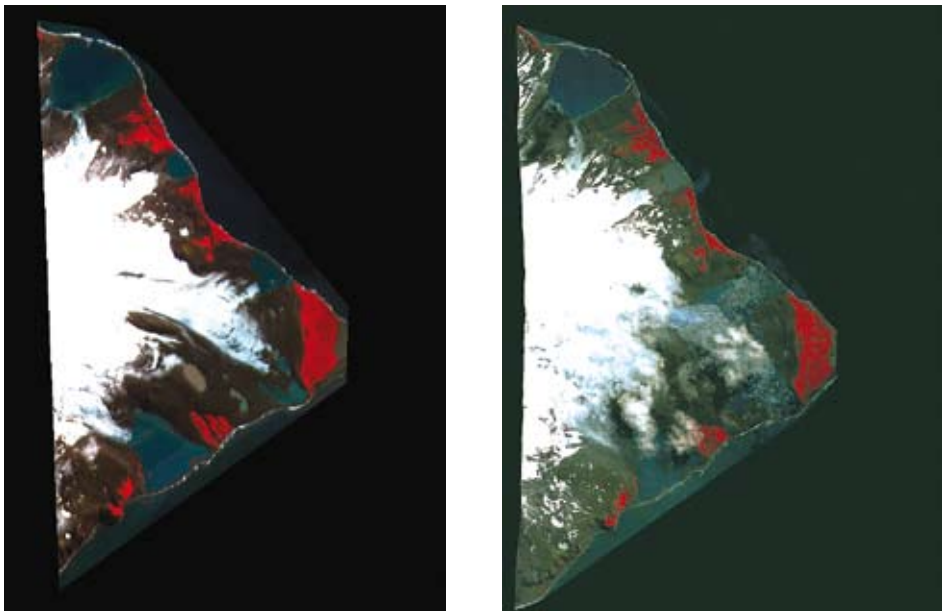


Figure 2: *Comparing the 1991 SPOT image at 20 m resolution (left), showing the Stephenson Glacier (white) and plant communities (red), with a 2006 QuickBird image (right) of the same region (resampled to the 20 m resolution of the SPOT image), enables change detection over 15 years. It is immediately apparent that the Stephenson Glacier has altered snow cover and a reduced extent. Some cloud cover is visible in the 2006 image.*

The project utilises high resolution satellite images, such as from the WorldView-1 and QuickBird earth imaging satellites. These satellites detect the near-infrared light wavelengths reflected by vegetation, allowing different land cover types, such as bare rock and plant communities, to be identified. The satellites have a resolution of 50 cm and 60 cm, respectively, and can collect all the required information in one pass of the island.

The satellite images must be corrected for spatial distortions arising from topographical variations (such as mountains and gullies) in the earth's surface and the tilt of the satellite as it passes over these features. This 'orthorectification' is done with the help of a digital elevation model showing the terrain in 3D, on-ground photos, and previously collected global positioning system (GPS) data (*Australian Antarctic Magazine* 7: 10–11, 2004).

Once corrected, important features such as the coastline, glacial extent, vegetation and lagoons are manually digitised in a geographic information system (GIS). The eventual aim is to automate this time-consuming process

ISLAND REMOTELY

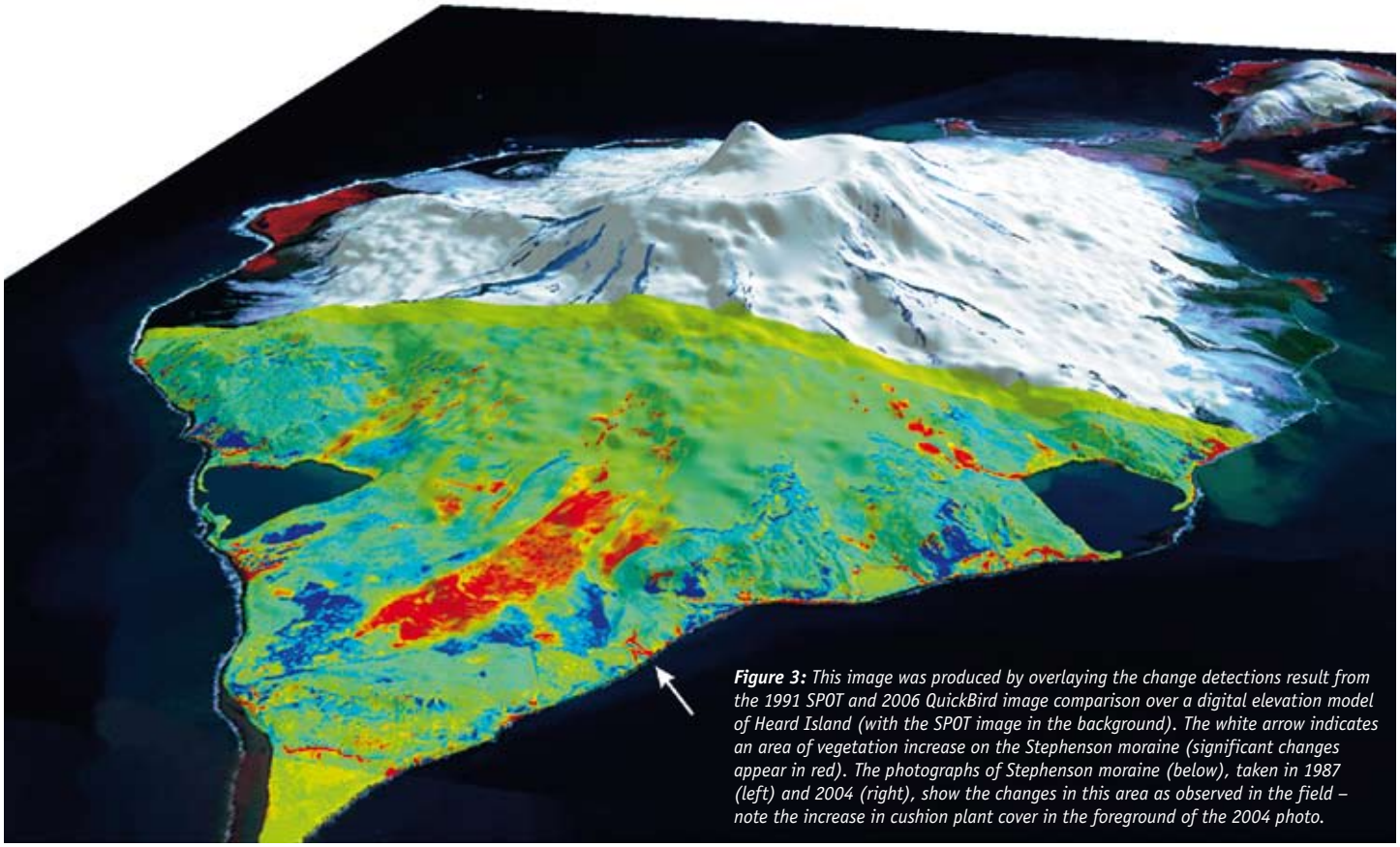


Figure 3: *This image was produced by overlaying the change detections result from the 1991 SPOT and 2006 QuickBird image comparison over a digital elevation model of Heard Island (with the SPOT image in the background). The white arrow indicates an area of vegetation increase on the Stephenson moraine (significant changes appear in red). The photographs of Stephenson moraine (below), taken in 1987 (left) and 2004 (right), show the changes in this area as observed in the field – note the increase in cushion plant cover in the foreground of the 2004 photo.*

using pattern-recognition software. Instead of analysing each individual pixel, as is common in traditional feature extraction methods, homogeneous (similar looking) objects would be derived from the image by image segmentation (Figure 1). Object characteristics such as spectral (light) properties, shape, size, texture and context can then be used to classify the object into a meaningful class and produce up-to-date maps. This so-called 'object-based image analysis' approach aims to simulate the way humans visually analyse imagery.

The project also involves the development of automated techniques to identify changes in the coastline, glacial extent, and vegetation cover. Change detection is based on a comparison of two or more images. Preliminary results show that there has been an increase in vegetation between 1991 and 2006 (Figures 2 and 3). Comparing QuickBird images from 2003 and 2006 revealed that detailed changes in vegetation communities can be automatically identified and mapped.

