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ANTARCTIC

LAGACE LEGACY EDITION

What does the United Nations Paris Climate Agreement Mean for Antarctica?

New Zealand: 60 years in Antarctica

NEW ZEALAND ANTARCTIC SOCIETY

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The deadlines for submissions to future issues are 1 February, 1 May, 1 August, and 1 November.

NEW EMAILS
Calling New Zealand members and subscribers affected by Vodafone cancellation of email services: if you previously used a Vodafone, Clear, ihug, or Paradise email address could you please urgently advise our Membership Team – **membership@antarcticsociety.org.nz** – of your new email address.

Cover photo: Surface meltwater export off the Nansen ice shelf at a 130-metre-wide shear-margin river waterfall on 12 January 2014. *Photo credit: Robert Fletcher, from Bell et al., (2017, Nature).*
Photo above: Vince Belgrave prepares Dog for a flight to Cape Bird. *Photo courtesy of Trevor Chinn.*

From the Editor

In this issue, *Antarctic* is privileged to have as our lead article, the text of a lecture that Timothy Naish, presented as his recent SCAR lecture to the 45th Antarctic Treaty Consultative Meeting in Beijing this year, entitled *What does the United Nations Paris Climate Agreement Mean for Antarctica?*

The Society extends its congratulations to Randal Heke on his award of the New Zealand Antarctic Medal. (Some of Randal's Antarctic reminiscences are in our June 2016 issue.) Following the completion of Scott Base, by a construction team lead by Randal, the New Zealand flag was raised there on 20 January 1957; 2017 marking 60 years of New Zealand's presence in Antarctica. New Zealand's initial involvement in Antarctica involved both the Trans-Antarctic Expedition and the International Geophysical Year. Much has been written, here and elsewhere, about the TAE, and in this issue Fred Davey gives us a brief overview of the IGY: *New Zealand and the International Geophysical Year.*

In three historical pieces, John Clemens and Sue Molloy write of *Rediscovering the Christchurch Magnetic Observatory*, Bill Conroy writes of *Charles Williams: "A Lion in Courage"*, and Richard McElrea discusses *The Man who Shared a Cabin with Shackleton.*

Capping off New Zealand's 60 years in Antarctica Jillian Dempster, in *Remembering a Diplomatic Breakthrough for the Ross Sea*, writes about the brand new Ross Sea Marine Protected Area, which came into force on 1 December 2017, and some of the hurdles in bringing it into being.

Further to the note from the President, we acknowledge the life of Life Member Norman Hardie, with a Tribute by Colin Monteath.

Lester Chaplow

CORRECTION:

In our previous issue, vol. 35, no. 3, it was stated that "In 2016 the international Antarctic science community through COMNAP identified the most critical scientific questions facing the global Antarctic science community." In fact this was done through the SCAR (Scientific Committee on Antarctic Research) Horizon Scan Process; see paper by Kennicutt et al. in *Antarctic Science*, pages 1–16, 2014.

From the President

The new Society website has been running since late September and has been a significant achievement for the Society, being planned and delivered in just 12 months, and within budget. The Society now has a fresh and modern public face, offering improved and expanded communications and services for members. Joining the Society or renewing membership is now an automated option. There is an online merchandise store, and the website provides a platform for our Antarctic magazine and upcoming events, and an electronic archive reaching back around 60 years of *Antarctic* issues. A single Facebook page is also linked to the website for all those social media-ites. Sincere thanks must go to our Patron Dr Peter Barrett who has led the website development with a small, creative, talented, and determined subcommittee.

In October we sadly lost another of our life members, Norman Hardie, who, in the foreword to Hardie's 2006 memoir *On My Own Two Feet*, Hillary called "a skilled mountaineer and a formidable explorer… renowned for his considerable determination and refusal to accept defeat". He was a peer of Hillary's, joining him on several expeditions, including one to Antarctica to make the first ascent of Mt Herschel.

As this very busy and productive Antarctic year draws to a close I would like to encourage you to check out and make use of the new website, enjoy some time out, and enjoy the planned Antarctic-related events around the three branches at the end of 2017 and into 2018.

Dr Linda Kestle

THE LAST INHABITANT OF SHACKLETON'S HUT

Oliver Sutherland, who spent the 1962–63 summer at Cape Royds as a 19-year-old student studying the Adélie penguin colony there, has recently written and published a memoir of his time in *Antarctica*. He was the last person to live in Ernest Shackleton's 1907 hut, accompanied by various visiting Scott Base staff during his sojourn. Graham Billing's novel *Forbush and the Penguins,* later turned into a feature film, was based on Oliver's experience at Cape Royds.

Copies of the 43-page booklet *The Last Inhabitant of Shackleton's Hut* can be ordered from the author, duvedal39@gmail.com, at a cost of $20, plus $7 postage.

What does the United Nations Paris Climate Agreement Mean for Antarctica?: Implications for New Zealand's future research priorities

By Timothy Naish, Antarctic Research Centre, Victoria University of Wellington, New Zealand. Timothy.Naish@vuw.ac.nz.

Earlier this year I was invited to present the Scientific Committee on Antarctic Research (SCAR) Lecture to the 45th Antarctic Treaty Consultative Meeting (ATCM) in Beijing, China. Through discussion with SCAR's president, Steven Chown, we decided I should address the overarching question – "What will the success or failure of the Paris Climate Agreement mean for Antarctica's physical and biological systems, and what will be the broader impacts for humanity?"

So, why this choice of topic? The ATCM is attended largely by lawyers, diplomats, and officials charged with the governance of activities of the Parties in the Antarctic region, as outlined by Antarctic Treaty System (ATS) and its Agreements – The Protocol for Environment Protection (CEP) and the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR). Understandably, the interests of ATCM have been inwardly focussed, specifically towards the stewardship of the Antarctic environment and ecosystems, and maintaining the continent as a place for peace and science. Historically the ATS and United Nations (UN) have not had a close relationship, but there is growing recognition of the important role the ATS could play on the global stage, particularly within the framework of the UN and its programmes. The role of Antarctica and the Southern Ocean in climate change and sea-level rise is especially significant.

SCAR is developing future research priorities that address the rapid pace of environmental change, and the growing global sustainability problems it brings. SCAR will continue to provide rigorous, defensible scientific evidence to the ATS, but in addition it aims to expand its partnerships and influence, such as its engagement with the Intergovernmental Panel on Climate Change and United Nations Framework Convention on Climate Change (UNFCCC). In particular, SCAR recognises the importance of the global adoption of the Sustainable Development Goals, and initiatives to give effect to them, such as Future Earth.

The Paris Climate Agreement

Something quite remarkable happened towards the end of 2015 in Paris at the 21st meeting of the Conference of Parties (COP 21) to the UNFCCC. The 196 member nations agreed to keep global warming below 2 °C, the "safe guardrail for dangerous climate change" identified by the IPCC and introduced by the UNFCCC at Copenhagen in 2009. This goal is to be achieved through nationally determined commitments (NDCs) aimed to reduce all anthropogenic greenhouse gas emissions to zero before the end of this century. Following pressure from vulnerable African and low-lying coastal nations, the parties further agreed to "pursue efforts" to limit temperature increase to 1.5 °C, and the IPCC was

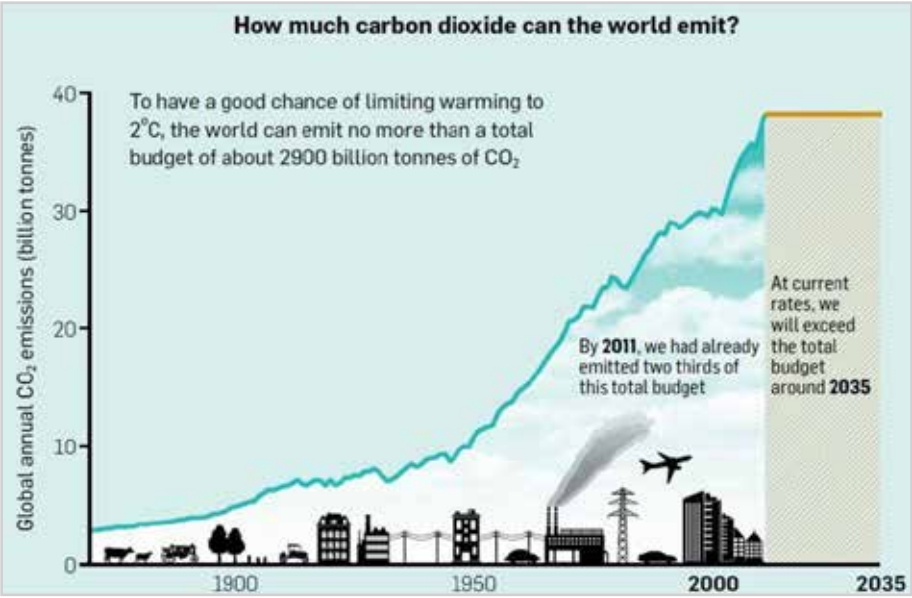

Fig 1: The historic rate of carbon dioxide emissions and the budget available before Earth's surface temperature reaches 2 °C average warming above preindustrial levels. *Source: Ministry for the Environment.*

Antarctic 35(4): 46-51 (2017).

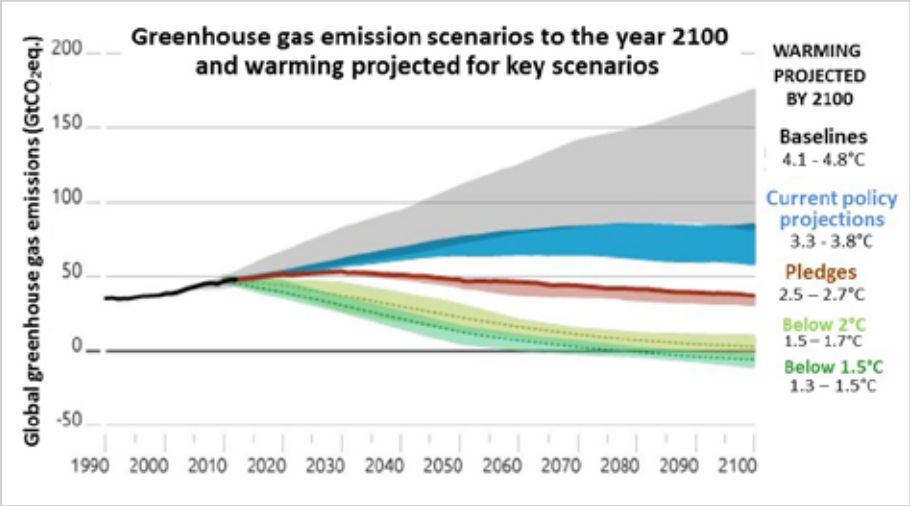

Fig 2: Global greenhouse gas emission scenarios and global average temperatures to the year 2100 for "business as usual" (baseline), an assessment of current global policy settings, the Paris Agreement pledges, and the 2 °C and 1.5 °C stabilisation scenarios. *Source: Climate Action Tracker http://climateactiontracker.org.*

charged with producing a Special Report on what impacts would be avoided by achieving this, including possible greenhouse gas emissions pathways. The Paris Climate Agreement was subsequently signed by 194 countries in New York on Earth Day, 22 April 2016, and went into force on 7 November 2016.

The Agreement is challenging, especially since the current rate of global emissions (40 billion tonnes per year) could take Earth's surface temperature to 1.5 °C in 5–10 years and 2 °C in 15–20 years. (Fig. 1). The NDCs tabled in Paris, if successfully implemented, will restrict global warming to ~2.7 °C (Fig. 2). This is still above the UNFCCC safe guardrail. Current policy settings would see global temperatures stabilising closer to 3.5 °C. To be on track to meet the Paris target, collectively parties need to commit to a 40% reduction in global greenhouse gas emissions with respect to 1990 levels by 2030. This is the EU commitment, but the NDCs of many nations, including New Zealand, fall well short of this. Time is short, so action should begin right away for us to have a chance of success. The Agreement requires parties to increase their commitments during 5-yearly global stocktakes to achieve the target.

How are the ATS and SCAR interacting with the UNFCCC and the IPCC?

While the ATS has no status within the UNFCCC, SCAR does have observer status within the IPCC through its membership of the International Council of Scientific Unions (ICSU) (Fig. 3). SCAR/ICSU nominates participants to attend IPCC plenary sessions and meetings as well as candidates to be considered for authorship of special and assessment reports. More importantly SCAR helps mobilise the international science community to address the impact of climate change on Antarctica, and the role Antarctica plays in the global climate system. Five of the six science priorities developed in the SCAR Horizon Scan process held in New Zealand in 2014 are of direct relevance and interest to the IPCC, now preparing for its sixth integrated assessment report and two newly commissioned Special Reports – *Global Warming at 1.5 °C* and *Climate Change and the Oceans and the Cryosphere*. Two of SCAR's strategic research programmes, *Past Antarctic Ice Sheet Dynamics* (PAIS) and *Antarctic Climate in the 21st Century* (AntClim21) made significant contributions to the IPCC's Fifth Assessment Report from the legacy of several large IPY research initiatives, and are positioning themselves to make even more significant contributions to the Sixth Assessment Report.

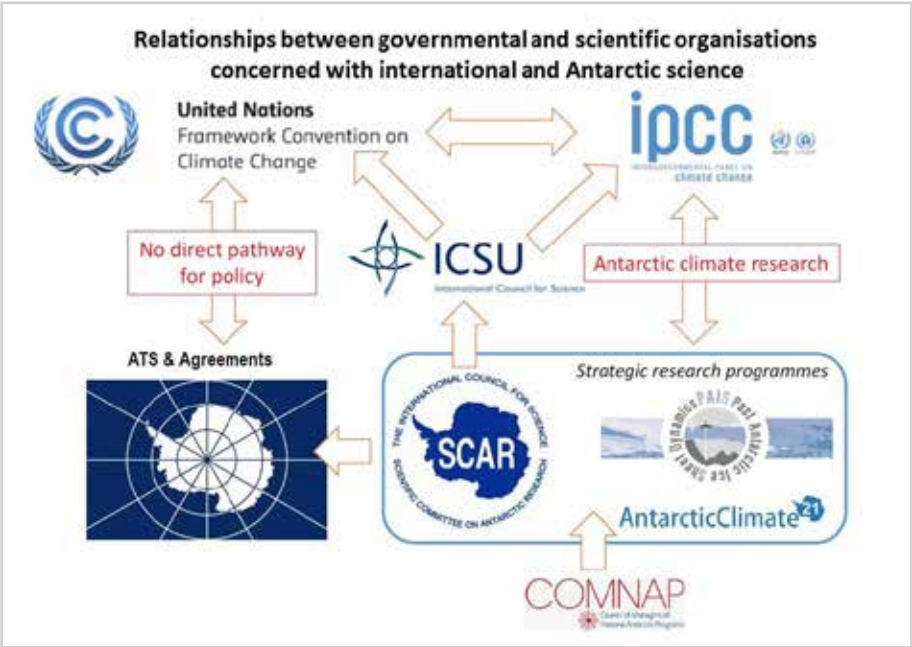

Fig 3: Relationships and interactions between the UNFCCC, IPCC, ICSU and the Antarctic Treaty System, key international governmental and scientific organisations with climate and Antarctic interests. *Source: Author.*

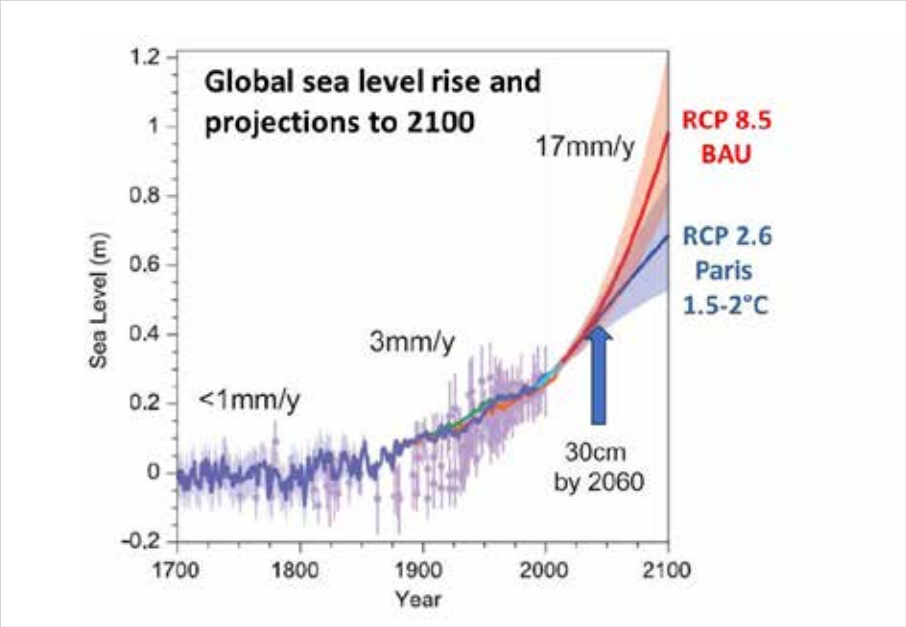

Fig 4: Historical global mean sea-level rise based on palaeoclimate reconstructions, and satellite and tide gauge measurements. This is continued on the right with projected sea-level rise for the IPCC 5th Assessment Report (2013) low (RCP 2.6) and high emission (RCP 8.5 – "Business as usual" or BAU) scenarios. *Source: IPCC.*

Antarctica's contribution to future sea-level rise

Changes caused by natural and anthropogenic drivers (e.g. CO_2) are communicated to Antarctica by oceanic and atmospheric processes, and influence the polar atmosphere, ocean, ice sheet, sea ice, and biosphere. Likewise, changes in Antarctica and the surrounding Southern Ocean have worldwide consequences. Some consequences of Antarctica's changing climate are listed in Table 1 (page 51).

Sea-level rise (SLR) is the clearest planet-wide signal of human-induced climate change. So far global sea level has risen 20 centimetres in response to a 1 °C warming. So what does the IPCC predict future SLR will be by the end of the century? In its 2013 assessment report it said SLR could be 1 metre higher with no policy on emissions reductions and 0.5 metres with aggressive emissions reductions as outlined in the Paris Agreement (Fig. 4). No matter what we do from now on we have already committed the planet to 25–30 centimetres of SLR over the next 40 years from the greenhouse gas warming that has already occurred. This is heat already built into the system and is known as committed climate change.

Arguably, the biggest uncertainty of societal and policy relevance facing climate science today is the future contribution of the Antarctic ice sheet to global SLR. After assessing the evidence, the IPCC noted the potentially large contribution from rapid retreat of unstable parts of the Antarctic ice sheet, but did not include this in their global sea-level predictions. They argued at the time of writing (2013) that the scientific evidence was not clear enough for quantifying the likelihood of a rapid and potentially non-linear response by Antarctica, but cautioned that "based on current understanding, collapse of marine-based sectors of the Antarctic ice sheets, if initiated, could cause global mean sea level to rise tens of centimetres above the *likely* range [of up to 98 centimetres] during the 21st century".

Satellite measurements and further analysis have now shown that the rate of polar ice sheet melting is accelerating. Greenland is contributing more than Antarctica at the moment, but Antarctic ice loss is expected to overtake Greenland to become the dominant contributor by the end of the century. This is because the ocean around Antarctica is warming and the ice sheet is thinning and retreating the fastest, where these warm water currents are moving onto the continental shelf and under the ice shelves (Fig. 5a). The ice shelves are the floating extensions of the land-based ice where it flows out onto the ocean. They play an important stabilising role, holding back the ice sheet from flowing into the ocean (Fig. 5b). When the ice shelves melt as they have around the Antarctic Peninsula and along the Amundsen Sea, the ice sheet slides into the ocean up to 10 times faster. This rapid ice loss contributes to global SLR and could result in an unstoppable runaway retreat of an entire sector of the ice sheet where the bed of the ice sheet lies well below sea level.

Two studies published in 2014 said that it may already be too late for the West Antarctic Ice Sheet. However, this is still actively debated. A key issue is the threshold for Antarctic ice shelf stability, including the role of temperature. How can we determine that threshold, and how fast will sea level rise if it's crossed? New computer ice sheet models are providing key insights. The models have been developed and tested on geological evidence of warmer-than-present climates in the geological past, and these same models are now being applied to the IPCC future climate scenarios. Table 2 (page 51) summarises key insights into Antarctic ice sheet and global sea-level sensitivity that can be determined only from palaeo (past) climate evidence.

What do the latest generation of Antarctic ice sheet models show?

New projections from computer-based Antarctic ice sheet models since the 2013 IPCC report indicate higher rates and magnitudes of

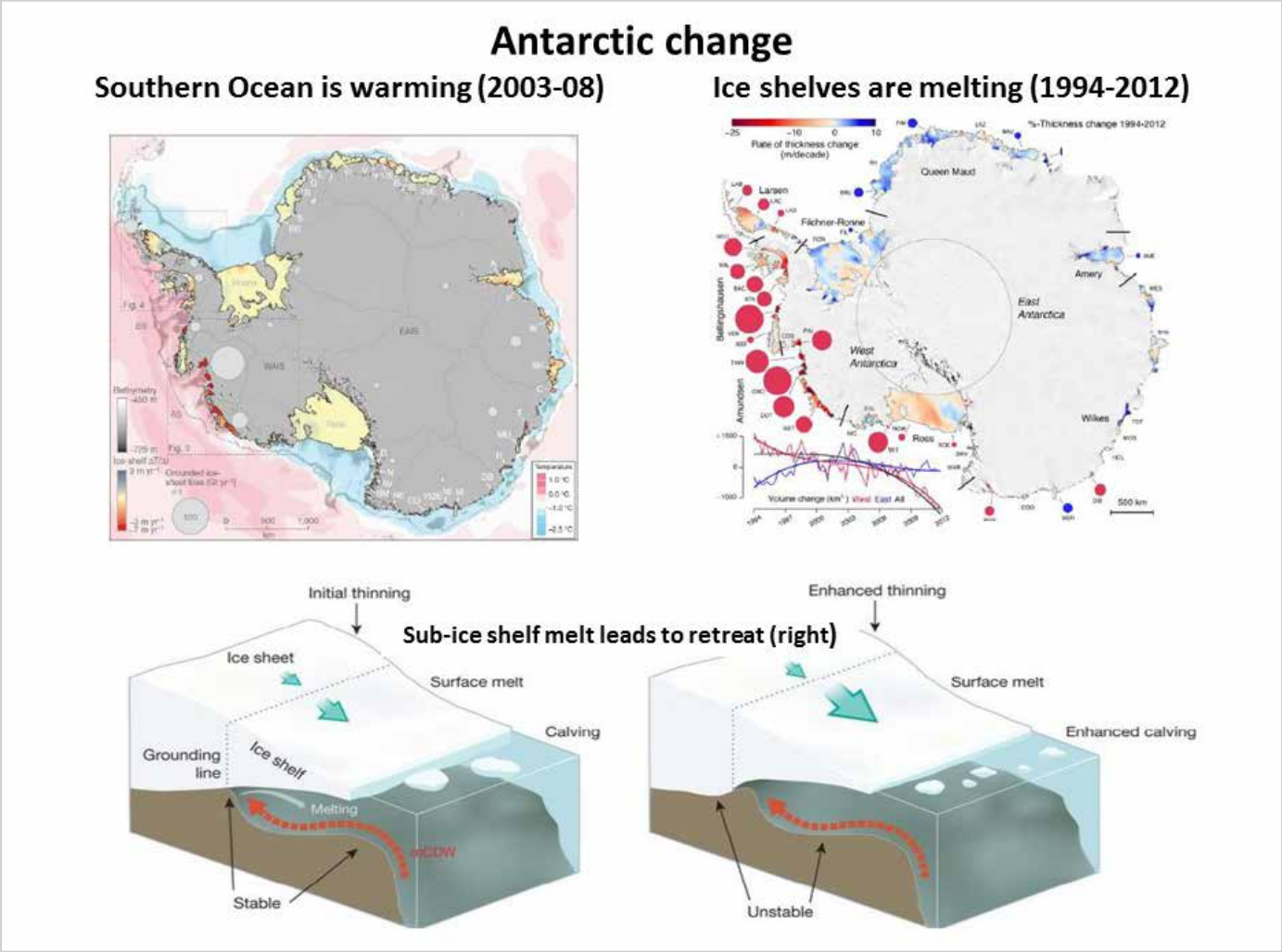

Fig 5: The two maps show the changes now taking place to the Antarctic region: on the left the warming ocean (in pink), and on the right areas where the ice shelves are thinning (red circles). In both maps changes are most marked along the Pacific coast of the West Antarctic Ice Sheet. *Sources: Pritchard et al. (2012, Nature); Paolo et al. (2015, Science).*