By completion of the year-long project the intention is to have used orthorectified images

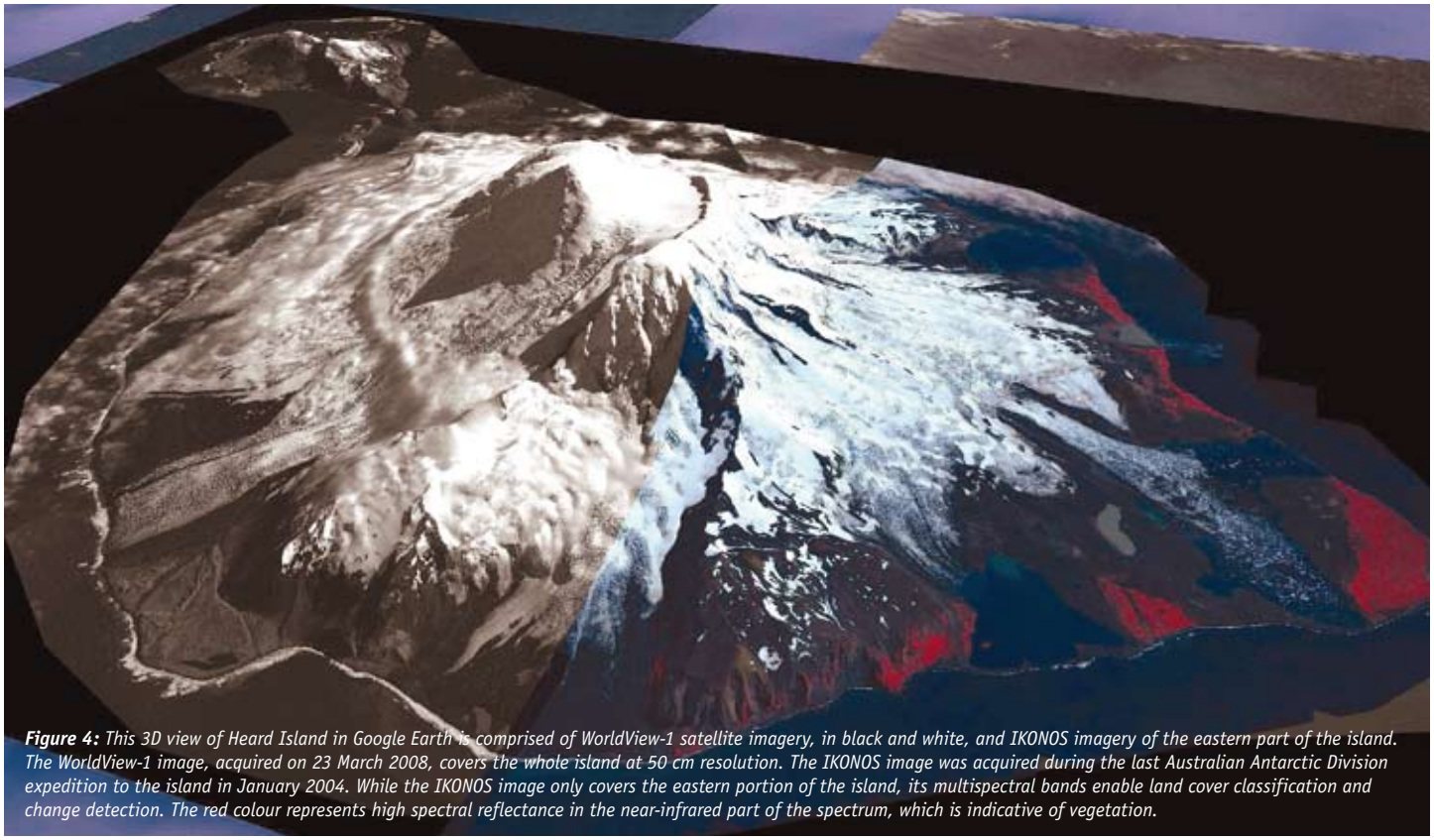


Figure 4: *This 3D view of Heard Island in Google Earth is comprised of WorldView-1 satellite imagery, in black and white, and IKONOS imagery of the eastern part of the island. The WorldView-1 image, acquired on 23 March 2008, covers the whole island at 50 cm resolution. The IKONOS image was acquired during the last Australian Antarctic Division expedition to the island in January 2004. While the IKONOS image only covers the eastern portion of the island, its multispectral bands enable land cover classification and change detection. The red colour represents high spectral reflectance in the near-infrared part of the spectrum, which is indicative of vegetation.*

from the Worldview-1 and QuickBird satellites to update topographic maps of the island, to map the coastline, human footprint, glacial extent and lagoons, and to map detectable changes in these features. Multimedia products – such as interactive tours and animations in Google Earth – are also being developed to publicly display the information and assist with the Antarctic Division's efforts to present Heard Island to the community (Figure 4). At the end of the project, image change detection and classification results will be published on the HIMI website (www.heardisland.aq) with downloadable Google Earth scenes and animations.

A major objective of the project is to further develop the capability of the AADC to assist with applying a similar approach to the remote monitoring of the Australian Antarctic Division's other areas of management and research interest.

EWAN MCIVOR[1], ARKO LUCIEER[2], URSULA HARRIS[3] and ANGELA BENDER[3]

1 Policy Branch, AAD
2 University of Tasmania
3 Australian Antarctic Data Centre, AAD

Big changes on a small island

Among the more recent changes observed on Heard Island was the creation of a new island from what was previously a narrow finger of land extending almost 10 km into the sea. The new two kilometre-long island, which was once part of Elephant Spit, could have formed for a variety of reasons, including sea level rise, strong ocean swells and/or winds resulting in coastal erosion. As the Spit has gone through cycles of erosion and re-creation in the past, the new island may not be a permanent feature, but its presence demonstrates the highly dynamic natural environment at Heard Island.

*The satellite image shows Elephant Spit in November 2002. (*Courtesy of the Image Science & Analysis Laboratory, NASA Johnson Space Centre.*)*

The Australian Antarctic Division visited the island briefly in December 2008 to complete some aerial, ship-based and terrestrial photographic surveys to detect environmental change; inspect some of Heard Island's heritage sites; check and maintain scientific equipment; and make sure refuge huts were still sound. Expeditioners aboard the *Aurora Australis* also collected further bathymetric data to improve charting in the region.

The information collected will provide important insights into the status of Heard Island's glaciers, lagoons, ice-free areas, vegetation and wildlife colonies, and will contribute to the Antarctic Division's responsibilities for monitoring and managing this unique and spectacular southern outpost through the remote monitoring project (main story).

The sea has, for the moment, claimed a large part of what was previously Elephant Spit, resulting in a new island to the east of Heard Island.

WILKINS ICE SHELF ON VERGE OF COLLAPSE

The Wilkins Ice Shelf, situated on the south-western flank of the Antarctic Peninsula (at about 70.25°S, 73.0°W) and named after the Australian aviator Sir Hubert Wilkins, is at risk of rapid collapse, after a thin ice bridge holding it back shattered.

The beginning of the demise of this 40 km-long feature, which connected Charcot and Latady islands, began in early April 2009, when satellite images revealed that new rifts forming along its centre axis resulted in a large block of ice breaking away.

Advanced Synthetic Aperture Radar (ASAR) images acquired on 2 April 2009 by the European Space Agency's Envisat satellite, showed that the rifts lengthened quickly along the ice bridge. Further ASAR images on 4 and 5 April showed that the bridge had broken up, adding about 330 km^2 of ice to the many pieces already in the embayment in front of the shelf (from previous calving events). As this article went to press, an image acquired on 18 May 2009 (bottom right) showed that the ice bridge had completely disappeared and that the existing fractures (rifts) along the northern front of the remaining section of the ice shelf were widening and new rifts were forming.