The two block diagrams show how warm circumpolar deep water rises up onto the continental shelf and melts the ice shelves, the diagram on the right showing the potential runaway scenario where the melting beneath leads to marine-based ice sheet retreat into deep subglacial basins. *Source: Hanna et al. (2013, Nature).*

future Antarctic ice mass loss for the higher-emission scenarios. These models now incorporate recently recognised processes that lead to rapid collapse of floating ice shelves and marine-based ice sheets. Model skill and performance have been developed and tested within the SCAR PAIS programme on past warm climate analogues constrained by geological data. These models indicate Antarctica may contribute as much as an additional 80 centimetres of global SLR by 2100 under the "business as usual", high-emissions scenario where CO_2 levels reach 800 parts per million by the end of the century (Fig. 6). The models also show that if a given CO_2 threshold is passed, Antarctica's ice sheets will continue to melt for centuries to come even after CO_2 levels and atmospheric temperatures have stabilised. This commitment to ongoing multi-metre SLR is because of the heat trapped in the ice sheet and ocean system, and the longevity of CO_2 in the Earth's atmosphere (centuries to millennia).

What if we stabilise Earth's temperature below 2 °C?

There is, however, a good-news story. The results of the new models show that stabilisation of Earth's temperature below 2 °C, the Paris Climate Agreement goal, reduces Antarctic ice loss from melting to less than half a metre of SLR. This dramatically improves the prospects for island and low-lying coastal nations. In other words, there appears to be a stability threshold in the Antarctic ice sheet around 2 °C of global warming that, once exceeded, commits the planet to multi-metre SLR. The threshold response is because of the stabilising role of ice shelves. Above 2 °C global warming, surface melting and catastrophic collapse of ice shelves is expected, after which ocean heat can rapidly remove marine ice sheets grounded in deep sub-glacial basins.

Moderating the good news is the current uncertainty around the stability threshold, which could be

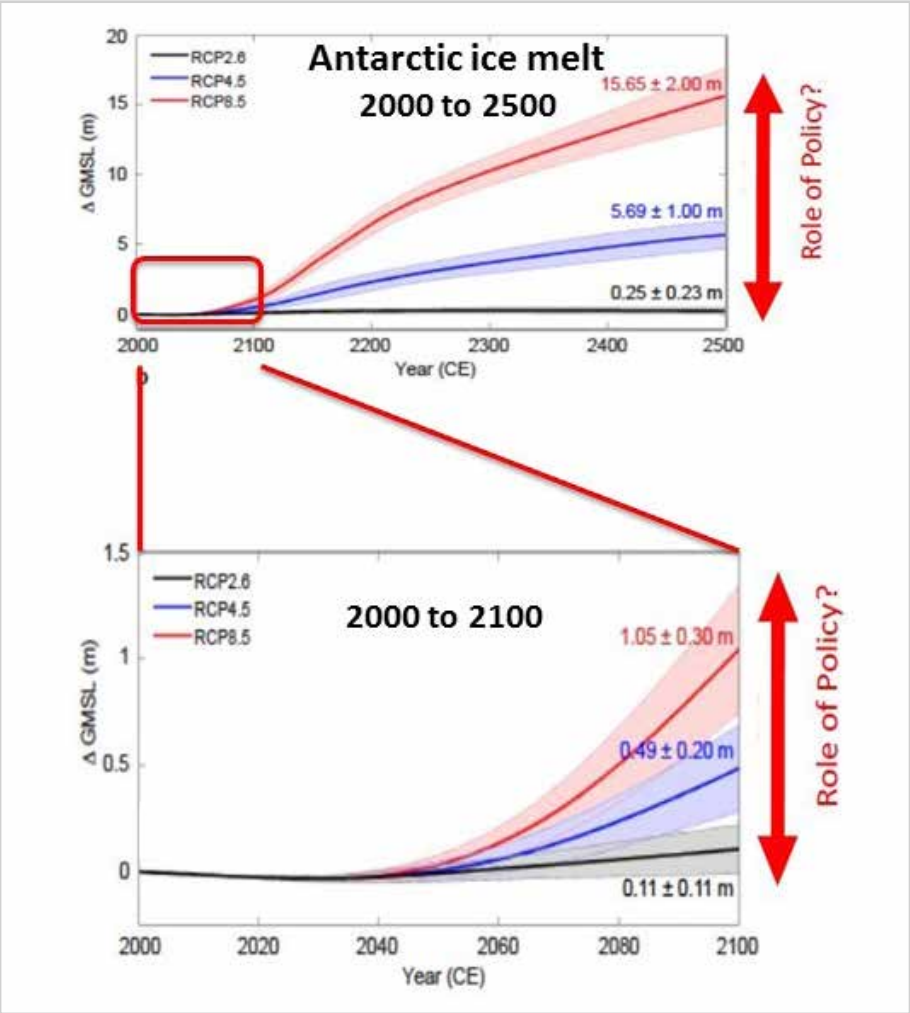

Fig 6: Antarctic contribution to global sea-level rise for high and low IPCC emission scenarios from a recent model that includes recently recognised processes of rapid ice shelf and runaway marine ice sheet retreat, and is calibrated by palaeoclimate reconstructions. The model shows that low emissions policies provide the only opportunity for preserving the ice sheets and limiting sea level rise. *Source: DeConto & Pollard (2016, Nature).*

as low as 1.5 °C. If global warming is stabilised between 1.5 and 2 °C, we are still committed to global SLR of about half a metre, mostly from unstoppable ice loss in the Amundsen Sea sector. However, large ice shelves will likely stay intact and seasonal sea ice will likely decline by only 10–20%.

Future research focus

Less than one third of the 194 member states of the UNFCCC belong to ATS and have direct access to Antarctica for research, yet the UNFCCC, through the IPCC process, requires that scientific knowledge. The ATS and its agreements (CEP and CCAMLR) also require evidence-based policy and decision-making that includes knowledge of the impacts of climate change. Critical knowledge gaps have been identified in the IPCC's Fifth Assessment Report, through strategic assessments carried out by national Antarctic programmes and funding agencies, and the SCAR Horizon Scan process. There are many areas, such as conservation and environmental protection and management, where understanding the impacts of climate change on Antarctica is a priority. However, an overarching theme of global reach continues to be understanding the response of Antarctica's ice sheet and the Southern Ocean to climate change and improving estimates of the ice sheet's contribution to global SLR. The urgency and scale of these strategic research priorities require:

- Multi-disciplinary international collaboration including expertise and alignment of resource
- Access to new satellite data, autonomous vehicles, instruments and observatories that can access the ice sheet interior, the ocean, the cavity under ice shelves, the base of ice sheets, and sediments and rocks under the ocean and the ice sheet
- More access to aircraft, ships, and over-snow traverse capability
- Commitment to long-term stable funding
- Use of emerging technologies for energy and for storing and communicating data in real time
- Access to remote areas of Antarctica all year round

To meet these challenges the Council of Managers of National Antarctic Programs (COMNAP) has undertaken the Antarctic Roadmap Challenges (https://www.comnap.aq/Projects/SitePages/ARC.aspx), which identifies the resources, infrastructure, logistics, and supporting technologies needed to enable priority science objectives to be achieved over the coming decade.

The bottom line

My parting comment to the 45th ATCM was that the clock is ticking and time is short. Many knowledge gaps on Antarctica's response to global warming will have wide-reaching impacts, and it is vital that we can anticipate and manage them. The ATS and its Agreements are key stakeholders whose functions will be impacted by climate change, but the Parties also have a collective responsibility to address these knowledge gaps for the sake of both humanity and the ecosystem on which we depend.

Sources of information

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Table 1: Global and Antarctic consequences of anthropogenic warming

Global	Warming of the climate system is unequivocal, and the human influence is clear.
Global	The clearest global response is global sea-level rise (SLR). 20 cm SLR observed since 1850; 15 cm of SLR occurred in the last 30 years.
Global	Given the global reach of Antarctic and Southern Ocean processes, climate change in the region will have widespread consequences for the Earth system and for human society dependent on it.
Ice sheet	The Antarctic ice sheet holds 90% of the world's ice and if returned to the ocean would raise sea level by 58 m. East Antarctic Ice Sheet contains 54 m SLR; West Antarctic Ice Sheet contains 4 m SLR.
Ice sheet	The ice mass loss is contributing to global SLR at an accelerating rate and by mid-century may be the single biggest factor contributing to global SLR.
Sea level	The largest uncertainty in predicting global future SLR is predicting the response of the Antarctic ice sheet to continued warming in the ocean and atmosphere.
Southern Ocean	At present, the Southern Ocean takes up more anthropogenic heat and CO_2 than oceans in other latitudes, which acts to slow the pace of surface climate change around Antarctica. 95% of the heat and 25% of the CO_2 have gone into the ocean.
Atmosphere & ocean	The tug of war between ozone hole and global greenhouse gases that acts to cool Antarctica while warming the rest of the planet, steepens the pole–equator temperature gradient of the Southern Hemisphere, invigorating zonal atmospheric circulation and causing warm circumpolar deep waters to upwell along the coast of Antarctica. This increased heat flux to the marine margins of the ice sheet is causing collapse of stabilising ice shelves and rapid thinning and retreat of the ice sheet.
Atmosphere & ocean	Freshening of the surface waters from ice melt has reduced the production of cold salty Antarctic Bottom Water by 50% between 1970 and 2014, with consequential changes for heat transport via the global ocean conveyor.
Ocean productivity	By returning nutrient-rich deep water to the sea surface and exporting nutrients to lower latitudes, the Southern Ocean overturning circulation supports 75% of global marine primary production north of 30° S.

Table 2: Information from palaeoclimate archives on the sensitivity of Antarctica's ice sheets and implications for global sea level

Sensitivity	Climate reconstructions from the geological past show that the Antarctic ice sheet is highly sensitive to relatively small increases in Earth's average temperature.
Polar amplification	This sensitivity is because amplifying feedbacks and processes cause the polar regions to warm two to three times more than the global average.
2–3 °C warmer	The last time Earth experienced atmospheric CO_2 concentrations of 400 ppm (today's concentration) was three million years ago. Global temperature equilibrated at 2–3 °C warmer, polar temperatures were 6–7 °C warmer, and Antarctica lost marine-based ice from its more vulnerable subglacial basins, contributing +13 m to global sea level. Greenland melting also contributed another +7 m.
3–4 °C warmer	400–600 ppm atmospheric CO_2 (3–4 °C global warming, ~15–17 million years ago) appears to be a threshold for loss of the mostly marine-based parts of the West Antarctic Ice Sheet (+3 m SLR), and marine-based sectors of the East Antarctic Ice Sheet (+17 m SLR).
4–5 °C warmer	600–700 ppm atmospheric CO_2 (4–5 °C global warming, ~25–34 million years ago) appears to be a threshold for loss of Antarctica's land-based ice, and at 1000 ppm CO_2 Antarctica has no ice.
Rates of change	After the last ice age sea level rose 120 m due to Northern Hemisphere (+100 m SLR) and Antarctic (+20 m SLR) ice melt from ~18,000 to ~8000 y BCE), a rate of 1.2 m/century or 12 mm year. For a few hundred years around 14,500 years ago the rate reached 4 m/century. Antarctica on its own contributed to SLR at between 1 and 1.5 m/century at this time.

New Zealand and the International Geophysical Year (IGY) 1957–1958: a brief overview

By F. J. Davey

New Zealand scientists made a significant contribution to the 1957–58 International Geophysical Year (IGY), making a wide range of geophysical measurements at a range of observatories, from 78° S (Scott Base) to 0.1° N (Tarawa, Gilbert Islands) (Fig 1). The sixtieth anniversary of the event (2017) is an appropriate time to acknowledge their efforts, particularly as during the 2007 International Polar Year New Zealand activities, which were in part to acknowledge the fiftieth anniversary of IGY, most attention was on the New Zealand part of the Commonwealth Trans-Antarctic Expedition (TAE, a private expedition) and little mention was made of the original New Zealand IGY activities and their major Antarctic contribution. Space allows only a very brief overview here.

International Polar Years for collaborative polar research were first conceived by Carl Weyprecht (1838–81). New Zealand was not involved in the First Polar Year (PY) of 1882–3, but it participated in a small way in the Second PY, 1932–3, but not in Antarctica. Geomagnetism was the main activity, with some limited meteorological and ionospheric observations made.

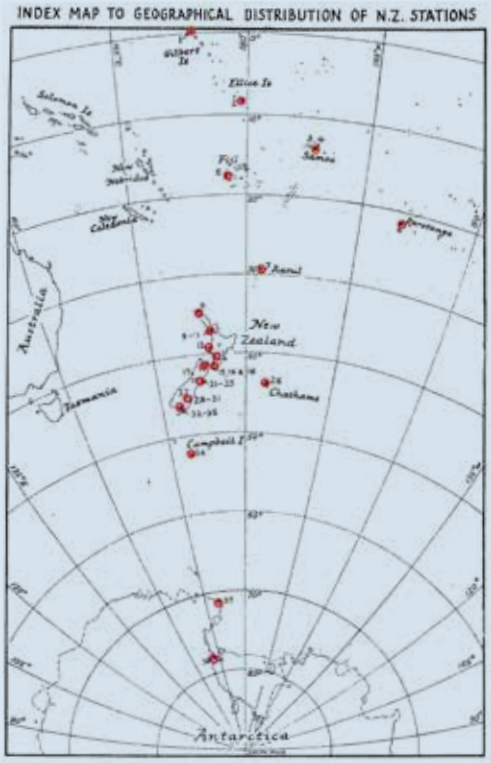

Fig 1: New Zealand IGY observatories. *Image: RSNZ IGY committee.*

The purpose of the IGY was understanding the physical structure and processes of the Earth and its environment. It was conceived informally in the US in April 1950. The International Council of Scientific Unions (ICSU)[1] set up a committee (CSAGI)[2] in October 1951 to develop an international programme to study the whole Earth, and invited the formation of national committees for IGY. In June 1953, the Royal Society of New Zealand (RSNZ) set up a New Zealand National Committee for IGY, and in 1954 provided draft research proposals to CSAGI. CSAGI subsequently recommended that New Zealand carry out an expanded geophysical /meteorological programme extending from Tarawa to the Ross Sea.

In September 1953, the RSNZ sent a letter to the prime minister requesting support for IGY, also noting New Zealand's Antarctic claimant status. In January 1955, Cabinet recommended a New Zealand base on Ross Island for a New Zealand IGY programme and TAE, and in April 1955 the support for the IGY and TAE programmes was finally approved by Cabinet. Funding for the IGY programme of £68,600 was approved in August, comprising £44,400 for the Antarctic component and £24,200 for the rest of the programme. In addition, there was a significant redirection of departmental resources to support the total Antarctic operations. Subsequently, in 1956, New Zealand and the US agreed to share an observatory at Adare/Hallett

The IGY Programme

The IGY observing plans ran from 1 July 1957 to 31 December 1958. A Continuing Geophysical Year ran through to 1 December 1959 with less intensive observations. The science disciplines studied included meteorology, geomagnetism, aurorae, airglow, the ionosphere, solar activity, cosmic rays, glaciology, nuclear radiation, and seismology. Most instruments were operated continuously during IGY, with extra observations made during critical periods – World Observing Day (three per month), and World Observing Period (ten continuous days, four times a year). Standard data formats were used for observations and reduction,

1 The ICSU became the International Council for Science in 1998.
2 Comité Spécial de l'Année Géophysique Internationale.

Fig 2 (left): Scott Base IGY party 1957–8. L–R: R. H. (Herbie) Orr, seismology, time; W. J. Peter Macdonald, radiation, sea level, glaciology; Neil Sandford, ionosphere, AZA transmitter; Trevor Hatherton, chief scientist, aurorae, gravity; Vern B. Gerard, geomagnetism. *Image: H Orr. Inset: E. I. Robertson, Chair of IDC.*
Fig 3 (right): Scott Base IGY party 1958–9. L–R: Back row: A. L. (Buz) Burrows, geomagnetism, sea level; R. Murray Robb, diesel mechanic; Cpl Lester O. Duff, vehicle mechanic; I. M. Gibson, ionosphere, AZA transmitter; M. J. H. Speary, cook; Lin H. Martin, leader, whistlers; Front row: Peter A. Yeates, radio operator; R. H. Bob Henderson, instrument mechanic, buildings; Don C. Thompson, senior scientist meteorology, ionosphere; Lt Franco Faggioni (Italian), seismology; G. Graeme Midwinter, radiation, aurorae. *Image: ADAM, Antarctica New Zealand.*

with data submitted to one of three World Data Centres (WDC): WDC(A) in the USA, WDC(B) in the USSR, and WDC(C) distributed between Western Europe, Japan, and Australia. Data were submitted directly by the observatories to the WDCs.

The New Zealand IGY Programme

As most of the current research on IGY objectives was being carried out by government departments, the Minister for Science formed a New Zealand Inter-Departmental Committee for IGY (IDC), chaired by E. I. Robertson (Director, Geophysics Division, DSIR; see inset of Fig 2). The IDC (lead organisation: Geophysics Division) implemented the research plan developed by the RSNZ IGY committee within the resources available. The New Zealand IGY programme followed the recommendations of ICSU, with observations made at 38 stations. Most observations were extensions of existing programmes. The 18 new stations, and those where significant additional types of observations made, were: Tarawa, Funafuti, Afiamalu, Rarotonga, Nadi, Raoul Island, North Cape, Wellington, Godley Head, Springston, Chatham Islands, Roxburgh, Invercargill (Waimatua, Awarua, Bluff), Campbell Island, Hallett Station, and Scott Base. In addition, oceanographic observations were made in the Samoa region (HMNZS *Tui*), and around and south of New Zealand (HMNZS *Pukaki* and *Hawea*, USNS *Brough*). Ionospheric research was a strong component of the New Zealand IGY programme, which operated five ionosondes out of a total of 140 for the whole IGY programme.

The New Zealand Antarctic IGY Programme

The comprehensive programme of research for Scott Base included meteorology, geomagnetism, aurorae, the ionosphere, glaciology, and seismology. Trevor Hatherton was appointed Chief Scientist of the New Zealand IGY Antarctic expedition. Cabinet decided on a permanent base (Scott Base) on Ross Island, shared with the Commonwealth TAE. Sir Edmund Hillary was named expedition leader (Scott Base) until TAE left Antarctica in March 1958 and Lin Martin (IGY leader, year 2) took over, from which time Scott Base supported just the IGY and other scientific programmes. All IGY personnel were selected by IDC; Scott Base IGY staff are shown in Figs 2 and 3. Facilities at Scott Base included the science laboratory, two geomagnetics huts, and a seismograph vault. All 10 main scientific instruments were installed and recording well before the IGY Observing Period started on 1 July. The tide gauge sensor took more effort, as it involved digging a hole through six-metre-thick permanent ice. Most instruments operated on a 24-hour basis, including through winter, and involved outside observations (aurorae) or travel to external huts (geomagnetism). Observations were also made of the geomagnetic secular variation since earlier Antarctic expeditions (to Cape Royds (1908), Cape Evans (1911), and Little America (1929, 34)), and of the absolute geomagnetic field in the region and at South Pole. Seismology observations recorded global earthquake events (60 per month), microseisms (caused by swells to the north and the effect of pack ice), and surface waves that gave the first crustal thicknesses for East Antarctica (35 kilometres) and West Antarctica (25 kilometres). Gravity measurements delineated the large gravity gradient across the Transantarctic Mountains–Ross Sea boundary.

The base at Cape Hallett was originally planned for Cape Adare, but reconnaissance indicated that landing at the latter could be difficult, so Cape Hallett was chosen instead. Hallett Station had a science party of four scientists: a US meteorologist, and three from New Zealand studying geomagnetism, aurorae, the ionosphere, radiation, and seismology (Fig 4).

Fig 4: Above: Hallett Station NZ IGY party 1957–8. L–R: John Humphries, ionosphere, W. I. (Bill) Ingham, seismology, geomagnetism, aurorae; Mark Langevad, electronics. *Images: W. Ingham.*
Below: Hallett Station NZ IGY party 1958–9. L–R: Ken J. Salmon, scientific leader, aurorae; Geoff A. M. King, ionosphere, geomagnetism; Ken A. Bargh, seismology. *Images: ADAM, Antarctica New Zealand.*

All instrumentation was of US origin, and only Humphries had seen any of the instruments (a C4 ionosonde) before arrival on base, and a major effort was required to set up the instruments. At the start of the second year the seismic piers were replaced and the hut rebuilt. Visual aurora observations had better protection (a plastic dome) for the observers than at Scott Base. Additional work included bird banding, and penguin and insect studies.

Results from the New Zealand Antarctic IGY Expedition

Eight papers in Nature: on ocean currents, microseisms, geomagnetic diurnal variations, crustal thickness, 6707A radiation and nuclear explosions. The research gave a better understanding of auroral zones, radiation balance, and the location of Antarctic convergence. Results were presented at a Symposium on Antarctic Research (initial results), convened by Hatherton in Wellington in February 1958 (38 participants from overseas), followed by a DSIR Bulletin 140, in 1961, *on New Zealand IGY Antarctic Expeditions, Scott Base and Hallett Station*, edited by Hatherton, who also edited (1965) a major synthesis of understanding of the Antarctic physical environment: *Antarctica*. During IGY, the Ross Dependency Research Committee (RDRC) was set up (25 March 1958), under the chairmanship of E. I. Robertson, and operation of Scott Base transferred to Geophysics Division, DSIR. Antarctic Division was set up by DSIR on 5 May 1959.