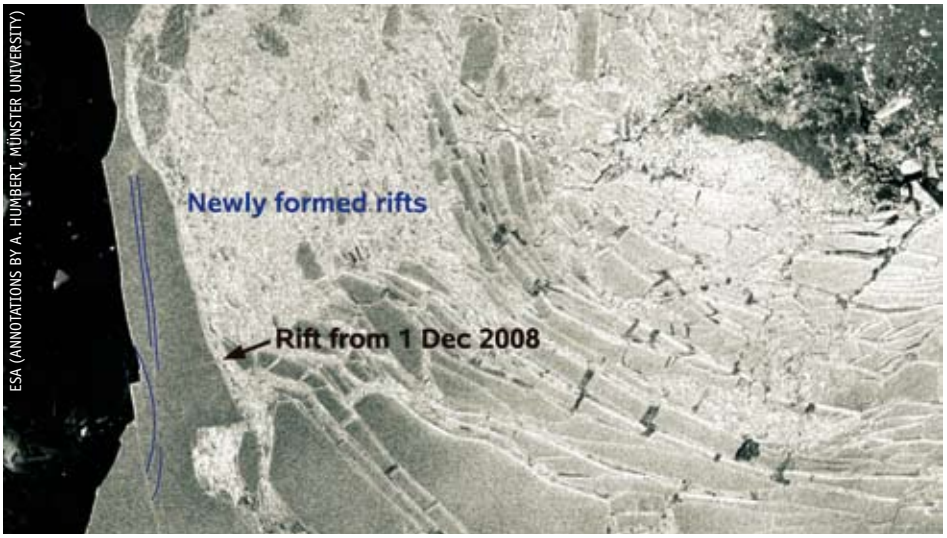
The Wilkins Ice Shelf has undergone significant changes since 2008, losing some 1800 km^2 of ice (about 14% of its size) up to the point where the ice bridge shattered, and after two significant calving events in February and May 2008 and further losses in June and July. These changes have been attributed to strong regional warming, and melting of the ice shelves from below. These events were reported in *Australian Antarctic Magazine* 14: 22–23, (2008).

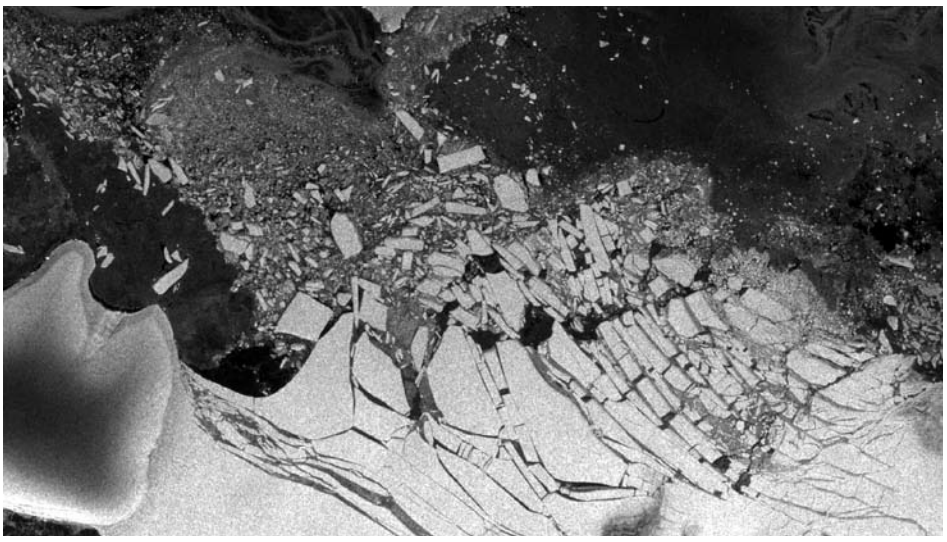
Scientists warn that the ice bridge break-up is the beginning of the next phase of the ice shelf disintegration, whereby thousands of square kilometres of ice that was, up until now, held behind the bridge, could now be released. Dr Ted Scambos of the US National Snow and Ice Data Center believes that such a collapse may not stop until at least half of the remaining ice shelf area is lost. Indeed, numerous icebergs have begun to calve from the northern front of the ice shelf, indicating that it is currently unstable.

This is the latest in a series of 'runaway disintegrations' of ice shelves along the Antarctic Peninsula, starting with the demise of Larsen A in 1995 and followed by the Larsen B in 2002. It is notable in that the Wilkins Ice Shelf is the most southerly and the largest Antarctic ice shelf to be affected to date.

See the latest images at: www.esa.int/esaEO/SEMRAVANJTF_index_0.html

ROB MASSOM[1,2], NEAL YOUNG[1,2] and WENDY PYPER[1]
AAD[1] and ACE CRC[2]





Envisat's Advanced Synthetic Aperture Radar captured the early stage of the disruption of the ice bridge that connects the Wilkins Ice Shelf to Charcot and Latady Islands on 2 April 2009 at 05:18 UTC (top). The new rifts that developed along the length axis of the ice bridge are visible. The first detachment (centre) along these new rifts occurred about seven hours later. As can be seen, the rift perpendicular to the length axis widened as the iceberg formed.

The bottom image, acquired on 18 May 2009, shows that the ice bridge has completely gone, and the fractures along the front of the remaining section of the ice shelf are opening up. Icebergs can be seen slowly migrating out of the area.

EVERY WHALE COUNTS FOR TEAM MINKE


JASON GEDAMKE

Aerial surveys of minke whales in pack ice could help determine whether the population is declining.

Antarctic minke whales (*Balaenoptera bonaerensis*) are one of the smallest species of baleen whales (which include blue and humpback whales) and the only baleen species that is still common in the seas around Antarctica.

Although they are the most abundant of the great whale species, research presented to the International Whaling Commission indicates an apparent decrease in their number over the last few decades. But whether this decrease is real, or merely the result of the survey method, remains a point of contention.

The data detailing Antarctic minke whale numbers and locations was collected over the last 20 years from non-ice-strengthened ships, which necessarily had to skirt the ice edge for safety. Even during summer, fragmented pack ice can extend many hundreds of kilometres out to sea, representing a vast area that these ships cannot access. One theory for the apparent decrease in Antarctic minke whales is that the animals have moved further into these ice zones, away from the view of research ships. This theory led to the idea that perhaps whales in pack ice could be counted from the air.

To develop this concept the Australian Antarctic Division, in collaboration with CSIRO, started an aerial survey program to study minke whales in various pack ice habitats in eastern Antarctica. The platform selected for the survey was a C212-400, a twin turboprop military transport aircraft, which can accommodate an observing team of four people and a flight leader (known informally as 'Team Minke'). High-definition video cameras, a high-resolution digital stills camera and an infrared camera were installed in the base of the aircraft, to detect whales underneath the aircraft, hidden from the view of the observers, and to collect data on pack ice habitat (*Australian Antarctic Magazine* 13: 8, 2007).

Like any activity involving aircraft, much preparation is needed for safe flying in Antarctica. The aerial survey team members have to be trained for underwater aircraft escape and field survival. They must also wear an immersion suit when flying, which aids survival in cold water (albeit the discomfort after wearing it for a few hours). Survey flights must also be planned around weather systems, which can ground aircraft for many weeks at a stretch. Negotiating the combination of aircraft and Antarctica is a challenge indeed!

The aerial survey programme has now been running for two summer seasons. The first survey in 2007–08, tested the concept of flying aerial surveys using C212 aircraft from an Australian Antarctic station. In 2008–09 a 'full' survey was flown over Vincennes Bay near Casey station (66° 17′ S, 110° 32′ E). This full survey was considered a great success, with nearly 500 whales counted in transects covering some 3000 nautical miles, during 40 hours of flying. In total, 76 Antarctic minke whales, 372 killer whales and 27 of unknown whale species were observed. Many whales were also detected with the various cameras, in some cases confirming ambiguous observer sightings – enough to build confidence in the future of such technologies to assist in marine mammal research.


TEAM MINKE

A killer whale captured by the digital still camera mounted under the aircraft.

The full survey is thought to represent the first ever fixed-wing aerial survey for whales in Antarctica (a team of German scientists have recently been surveying for minke whales using helicopters from a ship). Preliminary results from the survey will be presented to the International Whaling Commission meeting in Madeira in June 2009. Longer term, it is hoped that results from the aerial survey program in eastern Antarctica will be considered alongside those from the German helicopter surveys, to provide a better understanding of where Antarctic minke whales are congregating during the summer months and if, in fact, this can explain the decline in their numbers.