Summary of IGY: 1 July 1957–31 December 1958

Sixty-seven nations participated, with 4,000 stations/observatories and the involvement of about 40,000 individuals. Three major data centres were set up for IGY data, and 48 volumes of *Annals of the International Geophysical Year* were published. Major advances included the development or understanding of: artificial satellites (Sputnik 1); Van Allen radiation belts; mid-ocean ridges; large-scale weather patterns; causes, variability, and prediction of radio propagation; location of earthquakes; and the detailed shape of Earth.

In addition, the Special (later Scientific) Committee for Antarctic Research (SCAR), an interdisciplinary committee of the ICSU, was set up in February 1958, providing the impetus for the Antarctic Treaty.

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Rediscovering the Christchurch Magnetic Observatory: An essential New Zealand link to early Antarctic exploration

By John Clemens, Curator, and Sue Molloy, Botanical Resources Co-ordinator, Christchurch Botanic Gardens

The Magnetic Observatory first operated in the Christchurch Domain, now the Botanic Gardens, in November 1901. It has a diverse and happy history of supporting scientific observation, especially of geomagnetism, by members of Antarctic expeditions. The unbroken thread of observation continues on site today through gravitational, meteorological, and seismic monitoring.

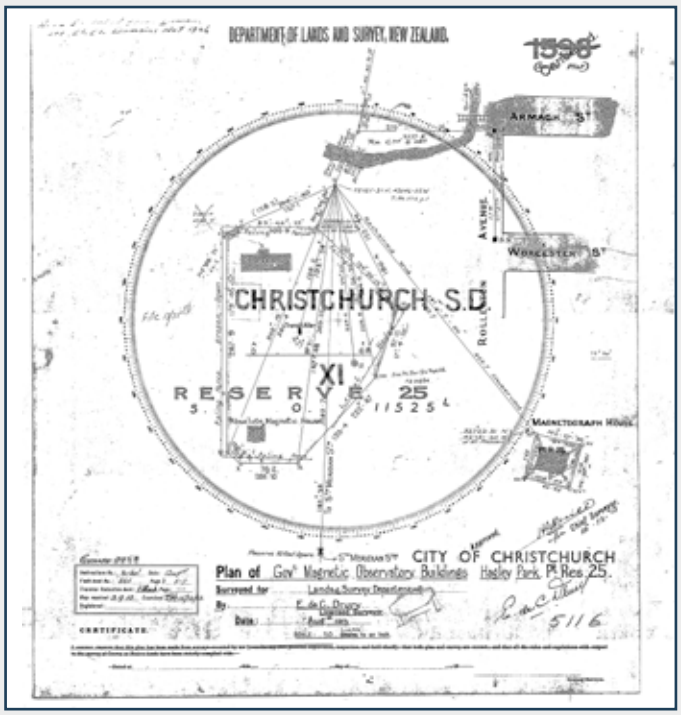
Those who in the early 1900s explored the seriously challenging Antarctic environment of poorly defined and shifting magnetic characteristics had to ensure their instruments were correctly adjusted. To do this they needed a reputable magnetic observatory in a port conveniently close to Antarctica.

At the time, there were only three magnetic observatories south of the equator (at Melbourne, Batavia, and Mauritius). Christchurch Magnetic Observatory would be the fourth. Its construction would make it possible for Commander Robert Falcon Scott to make the Port of Lyttelton and Christchurch the base of the British National Antarctic Expedition in November 1901.

When Scott's expedition left England in the *Discovery* in August 1901, Melbourne was the intended base from which Antarctic exploration would take place. However, those in Christchurch had strong links with the expedition and had other intentions. Captain Scott's cousin, Robert Julian Scott, headed Engineering at Canterbury College. Julian was the son-in-law of Charles Bowen (later, Sir Charles Bowen), one of the earliest settlers in Christchurch, a prominent politician, and a member of the Christchurch Domain Board. And Bowen was the brother-in-law of Sir Clements Markham who, as President of the Royal Geographical Society, had promoted Captain Scott to lead the expedition.

Adelaide-trained physicist Clinton Coleridge Farr had been undertaking a magnetic survey of New Zealand since 1899 and was based in Christchurch at the time. In July 1900, a year before the departure of *Discovery* from England, Farr approached the Christchurch Domain Board for a site to build the Christchurch Magnetic Observatory. When *Discovery* berthed in Lyttelton in late November 1901, the Christchurch Magnetic Observatory had been constructed. All necessary instruments had been installed, and Farr became the Observatory's first director.

A survey plan from 1913 shows three principal buildings making up the Magnetic Observatory. There was an Office that would also be the base for the



Department of Lands and Survey plan of Christchurch Magnetic Observatory buildings, August 1913.

magnetic survey of New Zealand and that housed a seismograph in its cellar, an Absolute House at which celestial and magnetic determinations were made, and a Magnetograph House where continuous recordings could be made of magnetic variation. The three were well separated from each other to avoid magnetic disturbances, and the two observation buildings contained no magnetisable building materials.

The buildings were described as being "very handsome" and of the "Swiss chalet type". The most elegant was arguably the Absolute House, shown in photographs nestled beneath trees in the Domain's park-like landscape and protected by a rustic fence. The more majestic Magnetograph House was built on higher ground to allow the construction of a deep, concrete-lined cellar in which the sensitive magnetometers and photographic recording paper could be shielded from sunlight and temperature variation. The gabled superstructure was a chart and photographic developing room. The original Office, with several rooms and its seismograph cellar, was similarly neat and compact.

Scott was to visit Lyttelton again with the *Terra Nova* in 1910, Ernest Shackleton came with the *Nimrod* in 1907, and the magnetic survey ships of the Carnegie Institution of Washington also called at Lyttelton: *Galilee* in 1907 and *Carnegie* in 1915, 1916, and 1920. Over the following years the Office was extended to house an increasing number of scientists and clerical staff to match an expanding range of scientific observations. Studies were made of cosmic rays, gravity, and atmospheric electrical properties, in addition to geomagnetism, meteorology, and seismology. The famous seismologists Beno Gutenberg and Charles Richter, who together developed the "Richter Scale", visited the Magnetic Observatory during the 1949 Pacific Science Congress hosted by the Wellington Observatory.

One of the last additions to the Magnetic Observatory was a scientific workshop built at the rear of the Office in 1941. It is the only original building to survive to this day. Observation of the Earth's magnetic field in Christchurch, as in so many other cities worldwide, became impracticable when the network for previously horse-drawn trams was electrified in 1905. The Absolute House was moved to a new observatory near Amberley where it was hoped, in vain, there would be less magnetic disturbance. The Office and Magnetograph House were removed soon after the lease granted to the then Department of Scientific and Industrial Research expired in 1970.

The Magnetograph House with original Townend and Orchid Houses, 1915. *Photo credit: Carnegie Institution of Washington.*

Scott: G. E. (Gertrude, née Bowen) Scott, Commander R. F. Scott, R. J. Scott.
Photo credit: Bowen Collection, Canterbury Museum, 1974.211.23.

While the principal Magnetic Observatory buildings erected in 1901 have gone, the memories and stories remain, as does the original site and Magnetic Observatory Workshop, where seismographic and gravity measurements continue to be made. Those returning from the austere icy continent today often seek out the Botanic Gardens to immerse themselves with flower colours, scents, and the rustle of the leaves. The Workshop reminds us that, over 116 years ago, the scientists and officers of the British National Antarctic Expedition, led by Captain R. F. Scott, would have walked the same paths on their way to work at the Christchurch Magnetic Observatory ahead of their departure for Antarctica.

Had the Magnetic Observatory not been built in time for the arrival of *Discovery* in November 1901, it is unlikely that Lyttelton and Christchurch would have been the base and final point of departure of that expedition, and the importance of Christchurch to the Antarctic might not have blossomed as we know it today. The Christchurch Botanic Gardens Charitable Trust is seeking donors to help enable the authentic and engaging interpretation of the Magnetic Observatory story at the Observatory Workshop.

Thank you to Sue Stubenvoll for encouraging and reviewing this article.

What's Behind the Photo?

In the course of preparing this article, I asked John Clemens about the significance of this image. The following was his response. – Ed.

Robert Falcon Scott was in Christchurch in 1901 and 1910. This would have been taken in November–December 1901 because there is a still-blossoming Gertrude Scott (née Bowen) who married Julian Scott in 1889, and no Kathleen Bruce, whom R. F. Scott married in 1907. Most 1910 photos I have seen have Kathleen and Robert Falcon together – on board *Terra Nova*, on Quail Island etc.

The photo is significant because it's a clue to the combination of family, politics, friendship, ambition, and money that might have brought *Discovery* to Lyttelton/Christchurch instead of Melbourne, the originally intended base when the ship left England.

Julian is Robert Falcon Scott's cousin. Julian was greatly respected by Premier Dick Seddon, whom he apparently resembled in stature and character. It was the Premier who I believe responded with government money to get the Magnetic Observatory built to specification and on time. Julian and Falcon Scott were very different personalities, but family is family.

Julian is married to Gertrude Bowen, daughter of Sir Charles Bowen, one of the very first Canterbury settlers, prominent politician, and member of the Domain Board at the time the physicist Coleridge Farr applied for a site for the Magnetic Observatory (July 1900).

In addition, Charles Bowen is married to Georgina née Markham, the sister of (Sir) Clements Markham, President of the Geographical Society in London, and one of R. F. Scott's staunchest supporters and the prime promoter of the *Discovery* Expedition. Charles and Clements had gone walking in the Andes in 1859 to obtain plants from which a quinine industry could be established in India and other British colonies.

And fostering all this intermarriage and friendship, there was Christchurch resident, Joseph J. Kinsey, a wealthy philanthropist, prodigious collector, and friendly correspondent with R. F. Scott for many years.

They would have known that without a magnetic observatory, Melbourne, where there was already an established magnetic observatory, would be the base.

It's just a family group, but one with different threads of power and influence.

Charles Williams: "A Lion in Courage"; New Zealand Maritime Hero

By Bill Conroy

Seaman/Stoker Charles Williams (DSM), the son of Master Mariner Capt. J. H. Williams and his wife Elizabeth, was born on 22 June 1881 in Nelson but spent his early years in Lyttelton. Later, emulating his father, he made the sea his career. During his relatively short life Williams made three trips to the Antarctic on *Terra Nova*, and, during World War I, served on five Royal Navy ships in the naval conflict around the United Kingdom – a good part of that service under the command of E. R. G. R. (Teddy) Evans (later Lord Mountevans). Williams appears to have earned his captain's respect, trust, and friendship, because in a letter to the parents following Williams's death in 1919 Teddy Evans was very forthright in his praise of his former shipmate. But, more of that later.

In 1897 at the age of 16 years, after completing his schooling at the Lyttelton District High School, Charles Williams entered merchant service on a schooner engaged in the New Zealand trade and started out on a very adventurous seafaring career.

The New Zealand Royal Navy Reserve had its genesis when the first navy training ship, in the form of HMS *Tauranga*, arrived in Auckland in July 1904 and began recruiting trainees. Williams soon joined the crew and served with *Tauranga* during her five-month stay in New Zealand. Williams was on that ship (along with 70–80 naval recruits) when she got caught in a violent storm on 12–14 October 1904, while on passage from Lyttelton to Wellington, and lost her First Lieutenant (A. J. Payne) overboard. According to newspaper reports of the incident Williams is mentioned as having conducted himself with some courage during the storm.[1,2]

In 1909 Williams left the navy, returned to Lyttelton, and resumed his former life. The run ashore was relatively brief, however, because, in late October 1910, *Terra Nova* and the British Antarctic Expedition arrived in Lyttelton and began to recruit local seamen to top up the crew for the voyage to Antarctica. Williams, as a "time expired" navy man, signed on to fill the place of a man who was to remain with the Antarctic shore parties.

Williams remained with *Terra Nova* throughout her service with the expedition, except for a period between July and October 1912 when the vessel was in dry dock at Lyttelton and most of the crew was carrying out survey work by launch in Admiralty Bay in the Marlborough Sounds.[3] The New Zealand-recruited seamen were temporarily paid off until *Terra Nova* was ready to return to work in late October 1912.[4]

Williams was in the crew for the voyage back to the UK, where *Terra Nova* was decommissioned in June 1913.[5] When he left *Terra Nova* Williams returned to Lyttelton and again took up his life ashore – until the outbreak of the Great War.

In March 1915 Williams sailed for the UK, where, on 1 May 1915, he joined the Royal Navy and reported to HMS *Pembroke* (at the Chatham Dockyard) for training as a stoker. It was the beginning of a dramatic and action-filled three-plus years serving in five Royal Navy ships in the waters around the United Kingdom, much of it under the command of Teddy Evans – most notably on HMS *Broke*, where Williams served as a stoker from 25 March 1917 until 5 November 1918. Evans commanded this ship from December 1916 to 25 October 1917.[6]

During his service in UK waters Williams was on a vessel that struck a mine (HMS *Viking*, 21 January 1916) and one that was badly damaged by shell fire (HMS *Conquest*). In both cases the ships suffered casualties but Williams escaped unscathed.

It was on HMS *Broke* under Evans's command that Stoker Williams showed his bravery and true mettle and came to official notice. Just before midnight on the night of 20–21 April 1917, six German Zeebrugge-based destroyers shelled Calais and then moved further into the English Channel and opened fire on Dover and the surrounding Kent countryside. That task complete, the German ships continued south and encountered HMS *Swift* and *Broke*, and opened fire. In the ensuing melee *Swift* was damaged, lost her radio, and eventually had to give up and make her way home. Undaunted, Evans threw *Broke* into the fight and rammed a German vessel amidships at high speed; the two ships were locked together.

1 "Recruiting for HMS *Tauranga*", *The Auckland Star*, 13 July 1904, p. 4.
2 "Loss of Lieut. Payne", *The Auckland Star,* 17 October 1904, p. 5.
3 See "A *Terra Nova* Mystery", *Antarctic*, Vol 34(1), December 2016, pp. 2–3.
4 E. R. G. R. Evans, *South with Scott* (London: Collins, 1921).
5 "Expedition's Return to England", *Nelson Evening Mail*, 12 February 1919, p. 5.
6 Royal Navy service record for Charles Williams (ADM 188/921/27358).

To partially quote the official account:

> *Broke's* sailors had to repel German boarders in hand to hand fighting while *Broke* exchanged fire with the German destroyer at point blank range. Getting clear *Broke* limped eastwards with boiler rooms badly damaged, steam dropping, half of the bridge on fire and decks swept with shell fire. Evans turned back and silenced the two damaged enemy ships but then *Broke's* engines stopped and she drifted. At this point three Royal Navy destroyers reached *Broke* and took her in tow for Dover. The engagement had cost *Broke* dearly with 21 men killed and 36 wounded. *Swift* and *Broke* were in dockyard hands for several weeks but there were no more German destroyer raids on the Dover Straits for ten months. Commander Evans was feted in the British press and he became known as "Evans of the *Broke*."[7]

During this engagement Stoker Williams conducted himself in a very gallant way. It is said that when the fight began Williams did outstanding work, at great risk, in attending to and securing the safety of the wounded. Later he was involved in the hand to hand fighting with the enemy when they boarded the *Broke*.

On 10 May 1917 *The London Gazette* announced the award of the Distinguished Service Medal (DSM) to Stoker Williams. His Royal Navy service record carries the words: "The Minister of Defence is to be informed in the event that this man is a casualty (Vide MP 3877)."[8]

In addition to service on HMS *Broke*, Charles Williams also served on the HMS *Attentive*, *Conquest*, *Viking*, and *Active*. Teddy Evans commanded the last two ships at times when Williams was in the crew.

Williams returned to New Zealand in mid-April 1919. His service record shows him as "Demobbed" on 21 June 1919. Back in New Zealand Williams set about settling into civilian life. He found himself very much a hero and the local papers gave full rein to literary licence as they enthusiastically, often with more creativity than accuracy, recounted the local lad's heroic deeds on the high seas.[9]

In September 1919, Williams signed on as a seaman on the SS *Tainui*, a wooden cargo ship operating along the New Zealand coast. At 6.30 p.m. on 15 September 1919, *Tainui* left Lyttelton bound for Wanganui with a mixed cargo, including 2,000 cases of benzene. At about 2.30 the following morning when the ship was off the North Canterbury coast, there was an explosion on board and *Tainui* was quickly engulfed in flames. A lifeboat was launched but it overturned and broke away with seven crewmen clinging to it. Williams decided to swim for shore and called to the others to follow him. Two men joined Williams as he left the boat and struck out. They did not reach the shore alive. Eight of the nine man crew drowned, with the ship's cook being the only survivor. Williams's body was recovered and he was buried in the Bromley Cemetery, Christchurch, on 19 September 1919; he was 38 years old.[10]

In February 1920 Stoker Williams's former shipmate Commander Teddy Evans wrote to Charles's parents, describing their late son as "a lion in courage". Evans said:

> I had grown to look upon him as a friend and a man to be implicitly relied upon. In those long gales and buffetings which we encountered in that dreary stretch of ocean between New Zealand and the Antarctic Continent, your son was always to the fore, a tower of strength and a lion of courage… We were in many bombardments and destroyer actions together, and of no man I know can it be better said that he was steel true and a modest, gallant British sailor… The list of the gallant *Terra Nova* men is dwindling fast, for we lost many in the war. The nation can ill afford to lose such men, at such an age.[11]

Generous praise indeed, Stoker Williams! Well done!

The author gratefully acknowledges the assistance received from the following in the preparation of this article:

(a) Christchurch City Libraries
(b) National Museum of the Royal New Zealand Navy
(c) Poulsom, N. W. & Myres, J. A. L. (2000), *British Polar Exploration and Research: A Historical and Medallic Record with Biographies 1818–1999.* London: Savannah Publications
(d) Sarndra Lees, *Random Meanderings*. invokinglibitina.blogspot.com/
(e) Scott Polar Research Institute, UK
(f) Tauranga City Libraries

7 *World War 1 at Sea: Naval Battles in Outline: DOVER, German Destroyer Attack on the Straits of Dover – 21 April 1917.* http://www.naval-history.net/WW1Battle1704Dover.htm

8 Royal Navy service record for Charles Williams (ADM 188/921/27358).

9 "A Christchurch Hero", *The Sun*, 26 April 1919, p. 9.

10 "*Tainui* Tragedy", *The Ashburton Guardian*, 18 September 1919, p. 4.

11 *The Otago Daily Times*, 13 February 1920, p. 4.

From *The Press* of 13 December 1919, page 8, we read that "At the Lyttelton District High School yesterday afternoon, a portrait of the late Seaman Charles Williams, who lost his life in the *Tainui* disaster, was unveiled… The portrait, which is in oils, by Mr Williamson, shows the late Seaman Williams in naval uniform, wearing the D. S. M. and the Antarctic Medal." Following the Christchurch earthquakes, the painting is now in storage, and not immediately available. We hope to publish a copy of this portrait at a future date. –Ed.

The Man who Shared a Cabin with Shackleton: Morton Moyes and the *Aurora* Relief Expedition, 1916–17

By Richard McElrea, QSO

When polar mariner John King Davis was given command of the *Aurora* Relief Expedition[1] in September 1916, he made several key appointments from the ranks of those who had previously served with him in Antarctic waters. One of these was Morton Henry Moyes, born in 1886 at Koolunga, South Australia.[2] In his 1962 book, Davis records:

> Another old friend of former days was Instructor Commander M. H. Moyes, who was later to rise to high rank in the Royal Australian Navy. He had been one of Frank Wild's western party in the Australasian Antarctic Expedition and his services were now made available as navigator for any sledge journeys that might have to be undertaken.[3]

In December 1971, with Harry Burson, I spent a memorable time at Ross Island, Antarctica, working as a volunteer New Zealand Antarctic Society "hut caretaker" at the historic huts of Robert Scott and Ernest Shackleton. Through correspondence with polar historian Les Quartermain of Wellington, and by reading his excellent histories of Antarctic exploration, I learnt the names of several men then still alive who had been part of those early expeditions. There were three Australians: Richard Walter Richards, Irvine Owen Gaze, and Moyes.

Early in 1977, Irvine Gaze was a guest of honour in Christchurch at the opening of the Antarctic Centre, Canterbury Museum. I had been corresponding with him and Richards prior to then and subsequently met Richards in Australia. Moyes was also invited but could not attend. He sent a gift for the Antarctic Centre of a book of nautical tables used in the navigation of the ships of four Antarctic expeditions, originally owned by Captain Davis.[4]

In September 1977 I wrote to Moyes, explaining that I had started to research in my spare time the story of the Ross Sea Party 1914–17 and hoped that I would be able to "publish a volume" on it.[5] He was generous in his response.

I met with Moyes in a rest home in New South Wales, in June 1980 on a private visit to Australia. He was aged 93 years. His eyesight was very limited and he could see me as silhouette outline only. He was

"I got what I thought would be necessary if I had to go and search for anyone down there. Then of course a week before we left who should turn up but Shackleton himself!"

1 As to the overlap between the Ross Sea component of the Imperial Trans-Antarctic Expedition 1914–17 and the *Aurora* Relief Expedition, refer Richard McElrea and David Harrowfield, *Polar Castaways: The Ross Sea Party (1914–17) of Sir Ernest Shackleton*, Canterbury University Press/McGill-Queen's University Press, 2004, p. 9. As to Davis's appointment, refer pp. 215–226.

2 Denis Fairfax, www.navy.gov.au/biography/commander-morton-henry-moyes

3 J. K. Davis, *High Latitude*, Melbourne University Press, 1962, p. 260.

4 "Morton Moyes served twice with Mawson", *Antarctic* 9(8):290, 1981 (Ed. J. M. Caffin).

5 Margery and James Fisher in their 1957 biography of Shackleton had laid down a challenge suggesting this history was still to be written. David Harrowfield joined the project in 1981 and *Polar Castaways* was published in 2004.

cheerful and alert. Our conversation, recorded on tape, ranged widely: his Antarctic experience with Frank Wild's western base party (Queen Mary Land) as a member of the Australasian Antarctic Expedition 1911–14, the *Aurora* Relief Expedition, and his unhappy experience with Davis on the first BANZARE voyage 1929–1930.