Planning is also underway for an extended aerial survey during the 2009–10 summer season, which will extend west from Casey station over to the Davis Sea.

NATALIE KELLY
Australian Marine Mammal Centre, CSIRO

JOSH SMITH

Team Minke and the C212-400 aircraft, which was fitted with a variety of imaging systems including digital and infrared video and a wide-angled, digital still camera, to capture whales hidden from the view of the team.

The Southern Ocean Research Partnership will focus on large whale species managed by the IWC including the humpback whale (pictured), and blue, fin, Antarctic minke, sei, southern right, sperm and killer whales.

Population dynamics of southern right whales

Numbers of southern right whales (*Eubalaena australis*) in the Southern Hemisphere were drastically reduced in the early part of the 19th century by unrestricted whaling – to the point where they were thought to be almost extinct.

But increased sightings from the early 1960s, together with reports of significant increases off South America and South Africa, resulted in a coastal research program, involving aerial surveys off southern Western Australia.

Aerial surveys have been conducted in the region every year since 1976 and were extended to include parts of the South Australian coast in 1993 and part of the west coast of Western Australia in 2000. The surveys aim to provide information on population increase and dynamics by assessing three whale classes: all animals, unaccompanied adults, and cow/calf pairs. The animals are counted and photographed and the photographs catalogued in a digital photographic database to enable identification of individual whales.

A 2007 survey run by Mr John Bannister of the Western Australian Museum, and supported by the Australian Marine Mammal Centre, continued off the coasts of Western Australia and South Australia (between Cape Leeuwin and Ceduna) in winter-spring. Three flights (involving different legs on different days) were undertaken between August and October to count the whales and take photos.

The total number of whales seen during the survey (286) was lower than any counts since 2003, largely as a result of the low number of cow/calf pairs recorded (57). By comparison, in 2005 and 2006, totals of 591 and 427 were recorded and 177 and 150 cow/calf pairs, respectively. However, more unaccompanied whales were observed (172) in 2007 – the second highest count since 2003.

Research suggests that oceanographic changes, such as higher sea surface temperatures in the years preceding the 2007 survey could have affected pregnancy rates of cows and thus the calving rate observed in 2007. If this is the case, Mr Bannister says the higher number of unaccompanied animals may reflect the presence of non-calving females. This theory is being tested through photographic matching.

A further survey flown in August 2008 gave much higher counts, contrasting markedly with the 2007 results. The total number recorded (702 animals including 236 cow/calf pairs) was higher than in any other year in the series.

Mr Bannister says that given the variability in counts from year to year, any major change in population size would take a long time to be detected statistically and at this stage an annual increase (from 1993–2008) of 6.2% is the best estimate of the population trend for southern right whales visiting the study region. This equates to a total current Australian population of about 2400 individuals.

WENDY PYPER
Corporate Communications, AAD

Whale research partnership

The first international workshop on non-lethal whale research in the Southern Ocean was held in Sydney in March. The workshop stemmed from Australia's proposal at the International Whaling Commission (IWC) meeting in 2008 to develop a Southern Ocean Research Partnership investigating non-lethal whale research. The Partnership aims to improve the delivery of priority science to the Commission and to be directly focused on positive conservation outcomes for whales. The 50 workshop participants included scientists from 12 countries (Australia, Argentina, Brazil, Chile, Costa Rica, France, Italy, Mexico, New Zealand, South Africa, Uruguay and USA) and several research and environment consortiums. During the workshop, participants agreed on the Partnership objectives, developed a research plan for assessment by the IWC Scientific Committee, and established a general procedural framework under which the Partnership might operate. The Partnership will be the largest non-lethal whale research program in the world. The Australian Marine Mammal Centre, based at the Australian Antarctic Division, will coordinate the overall work of the Partnership and manage the reporting responsibilities. More information: www.marinemammals.gov.au/

SUB-ANTARCTIC PENGUINS INFE

Scientists have discovered that ticks associated with penguins on Macquarie Island contain four new viruses, whose closest relatives are found in the Northern Hemisphere.

The four 'arboviruses' – viruses transmitted by arthropods (which include insects and ticks) – were identified in the globally distributed seabird tick *Ixodes uriae*, infesting colonies of King, royal and rockhopper penguins on the sub-Antarctic island.

While the viruses belong to groups that include the West Nile virus, Bluetongue and the unpleasant sounding Rift Valley fever and Crimean-Congo hemorrhagic fever viruses, project leader Professor Andreas Suhrbier, of the Queensland Institute of Medical Research, says the penguin viruses are 'fairly distantly related' to anything that harms humans or livestock, and unlikely to pose an imminent health threat.

This is good news for the increasing numbers of tourists visiting Antarctica whose immune systems may be compromised because of age, illness or immunosuppressive drugs for cancer or organ transplant. Such individuals are often more susceptible to infection by unusual agents.

'Even though these are seabird viruses, immunosuppressed people might become infected if they were bitten by a tick,' Professor Suhrbier says.

'However, *Ixodes uriae* usually prefers to feed on birds, rather than humans, so the chances of being bitten are low.'

The viruses do not appear to pose a threat to the penguin populations either, as penguin numbers continue to recover following an end to their rendering for oil in 1933.

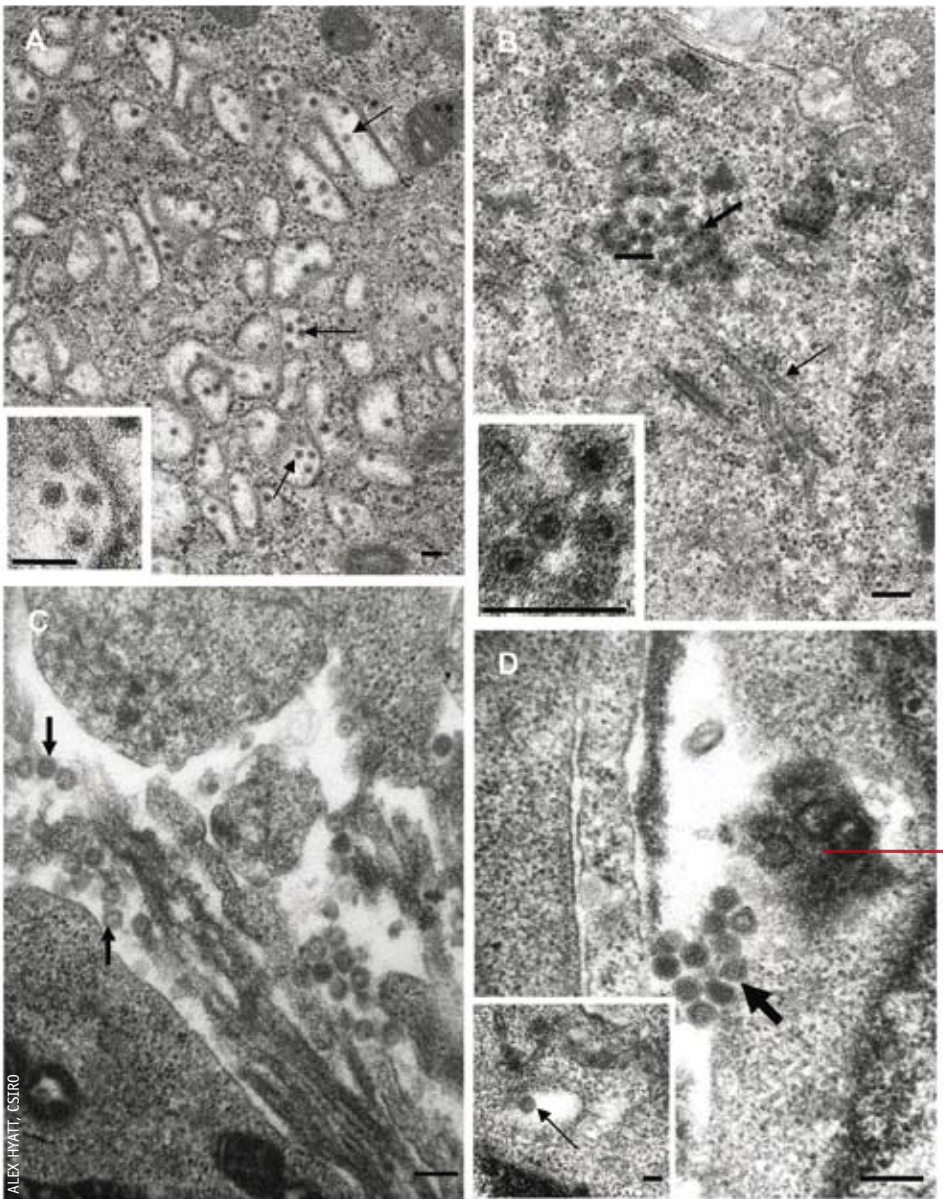
Interestingly, the viruses were closely related to viruses found on the other side of the world. One virus isolated from ticks in a rockhopper colony at Catch Me Cave, on the northern tip of the island, was closely related to the seemingly harmless Uukuniemi virus, which infects cattle and some seabirds in Finland. Another virus associated with King penguins at Sandy Bay was related to Broadhaven virus, which infects seabirds in Scotland.