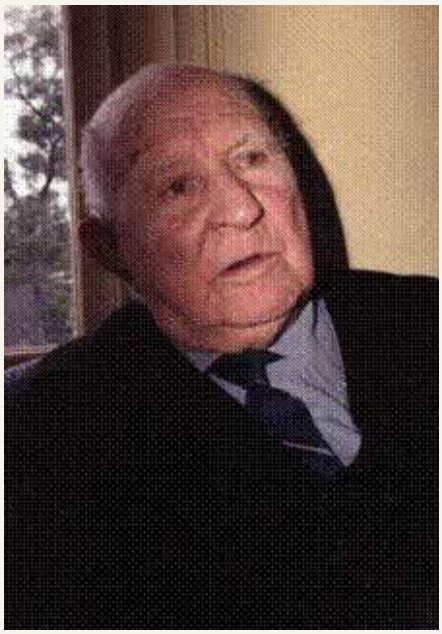
He said he remembered the *Aurora* Relief Expedition "pretty clearly." In 1916 he was the only instructor in navigation at the Royal Australian Naval College. He "got a shock" when he was told he was seconded for navigating duties with the expedition. A replacement instructor was being sent from England and this enabled Moyes to be released.[6]

He travelled to Port Chalmers, where *Aurora* had been under repair for over 12 months.[7] "I got what I thought would be necessary if I had to go and search for anyone down there. Then of course a week before we left who should turn up but Shackleton himself!" There was an "argument as to who would lead the expedition but the New Zealand Government insisted that Captain Davis would still be leader." In fact this had been well settled in previous months and Shackleton had no option but to accept he would be under the command of Captain Davis.[8]

Moyes could not be referred to as an officer as he "wasn't merchant service." He was called the "staff officer", but at Davis's request took over navigating duties as soon as they left port. This involved "extra sights" because of lack of knowledge of tides or current in southern waters.[9]

Sir Ernest Shackleton shared a cabin with the staff officer. Moyes referred to him as being "very nervy" following his experiences in the Weddell Sea "getting his men away from [Elephant] Island". In the lower bunk, a restless Shackleton would say: "You awake Moyes, you awake?" They would go to the saloon and talk for an hour or two, or seek the warmth of the engine room. Moyes recalled: "He was rather worried that his expedition had failed." After some days Moyes observed that Shackleton looked "much better" than when he had first come aboard. Shackleton would recount "stories of life on the ice after the wreck of the *Endurance*". Shackleton and Moyes discussed what may lie ahead of them. Their hope was to find alive and well the 10 men who had been left behind when *Aurora* broke out in May 1915, and "come straight back."

As the ship got within a day's sailing of its destination of Cape Evans, Moyes recorded that everyone became "under rather a tension as tomorrow may mean so much – 5 weeks sledging and looking for dead men or return to Australia at once."[10]



Commander Morton Moyes, aged 93, at his address in Roseville, NSW, Australia, 12 June 1980. *Photo: Richard McElrea.*

Aurora reached Cape Royds, northward of Cape Evans on 10 January 1917. Sea ice blocked further passage south. Shackleton, Moyes, Howard Ninnis, and "the Doctor" (Frederick Middleton) went ashore to Shackleton's old hut. There they found a note dated December 1915 saying the party was at Cape Evans.[11] Before they had returned to the ship "the man on the lookout called out there was something on the ice ahead…"

The dramatic story of the meeting with the survivors is told elsewhere.[12] It was soon learnt three members of the party had died. Moyes, one of the three men who met the advancing figures, told me he had "never seen anything like it

6 Moyes was educated at the Collegiate School of St Peter, Adelaide, and the University of Adelaide, graduating BSc in 1910 before teaching at Townsville Grammar School. At university he had been impressed by his geology lecturer Douglas Mawson, and he successfully applied to join Mawson's expedition in 1911 and served as meteorologist to Wild's western base party. In March 1913 he became Headmaster of the University Coaching College in Sydney from where he was recruited to the newly formed Royal Australian Naval College. His duties were considered of national importance and prevented him from enlisting in the Australian Imperial Force despite his pleas for "active service in the navy" (Denis Fairfax, www.navy.gov.au/biography/commander-morton-henry-moyes).

7 The ship had broken out from Cape Evans on 6 May 1915 with 18 men on board, and drifted in the pack ice of the Ross Sea until 14 March 1916 when it was released to open water. Under jury rudder *Aurora* reached Port Chalmers on 3 April 1916 (refer *Polar Castaways*, chapters 10, 12, and 15).

8 Refer *Polar Castaways*, pp. 212–227.

9 In a 1921 article, Davis referred to Moyes acting "as surveyor and meteorologist… also to be available for shore journeys" (*Life*, 1 March 1921). Davis curiously makes no reference to Moyes's navigational role.

10 Moyes diary, 9 January 1917, Mitchell Library.

11 Refer *Polar Castaways*, p. 245. Moyes refers in his diary to "a note with no information dated Dec. 1915".

12 Refer *Polar Castaways*, pp. 245–251.

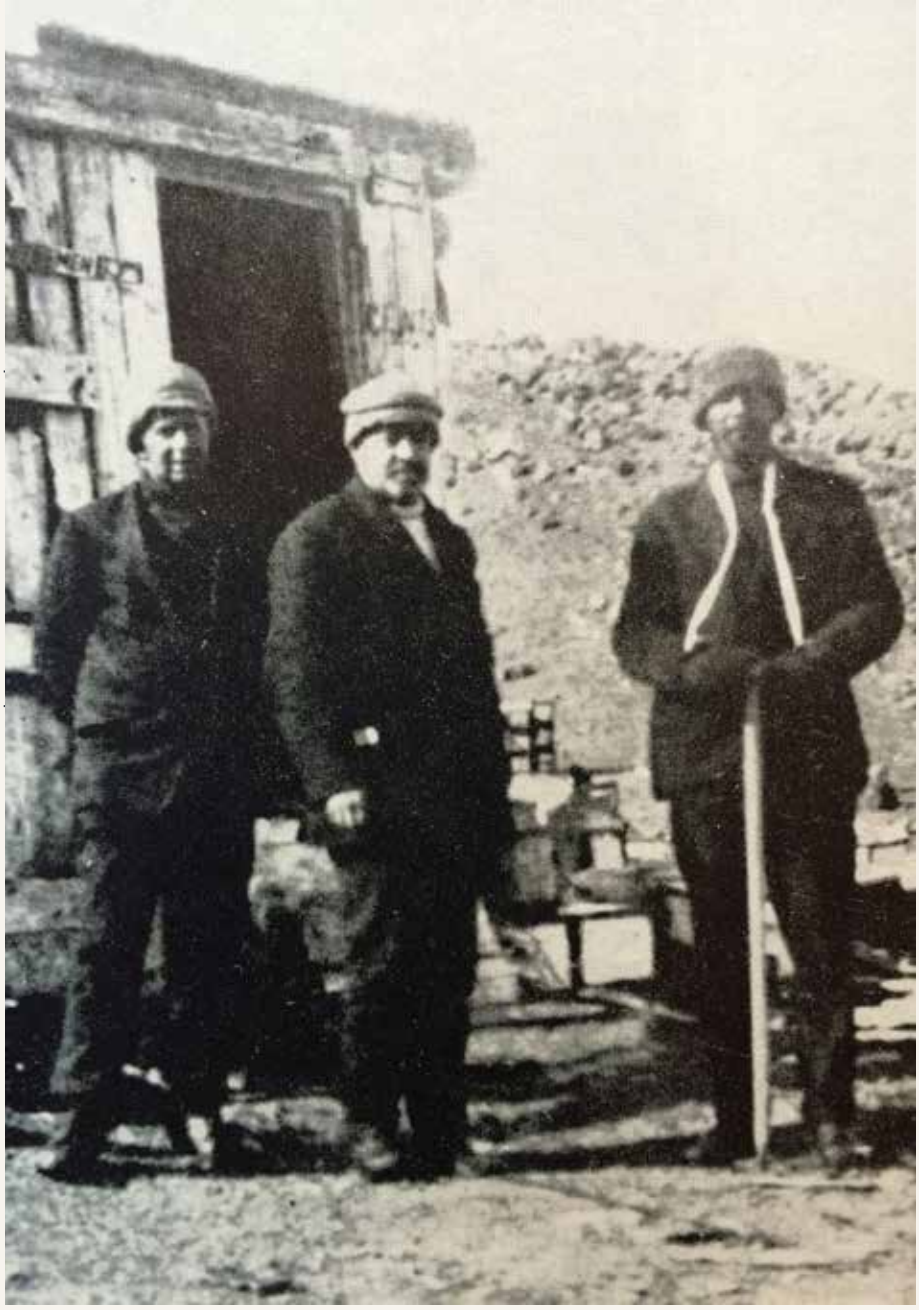
in [his] life". He said they "looked dreadful". The men had been without soap, and had run out of coal in the second winter. They had greasy clothes and their faces were "dirty brown". Seal blubber used as fuel in the hut had produced a "nasty greasy smoke…and it had got through their hair and everywhere. They were a dreadful looking lot."

Moyes expressed admiration that they had "absolutely completely got on and done the job that Shackleton had asked them to do".

Shackleton led search parties to nearby areas looking for the bodies of Æneas Mackintosh and Victor Hayward who had last been seen when they left *Discovery* Hut in an attempt to reach Cape Evans, on 8 May 1916. Davis kept Moyes on board to assist in searching the western side of McMurdo Sound for any sign of the lost pair. Moyes observed: "It was of course a forlorn effort." Moyes also helped in loading stores and specimens from the Cape Royds hut to the ship.

Shackleton's priority was to search for the remains of the two men. This prevented him from making a sledge journey to the grave of Rev. Arnold Spencer-Smith, who had died on 9 March 1916, northward of White Island on the "Great Ice Barrier".[13]

On the return voyage to New Zealand Shackleton told Moyes he would be selling the ship within days as he wanted to "get back to the war". Moyes sailed for Sydney shortly after arrival in Wellington to return to his duties at the naval college. Davis, who arrived in Sydney a few days later, presented him with a parcel containing a theodolite, a gift from Shackleton.



(L–R:) Frederick Middleton, Sir Ernest Shackleton, and Morton Moyes at the Cape Royds hut, 10 January 1917. *From: Two Huts in the Antarctic by L. B. Quartermain. Wellington: R. E. Owen, Government Printer, 1963.*

When I asked Moyes whether he felt that he was part of the Heroic Era, he replied: "I do now. I didn't then."

Captain Morton Moyes OBE died the year following our meeting, on 20 September 1981. He was the holder of Polar Medals in silver and bronze and a bronze clasp. Antarctic features bear his name – Cape Moyes (66° 35' S, 96° 25' E), Moyes Islands (67° 01' S, 143° 51' E), and Moyes Peak (67° 45' S, 61° 13' E).[14]

13 See map (third to last) following p. 208, *Polar Castaways*, showing position of grave, and map opposite, showing movements of *Aurora* and search parties 10–17 January 1917.

14 *Antarctic* 9(8):291, 1981.

Remembering a Diplomatic Breakthrough for the Ross Sea

On 1 December, the world's largest Marine Protected Area came into force in the Ross Sea. New Zealand diplomat *Jillian Dempster* was there in Hobart, a year ago, when the deal was dramatically struck.

The Ross Sea is one of the world's most spectacular places. Directly south of New Zealand, its pristine waters are an abundant source of Antarctic wildlife, from emperor penguins and killer whales to Antarctic toothfish and sponges that live for 500 years. This month, a New Zealand-sponsored plan for a marine protected area (MPA) in the Ross Sea came into force. The MPA is massive – at more than six times the size of New Zealand, it will be the largest in the world. More than a million square kilometres of ocean will be protected from fishing of any sort. Two further research areas, amounting to nearly half of that space again, will allow limited, monitored fishing.

While the case for these new protections has been strong for years, the MPA was no sure thing. Getting it over the finish line took an immense effort – from government agencies, scientists, NGOs, the fishing industry and world leaders. And we were up against it. When I arrived in Hobart just over a year ago for the annual meeting of CCAMLR – the Commission for the Conservation of Antarctic Marine Living Resources – I had almost no expectation that the MPA was about to win approval. Years of previous meetings had ended in disappointment. As a diplomat involved in multilateral negotiations, I know all about slow progress – or, as I sometimes call it, bashing my head against a wall – but this felt like no progress. Even though we had a viable proposal, put forward jointly by New Zealand and our partners the United States, and even though our science was detailed and sound, it looked like we wouldn't persuade everyone. That means failure, because a new MPA needs consensus from all 24 member countries and the European Union.