'This research appears to demonstrate that large geographical distances do have an important role in the evolution of these viruses,' Professor Suhrbier says.

One likely explanation for this long distance relationship is that the ticks harbouring these viruses are carried by migratory seabirds, such as sooty terns and Arctic shearwaters. These birds visit Macquarie Island each year and travel to every continent during their annual migration. The ticks and their viruses could thus find their way to most seabird populations in the world.

'One might also speculate that if the migration patterns of these seabirds change, as a result of climate change, these viruses might come into contact with new bird or animal populations, with some potential to cause problems,' Professor Suhrbier says.

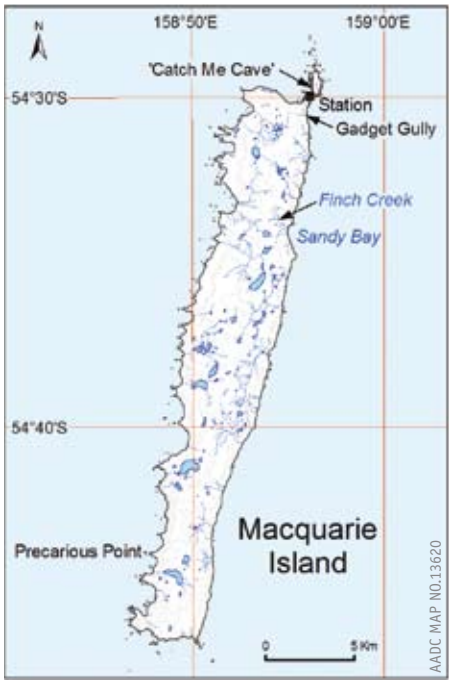
The research team isolated the viruses from ticks collected under rocks in the 'very large, smelly and wet bogs' surrounding the King, royal and rockhopper penguin colonies. Gentoo penguin



ALEX HYATT, CSIRO

Transmission electron microscopy reveals the flavivirus (A) isolated from ticks in a King penguin colony, inside the cytoplasmic vesicles of infected cells. The 'enveloped' virus (an outer membrane surrounds the genome) is about 45 nm in diameter. (B) shows a non-enveloped orbi- or colti-virus from King penguin-associated ticks, about 65 nm in diameter, in the cell cytoplasm. (C) was identified as a phlebovirus (in the family Bunyaviridae*) from a rockhopper colony. These enveloped viruses are spherical, 80–100 nm in diameter and occur outside cells. The nairovirus, also from the* Bunyaviridae *family (D), was found in the royal penguin colony. Scale bars are 200 nm.*

CTED WITH TICK-BORNE VIRUSES



The areas where the ticks were collected.

Rockhopper penguins at Catch Me Cave carried a tick-borne phlebovirus.

colonies were also searched but no ticks were found associated with them.

'Gentoos move their colony every year by up to 100 m, which probably limits tick infestation, as the ticks drop off when the birds go out to sea, and as young penguins mature,' he says.

Viruses were extracted from the macerated ticks back in the laboratory and identified by transmission electron microscopy and genome sequencing. Viruses belonging to four of the seven genera of viruses containing arboviruses – flavivirus, orbivirus, phlebovirus and nairovirus – were subsequently identified.

While similar viruses were isolated from *Ixodes uriae* on Macquarie Island some 30 years ago, no sequence data is available for them. As a result, the four arboviruses isolated by Professor Suhrbier and his team were considered to be new to science and have been named after the places where the ticks were collected – Sandy Bay, Catch Me Cave and Finch Creek (the fourth was almost identical to Gadgets Gully virus, isolated by others).

As a next step in his research Professor Suhrbier is keen to obtain frozen serum samples from Antarctic and sub-Antarctic cruise passengers who develop unexplained fevers, likely to be of viral origin, after visiting seabird colonies and being bitten by a tick.

This research was funded by the Australian Antarctic Division.

WENDY PYPER
Corporate Communications, AAD

Two arboviruses were isolated from ticks associated with king penguins.

The Finch Creek virus was isolated from ticks associated with royal penguins.

SUB-ANTARCTIC IN THE SPOTLIGHT

The Second International Forum on the sub-Antarctic, held in Hobart in April, focused on changes in the sub-Antarctic during the recent past (1800–1950), and changes in both science and environmental consciousness since 1950.

Several themes recurred during discussions amongst the 60 participants. Ocean acidification and its effects on both the marine food chain and the ocean's ability to absorb atmospheric carbon dioxide, and the increasing likelihood of exotic species invading the region's land masses, were seen as particularly unwelcome developments, likely to become more troublesome in the future. Discussions also included 'fertilisation' of the ocean with iron as a possible way to enhance phytoplankton growth, and ways in which terrestrial ecosystems can be managed to mitigate the effects of external change.

Research into the physical structure of sub-Antarctic waters, using small oceanographic sensing transmitters attached to the heads of seals, is revealing much about the complexity of the three-dimensional Southern Ocean and how it is exploited by elephant seals. Reanalysis of climate datasets from Macquarie Island, and elsewhere in the sub-Antarctic zone, reveals a complex pattern of increasing drying around Marion Island and increasing precipitation at Macquarie Island. Such changes are likely to intensify as the strength of westerly winds increase and as the northern limit of the Antarctic Circumpolar Current moves pole-wards. These major events will likely induce shifts in the parts of the ocean where various species of plankton are to be found, with concomitant changes in the feeding patterns of top predators.

The Second International Forum on the sub-Antarctic attracted participants from six countries, with expertise in science, management and policy.

The Royal Society of Tasmania will publish the proceedings of the Forum. A Third International Forum on the sub-Antarctic is expected to be held in Hobart in 2011. For more information see www.sub-antarctic.org/index.html.

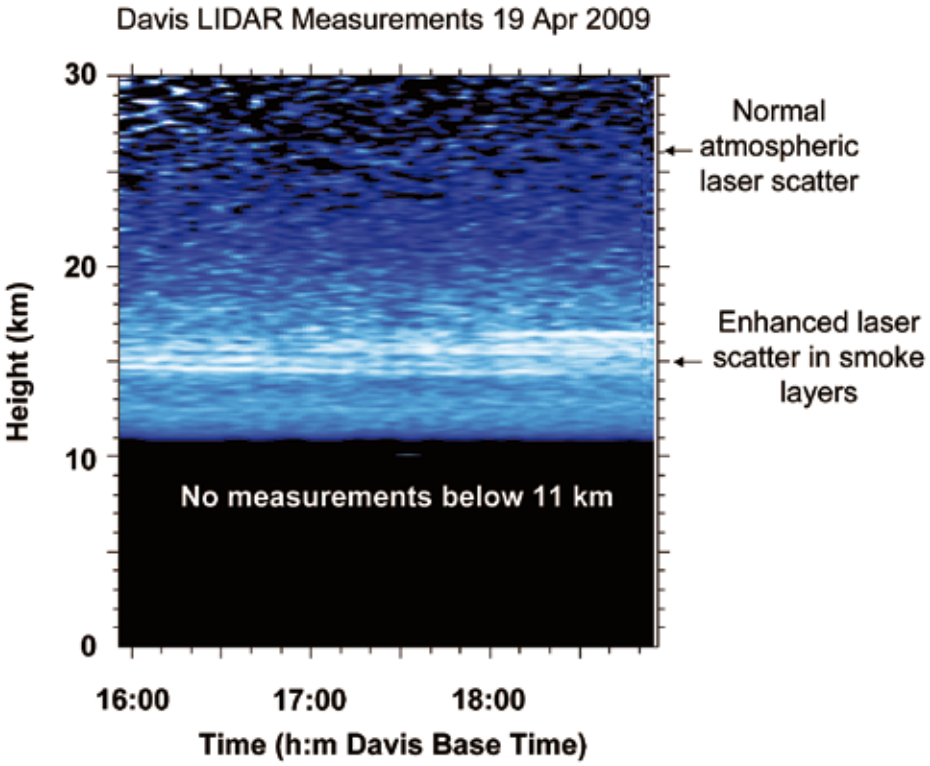
MICHAEL STODDART
Sub-Antarctic Forum Steering Committee

Bushfire smoke visible in Antarctica

The devastating bushfires that swept through parts of Victoria in February have produced unprecedented effects on the atmosphere of the Southern Hemisphere.

Satellite measurements show smoke from the fires penetrated into the stratosphere and dispersed over a wide geographical area. This phenomenon was captured by NASA's CALIPSO (Cloud-Aerosol LIDAR and Infrared Pathfinder Satellite Observation). Since late February, the Australian Antarctic Division's atmospheric LIDAR instrument at Davis has detected the smoke at altitudes of 14–20 km. The smoke layer has also been detected by LIDAR instruments in Brazil and at Dumont d'Urville in Antarctica.

Together with collaborators at the US Naval Research Laboratory and other LIDAR sites, the Antarctic Division is gathering data on the smoke layer to understand its dispersal and climate effects. The smoke particles act as nucleation sites, promoting the growth of sulphuric acid droplets. These droplets are likely to have a small effect on the climate at high altitudes by warming or cooling the atmosphere (which depends on the size of the droplets), and by producing chemical reactions that will ultimately result in loss of stratospheric ozone.



This image was produced from LIDAR measurements collected in April and shows thin layers in the lower stratosphere that were illuminated by the LIDAR's green laser beam.

ANDREW KLEKOCIUK
Ice, Ocean, Atmosphere and Climate program, AAD

A VIEW FROM WOMBAT

I am unsure how many temporary art studios I have set up over the past 25 years but it must be well over 100 scattered across 50 countries.

Stephen in his studio with some works in progress.

I recall a tent in Greenland, a bus in the Sahara Desert, a cabin on a nuclear icebreaker at the North Pole, formal artist residencies in Paris, Melbourne, Sydney and Taipei, and a BBQ room in Argentina. There was a five-star hotel in Beijing, a no-star hotel in Burkina Fasso, a squat in Amsterdam, apartments in Hong Kong, Yangon and Phnom Penh, a shed in Broome, a shack in Tonga and a donga by the heli-pad at Davis station over the summer of 2002–03 – where I worked as the Australian Antarctic Arts Fellow. Now I am back in Antarctica, again as the Arts Fellow, but this time to winter-over.

If you remove the primary and serious scientific data collecting element from Antarctic pursuits, then wintering on an Antarctic station could be seen as some form of chilly Big Brother experiment (thankfully without the youthful wannabes and live broadcasts of high-spirited antics). But Antarctica is a long way from TV Land and certainly a lot more real than reality TV.

Mawson station seems like home now after two months of living here. A very strange form of home, but it is comfortable, friendly, safe and stunning. The 15 capable expeditioners I share the station with are all busy keeping things in order and preparing for the coming winter months. As the Arts Fellow it is my job to make art on station and that's how I spend eight hours each day. The studio I have set up is in a science building called Wombat and out the window is a superb view of Horseshoe Harbour and West Arm. Some days there is a large view of zero; lashings of nothing. But even then (or perhaps especially then) I am stimulated by the intensity of where I am, as is everyone here on station.

I believe the last Australian artist to winter on this continent was Mr Frank Hurley, in 1915, whose photographic works from that expedition are now stamped securely into the heroic era of Antarctic culture. Iconic images of human '*Endurance*'. I am in another century but equally awestruck by this 'Home of the Blizzard'.

It is a huge undertaking to plant anyone here for an extended period of time, as anyone who has had dealings with Antarctica will know. From my perspective it is a huge task to visually turn this fuzzy space into a place. I am not here to simply represent and copy what the millions of photographic images of Antarctica do so well. I want to frame the beauty and chaos in another way. I currently collect, juggle, meld and ponder in order to interpret what I glean from this outlandish land of ice into art. It is a tricky job indeed.

This inhuman terrain strangely has the ability to seduce many folk that make it here. Environmental psychologists may reason that Antarctica causes a 'diminutive effect' on us; meaning that we are belittled but invigorated by the sublime scale of all that white stuff outside. Others might say it is just 'bloody amazing'.

Antarctica is basically formed by a lack of warmth and a lack of humans. This is what made my desire to winter-over necessary in order for me to get a handle on this southern realm of our planet.

My plan for the year in Wombat is to paint, sew, draw, write, photograph and film my way through superlatives and the mixture of experiences, both dark and light, that I shall encounter at Mawson station. It's 'all good' as they say, and if my ideas don't get blasted away in the katabatic winds, I will return to Australia late this year to commence exhibiting a great deal of Antarctic visual culture in galleries across Australia and overseas.

To see some of Stephen's artwork visit www.stepheneastaugh.com.au

STEPHEN EASTAUGH
Australian Antarctic Arts Fellow, 2009

Some days there is a large view of 'lashings of nothing' from Wombat studio – what artist wouldn't find this inspiring?

PHYSICIST MARKS A 40 YEAR

Vin with a husky pup during his first visit to Wilkes in 1968.

VIN MORGAN

One of our longer-serving scientists, recently retired glaciologist, Vin Morgan, celebrated 40 years with the Australian Antarctic Division late last year. This is his story.

My association with the Australian Antarctic Division began in 1967 when I was finishing my physics degree, and the need to get some sort of job was looming. A job at the Antarctic Division that involved experimental work in physics, in an interesting place, looked a lot more fun than sitting in an office. I duly applied and after a chat with Science Director, Phil Sulzberger, mainly about where the program was going, I was signed up.

In 1967 the Antarctic Division was crammed into an office block in St Kilda Road, Melbourne. The expeditioner physicists all worked in one long room. There were two generations; returned expeditioners who had wintered at Wilkes the previous year, and new expeditioners who were to winter the following year. Although the chatter probably didn't do much for scientific output it was extremely useful for the new expeditioners. After eight months I felt I knew a lot about Wilkes station and living in Antarctica.

Telex messages from the 1967 winterers indicated that the upper atmosphere physics equipment wasn't running very well. So the electronics engineer, Bruce Morton, and I, organised and constructed equipment to replace most of it, and tested it at the Division's field station at Eltham, near Melbourne.

I sailed from Melbourne on *Thala Dan* and we arrived at Wilkes on January 22, 1968. In those days, changeover was a frenetic time during which the new expeditioners had to unload all the stores and equipment and learn how to run the station in just a few days. But in 1968 changeover was extended to allow some new buildings to be assembled at 'Repstat' – the replacement station for Wilkes, which became Casey in 1969 (*Australian Antarctic Magazine* 15: 24–26, 2008).

During changeover Bruce and I moved all the old equipment out of 'Cosray', as the upper atmosphere physics and cosmic rays hut was called, and installed our new gear. It worked well and a reasonable amount of data was collected during the year.

Apart from the physics work I did a couple of (short) dog trips and a vehicle trip in to near 'S2' on Law Dome. I did printing and editing for the 'newsletter' *Drift 68*. I was also 'court marshaled' for being the 'phantom poet' – which was pretty funny because I actually wasn't the phantom poet (although I did like his work).

In 1969 Bill Budd, head of glaciology at the Antarctic Division, wanted a physicist to set up a system to carry out oxygen isotope analysis, to investigate the Amery Ice Shelf ice core that was drilled in 1968. I was in the right place at the right time, and I moved from upper atmospheric physics to the glaciology program, where I've remained ever since.

I spent my first year as a glaciologist at CSIRO Chemical Physics, rebuilding a mass-spectrometer for the isotope analysis. It was actually the first mass-spectrometer in Australia and amongst the rather quaint (even for 1970) circuit diagrams and drawings were letters from the Australian and US governments negotiating security arrangements for the importation of the machine. Mass spectrometers separate isotopes and just after the Second World War these types of machines were proposed for producing enriched uranium.

Once I got it working again we got some nice results that showed ocean water was freezing onto the base of the Amery Ice Shelf. Initially, the isotope measurements on the Amery and Law Dome cores were used as tracers of ice flow, to provide data for the computer modeling of the ice sheet being conducted at the University of Melbourne.

Around 1970 a series of landmark papers showed how ice core isotope ratio data could be used as a proxy for climatic temperature. So I started interpreting the core profiles as climate records. In 1970, ice core climate records were a

CAREER IN GLACIOLOGY

pleasantly obscure line of research. Now, climate change is a hot topic of conversation, and ice core records have appeared in popular films and on ABC TV. Today the glaciology section has an ice core/climate history group, who are still measuring isotopes in ice cores. In 2007 they purchased their third mass spectrometer.

The biggest challenge of my career was the deep ice core drilled at 'DSS' near Law Dome Summit between 1989 and 1993. Law Dome is a small ice sheet attached to the edge of the main East Antarctic ice sheet, and with an independent ice flow. It exists because its bedrock is an island separated from the bedrock of East Antarctica by a deep trench. Law Dome is the backyard of Wilkes and Casey stations so its glaciology has been studied since the International Geophysical Year in 1958.

Previous ice drilling on Law Dome had reached depths of about 400 m, but in the late 1980s we decided to try to drill a full depth, 1200 m core at the summit, to get a long, high resolution coastal climate record. I was the principal investigator for the project, which involved a lot of logistics and new technology that seemed to require a huge amount of organisation. In the end, however, with a lot of support from the Antarctic Division's instrument workshop (for the drill) and engineering group (for field and station logistics), the base of the ice sheet was reached after several summer seasons' work, in February 1993. The core produced a climate record extending back 90 000 years and the glaciology team is still analysing it.

I have observed some significant changes during my time in Antarctica, including enormous improvements in communications. In 1968 there were no phones and no internet; just telex messages, HF radio telephone (which was usually unintelligible) and a bit of amateur radio. The stations were more isolated; if there was a solar proton event it could black out HF radio and there would be no communications with anyone for several days.

BARBARA FRANKEL

Vin monitors an ice core drill at Law Dome in 2004.

MARK CURRAN

Vin returned to Wilkes in 2008 – 40 years after he first set foot on the station.

Women did not even visit the stations until 1959 and it was not until 1976 that Dr Zoe Gardner wintered at Macquarie Island. The rationale was that the fragile little things wouldn't be able to cope with the tough conditions. This is patently nonsense and today women work side by side with men on stations and in field camps. Women were perhaps not helped by the statement of one of the first two women to winter (Jeannie Darlington of the Ronne expedition) who wrote: 'Taking everything into consideration, I do not think women belong in Antarctica'.

Another major change is the attitude to the continent itself. In the 60s we thought the continent could look after itself and that making a mess didn't matter. Rubbish from the stations was dumped; either around the stations or sometimes, as a gesture towards disposal, on the sea ice, where it disappeared into the ocean as the sea ice melted or was blown out to sea.

Although I retired in November 2007 I am still doing a bit of work with the ice core group and I did some drilling at Law Dome over the 2008–09 summer. We had originally planned to do some ice coring at Aurora Basin, some 600 km south of Casey, but the trip was thwarted by an unusually windy winter, which resulted in sastrugi criss-crossed in two directions across the surface of the study site, preventing landing by the C212 aircraft.

During the trip I got to visit Wilkes once more. Although most of the Wilkes buildings are filled with ice, the old powerhouse is clear and has been set up with a stove and bunks. It's known as the Wilkes Hilton – a home away from Casey. So I spent the night of December 3, 2008 at Wilkes; nearly 41 years since I was first there!

VITAMIN D DEFICIENCY EXPERIENCED IN ANTARCTICA

A study of 120 healthy adults, spending one year in Antarctica, found that most (85%) were deficient in vitamin D six months into their stay, due to sunlight deprivation.


FREDERIQUE OLIVIER

Reduced exposure to sunlight in winter in Antarctica often leads to Vitamin D deficiency in expeditioners.

The research follows a pilot study reported in *Australian Antarctic Magazine* 8: 29 (2005), and was conducted by Dr Sandra Iuliano-Burns and colleagues from the University of Melbourne, Dr Jeff Ayton of the Australian Antarctic Division, and Professor Graeme Jones of the Menzies Institute.

Vitamin D deficiency is common during winter in many countries, due to a lack of sun exposure. Without vitamin D the body cannot absorb as much calcium, so it turns to the supplies of calcium in the bone, resulting in bone loss. One of the key questions the study hoped to answer was whether this bone loss was transient or irreversible.

The study found an increase in bone turnover (the extraction and replacement of calcium in the bone, by the body) about six months after vitamin D deficiency was observed. Bone mass density was found to be reduced in the 'proximal femur' (thigh bone, near the hip), but not in the lumbar spine (lower back). Individuals with bone loss, however, had lower dietary calcium intakes, suggesting that supplementation of these individuals may be beneficial in suppressing bone turnover.

As the bone loss experienced in the study group was small (1 ± 2%) and of uncertain biological significance, and follow-up bone density data was unavailable, the permanency of bone loss could not be confirmed by the study. However, continued research during future Antarctic expeditions may resolve this. The study concluded that baseline vitamin D levels in expeditioners should be assessed prior to prolonged sunlight deprivation, and supplementation may be necessary for those with reduced levels.

More information: Iuliano-Burns S, Wang X. F, Ayton J, Jones G and Seeman E. Skeletal and hormonal responses to sunlight deprivation in Antarctic expeditioners *Osteoporosis International* Published online: 17 January 2009. www.springerlink.com/content/xj31773m34514627/fulltext.pdf

Expedition and Wilderness Medicine

As people travel more often to remote and dangerous locations around the world, the number of injuries and illnesses associated with these expeditions has increased.

So has the need for medical personnel trained specifically to handle the health risks that are faced far from professional care and resources. With this in mind, three health care professionals have edited a comprehensive, 749-page book, *Expedition and Wilderness Medicine*. Australian Antarctic Division Chief Medical Officer, Dr Jeff Ayton, and former Antarctic Division Chief Medical Officer and Chief of NASA's Medicine of Extreme Environments program, Dr Des Lugg, have contributed a chapter on polar medicine.

Drs Ayton and Lugg point out that many people travelling on polar expeditions are more likely to develop signs and symptoms of diseases contracted in temperate or tropical climates before the journey. There are, however, a range of polar medical problems, including dehydration, cold injury – such as frostbite and polar hands – sunburn, and snow blindness caused by UV burns to the eyes.


PAUL PETERSON

An Australian Antarctic expeditioner with a severe ankle fracture after a slip on ice.

The chapter includes a review of illnesses, injuries and medical procedures over 17 years of the Australian Antarctic program (1989–2005) and the factors to consider when planning expedition health care. These include field activities and medevac capabilities; facilities, equipment and supplies required; selection and training of medical staff; telemedicine; and medical research.

Expedition and Wilderness Medicine is available from Cambridge University Press www.cambridge.org

IN BRIEF

Budget 2009

Australia's leadership in Antarctic science and research has been reinforced with the commitment of an extra $25.2 million over two years for the Australian Antarctic Division, and funding of $11.7 million in 2009–10 to continue the airlink program.

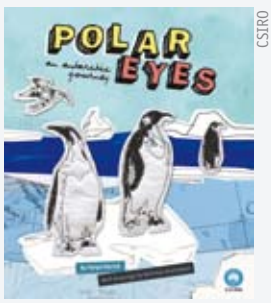
The $36.9 million in funding, announced in May, will underpin our commitment to scientific research, the maintenance of infrastructure at Australia's three Antarctic stations, Macquarie Island and the Wilkins aerodrome, and continue the government's commitment to the airlink program.

Parliament House Exhibition

ALISON LESTER

Antarctic Art: an exhibition by children, for children, featured at Parliament House in May and June. The exhibition showcased work done by the children from the University of Melbourne's Early Learning Centre, and a number of Australian Antarctic Arts Fellows who produced work for, or with, children. During the International Polar Year (IPY), the children of the Early Learning Centre studied Antarctica with the help of Casey Station Leader, Bob Jones. Their project, *Antarctica – an icy land of secrets*, received a Regione Lazio Award for its contribution to the IPY.

Polar Eyes: a journey to Antarctica



CSIRO

Two Australian Antarctic Arts Fellows have combined their writing and illustration skills to produce an informative children's book on all things Antarctic. Science writer, Tanya Patrick, of CSIRO Education, and artist Nicholas Hutcheson, visited Antarctica in 2007 and 2008 respectively. While Tanya kept a diary of interviews, observations, photographs and answers to nearly 2000 questions from children across Australia, Nicholas filled his sketchbooks with drawings of penguins, people, icebergs, and much more. Their collaborative 76-page book *Polar Eyes* covers such diverse topics as wildlife, latitude and longitude, icebergs, tying knots, geophysics and food. It provides lots of hands-on learning activities, including building an igloo, rescuing someone from a whiteout, studying animal behaviour, and building a table-top biosphere. A range of interviews with Antarctic scientists are also included, as are answers to questions posed by CSIRO's young *Scientriffic* magazine readers. *Polar Eyes* is available from www.csiroshop.com for $24.95.

Ross Sea Party photographs online

"Just about the wildest looking gang of men that I have ever seen in my life. Smoke-bleared eyes looked out from grey haggard faces; their hair was matted and uncut; their beards were impregnated with soot and grease." John King Davis.

This is how the seven survivors of the Ross Sea Party appeared to Davis, commander of the ship that rescued them in 1917. The men had spent more than two years marooned in Antarctica, laying supply deposits for Ernest Shackleton's Imperial Trans-Antarctic Expedition of 1914; an expedition that would never arrive.

The party's epic sledging journeys encompassed 169 days. One member of the party, the Victorian (Andrew) Keith Jack, kept a detailed diary and took many striking photographs, which are housed at the State Library of Victoria.

The Ross Sea Party account, the Diaries of Keith Jack, and Ross Sea Party photographs, can now be viewed in the Victorian Stories section of the Culture Victoria website (www.cv.vic.gov.au/). The website tells the stories of people who have lived and worked in Victoria, and the events that have shaped the lives of Victorians and Australians. It was created through the Victorian Cultural Network – a collaborative project between the Australian Centre for Moving Image, Museum Victoria, National Gallery of Victoria, State Library of Victoria, and The Arts Centre.

Andrew McConville (State Library of Victoria) and Eleanor Whitworth (Arts Victoria).

The rescued party.

STATE LIBRARY OF VICTORIA

Southern Ocean Sentinel workshop

A system for measuring climate change impacts in the Southern Ocean was the subject of an international scientific workshop convened in Hobart in April. The participants summarised the state of knowledge on observed and potential climate change impacts on Southern Ocean marine biodiversity, and considered the scientific and technological research required to establish a Southern Ocean Sentinel monitoring program that would signal the magnitudes and rates of change in Southern Ocean marine ecosystems, caused by climate change. They concluded that an international program to develop a system for predicting future impacts, including associated field monitoring, was feasible, and would contribute to established international climate programs. Collaborative links between Australian and international scientists and scientific programs are now being pursued to establish a Southern Ocean Sentinel.

First expedition medicine course for Australia

The first expedition medicine course for Australia has been developed by General Practice Training Tasmania in consultation with the Australian Antarctic Division's Polar Medicine Unit.

The Special Skills Post in Expedition Medicine aims to provide General Practice registrars with a comprehensive grounding in expedition medicine through a six month course involving travel medicine, general practice, emergency medicine, a self-guided workbook and an eight day field trip.

Course participants will have access to the Polar Medicine Unit staff and resources. The course is available as an optional part of general practice training in Tasmania – details at www.gptt.com.au/. General Practice Training Tasmania and the Polar Medicine Unit are now exploring options for a certificate/diploma/masters program.

MIKE WOOLRIDGE

Field skills are an important part of a doctor's repertoire in Antarctica.

Australia Day Awards

MAT OAKES

This year's Australia Day Award was presented to the Australian Antarctic Division's Crisis Management and Recovery Team and the Davis Station Team in recognition of the extraordinary individual and collective efforts of people across the whole of the Antarctic Division, who were involved in the successful care and evacuation of an injured expeditioner from Davis station in October/November last year. The Division's Chief Medical Officer, Dr Jeff Ayton (pictured), accepted the award on behalf of those involved.

Prince Albert II visits Davis

His Serene Highness Prince Albert II of Monaco visited Davis station in January as part of a month-long expedition to learn about the impact of climate change in Antarctica.

PAUL ENDERSBY

Prince Albert (left) and Davis Station Leader, Bill de Bruyn.

Prince Albert's trip took in 26 scientific hot spots around the continent and followed a similar trip to the North Pole in 2006. Last May, Monaco became the 47th state signatory to the Antarctic Treaty, which regulates human activities on the continent.

During his time at Davis the Prince was treated to a science and station tour, visited nearby rookeries and icebergs and spent an evening mixing with expeditioners and playing pool. More information about Prince Albert's 'South Pole Expedition' is at www.fpa2.mc/default.asp?lang=en

Kids Antarctic Art exhibition

NUMEROUS CHILDREN WITH ALISON LESTER

Australian Antarctic Arts Fellow, Alison Lester, whose artwork has appeared in various issues of this magazine, has been on the exhibition trail with *Kids Antarctic Art*. Since the exhibition was opened in Hobart in 2007, it has had three showings in Melbourne, one in Brisbane and is scheduled for exhibition in Port Macquarie and Tokyo in 2009. You can view the exhibition online at www.alisonlester.citymax.com/page/page/4809677.htm

Whale tags track bigger picture

NICK GALES

Scientists at the Australian Antarctic Division have tracked the path of humpback whales, from the Australian coast to their feeding grounds near the Antarctic continent, for the first time.

Sixteen whales were satellite tagged near Eden in New South Wales last October, and their route tracked for almost six months over a distance of some 4000 km. The results showed that whales from Australia's east coast disperse more widely than previously thought, and outside the area traditionally identified for this population by the International Whaling Commission.

The study, led by the Australian Marine Mammal Centre Director, Dr Nick Gales, suggests the whales spend more time feeding in temperate waters than previously thought. These areas include east of Flinders Island, off northeast Tasmania, and west of Fiordland, New Zealand.

'This is the first study to show migration through Bass Strait and down Tasmania's west coast,' Dr Gales said.

'These tags will provide important information on the feeding distribution and behaviour of humpback whales in Antarctica and the relationship between their food source – krill – and retracting sea ice during the summer melt.'

To view an animation of the whales' tracks go to www.aad.gov.au/default.asp?casid=36415

This image captures an event that occurs quite rarely at Casey – a sustained period of snowfall with no wind over the previous afternoon and night. As I knew the situation would not last long, I took the photo as soon as there was enough daylight and before anyone moved the vehicles. Later that afternoon normality was restored, with the snow rapidly being redistributed around the station and the dreams of many for a weekend of skiing on fresh powder snow 'gone with the wind'.

FREEZE FRAME

Ian Phillips is a Supervising Communications Technical Officer currently enjoying his second winter at Casey. He has also wintered at Davis and Macquarie Island and worked over a number of Antarctic summer seasons. Ian is fascinated by the challenge of capturing the essence of the Antarctic environment as a 'moment in time'. He aims for photographs of high technical standard coupled with artistic value, and says he occasionally manages a reasonable measure of success.

EXPEDITIONER PHOTO

ANTARCTICA valued, protected and understood

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Australian Antarctic Division

www.antarctica.gov.au