Then, in the middle of last year's meeting, the landscape changed. Russia, which had opposed the MPA for several years, suddenly said it was open to negotiating a deal. I remember the day clearly. First there was the sheer surprise – you could hear a pin drop when we got the news. That gave way to a fresh momentum. With a huge amount of technical work still to do, we went into what would usually be a dry, laborious meeting. But this one was the opposite: we began agreeing on key details one after the other, like magic.

So what happened? How did the Ross Sea MPA finally become a reality? While Russia was the last to agree, it wasn't all about one country. It was mostly about years of hard work and determined, creative diplomacy – from New Zealand's substantial, ongoing investment in Ross Sea science, to quiet meetings in the corners of CCAMLR, to arguing our case in capital cities around the world, to agreeing on major concessions with many countries. Advocacy from politicians, including former US Secretary of State John Kerry, was another critical factor late in the piece. All that bashing our heads against the wall added up.

There's still plenty of work to do. One condition for the agreement was regular scientific monitoring, which will be an important gauge of whether the MPA is succeeding in its conservation goals. But that's the job ahead. Right now we can celebrate an environmental achievement that New Zealand should take real pride in. I'm hoping the Ross Sea MPA will be a model for protecting more of the world's seas and oceans – in Antarctica and everywhere else.

Jillian Dempster is New Zealand's Permanent Representative to the United Nations in Geneva. In 2016, she was head of the Ministry of Foreign Affairs and Trade's Antarctic and Southern Ocean Unit and New Zealand's Commissioner to CCAMLR.

Photo above: Former New Zealand Commissioner to CCAMLR Jillian Dempster, left, with her United States counterpart Evan Bloom, centre, and CCAMLR Chair Vasily Titushkin, in 2016. *Photo: Doro Forck / CCAMLR.*

Tribute: Norman Hardie: December 1924–October 2017

By Colin Monteath

I first met Christchurch mountaineer Norman Hardie in May 1983 when I was Field Operations Officer for the New Zealand Antarctic Research Programme. I introduced myself and asked Norman if he fancied a five-month stint as leader of Scott Base. He had been to Antarctica before as a survival instructor in the early 1960s, and, in 1967, as a surveyor with Sir Edmund Hillary's expedition that went on to make the first ascent of the elegant Mt Herschel in northern Victoria Land. A friendship, started here at my desk and carried on during that summer at Scott Base, has endured and deepened over the years.

Norman David Hardie was born in Timaru on 28 December 1924. He was educated at Timaru Boys' High School, then at the University of Otago and the University of Canterbury, graduating with BE in Civil Engineering. His first job, in 1948, was with the Ministry of Works at Lake Pukaki. By 1951 Norman was in London, where for the next four years he worked for a consulting engineering company. While there, Norman married University of Canterbury friend Enid Hurst. He returned to Christchurch in 1955 to work as a consulting engineer. Norman became the chairman of the Canterbury Branch of the New Zealand Institution of Engineers (1969–71) and was later made a Distinguished Fellow of the Institution of Professional Engineers of New Zealand.

Norman's mountain life started during the late 1930s as a government deer culler. During his final university years his interest in hunting led him to the Canterbury University Tramping Club and this fostered a desire to take up mountaineering. Climbs at the head of the Rakaia followed in 1946, as did ventures into the Landsborough River catchment, and a first ascent of the still rarely climbed south ridge of Sefton. Norman's role in the 1948 rescue of a badly injured Ruth Adams, from close to the summit of La Perouse, was written up in his autobiography *On My Own Two Feet* (2006).

As a mountaineer based in London, he was asked by John Hunt to volunteer his time and expertise to co-facilitate the ground work for the 1953 Everest expedition that was sponsored by the Royal Geographical Society. In 1954 Norman finally got his break to climb in the Nepal Himalayas, joining the New Zealand Alpine Club Barun Valley expedition led by Hillary. Some 20 new climbs were completed in what is now the Makalu-Barun National Park, including the 7,000-metre plum Baruntse. Norman was the deputy leader of the 1955 British expedition to Kangchenjunga, the world's third-highest mountain. He helped to refine the oxygen equipment for this venture. Ostensibly a reconnaissance, it quickly turned into a full-blown assault on the summit. Joe Brown and George Band reached the summit first, with Norman and Tony Streather summiting the following day. After the Kangchenjunga climb Norman and some Sherpas set out to walk all the way to the Khumbu. This journey forms the basis of Norman's first book *In Highest Nepal* (1957), which was later translated into German and Japanese. Following his participation in Ed Hillary's 1960–61 Himalayan Scientific and Mountaineering (Silver Hut) Expedition, the Khumbu became central to Norman's life for several decades. He played a key role in the functioning of the Himalayan Trust, remaining on its board from 1966 to 1988. During this period Norman and Enid made 14 visits to Nepal for school building, national park work, and re-afforestation programmes.

Norman served for 21 years on various New Zealand Alpine Club committees and was NZAC president from 1973 to 1975. He also served on the Arthur's Pass National Park Board and on the Craigieburn Forest Park Committee. He was a member of the Christchurch Civic Trust Board and the College House Board. In 1992 Norman was awarded the Queen's Service Order for services to mountaineering and conservation. He was an Honorary Life Member of the Alpine Club (UK) and The Himalayan Club, and Life Member of the New Zealand Antarctic Society and the New Zealand Alpine Club.

Norman retained a deep interest in engineering and mountaineering throughout his life, attending and giving lectures and offering advice to younger climbers. He helped innumerable authors get Nepalese facts straight, as well as offering editorial advice on draft manuscripts and journal articles.

Norman is survived by his wife Enid, daughters Sarah Jane Hardie and Ruth Wells, and grandchildren Henry, Tamar, and Roslyn Wells and David Turton.

Norman Hardie, at Scott Base 1983.
Photo courtesy of Colin Monteath, Hedgehog House, New Zealand.

Thank you!

I would like to take this opportunity to thank those contributors and reviewers who have contributed articles and assisted in the production of Antarctic over the last year. Some have written, some have reviewed, and some have responded to question after question from this Editor. My thanks to Gus Anning, Antarctic Heritage Trust, Antarctica New Zealand, Peter Barrett, Margaret Bradshaw, Janet Bray, Anderson Chaplow, Trevor Chinn, John Clemens, Bill Conroy, Fred Davey, Jillian Dempster, Brett Fotheringham, Sean Garwood, Gusto Design, Arnold and Jan Heine, Grant Hunter, George Jones, Anita Kerr, Linda Kestle, Richard McElrea, Sue Molloy, Colin and Betty Monteath, Timothy Naish, Simon Nathan, Robin Ormerod, Bob Park, Michelle Rogan-Finnemore, Bryan Storey, Sue Stubenvoll, Oliver Sutherland, Joanna Szczepanski, The Antarctic Office, Tony Thrupp, Myra Walton, Nigel Watson, Mike Wing, and Mariska Wouters.

Lester Chaplow

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PIONEERING WOMEN HONOURED IN ANTARCTICA

Antarctica New Zealand has named three science laboratories at the newly refurbished Hillary Field Centre at Scott Base after pioneering Antarctic women. The three women, all from New Zealand, are Pamela Young – the first woman to work at Scott Base (1969–70), and one of the first women at the South Pole (November 1969 – jointly with five others), Thelma Rogers – the first woman to spend an entire winter in Antarctica (in 1979), and Margaret Bradshaw – the first woman to lead a deep-field science event in Antarctica (1979–80).

Wal's Dog on Ice

In our June issue this year, we noted the passing of Murray Ball, the creator of the Footrot Flats cartoons. Here, our back cover piece by Trevor Chinn remembers Wal's Dog on Ice.

By Trevor Chinn

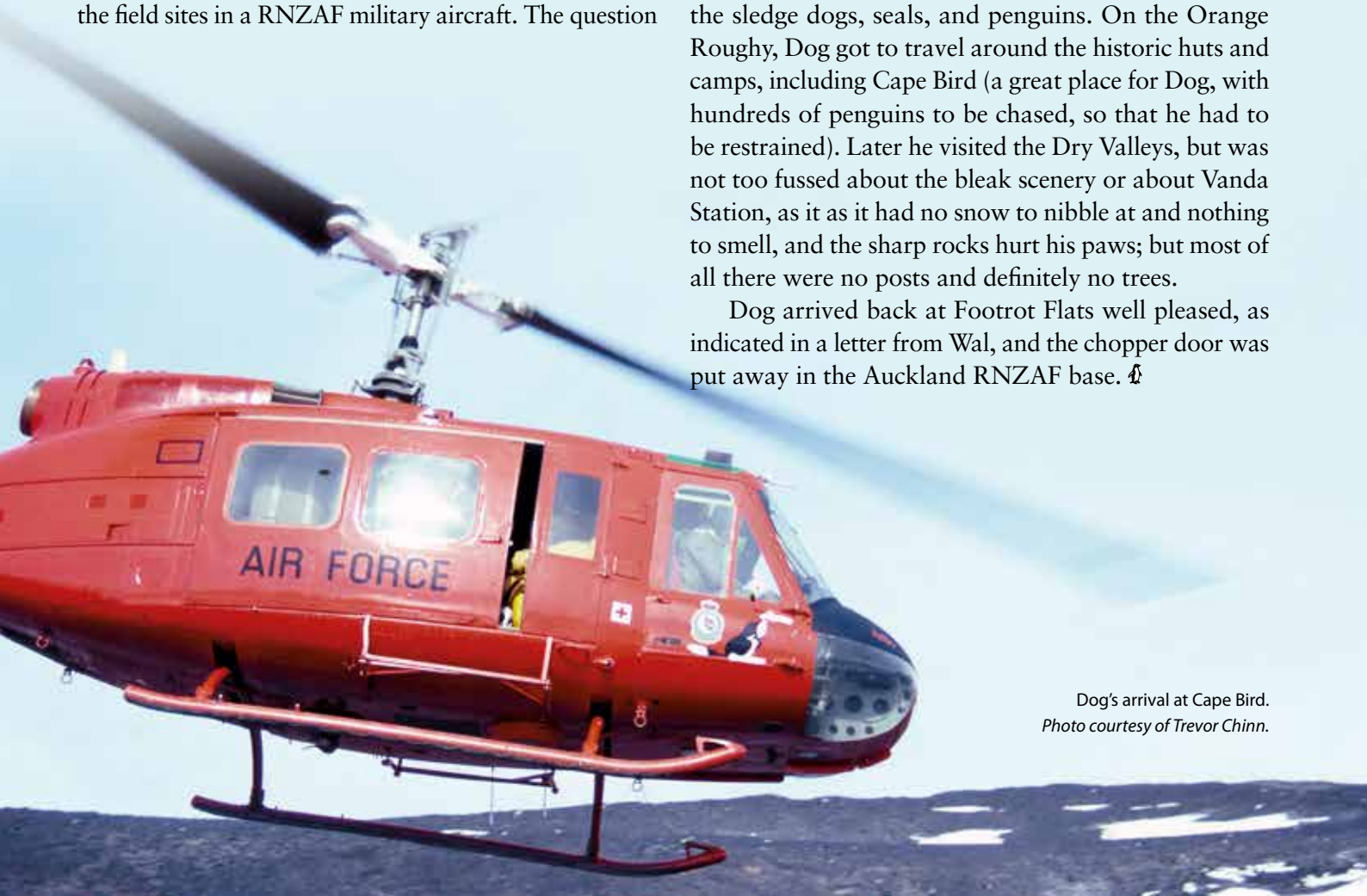
In days of old when dogs were gold, and sledging in Antarctica was the king of sports, an addition was made to the US Huey Iroquois helicopter group serving adventurers in McMurdo Sound. The addition was the first of the Royal New Zealand Air Force helicopters to assist with both the New Zealand Antarctic Research Programme and the US Antarctic Research Program, and in preparation the New Zealand Huey had been painted in the US Airforce aircraft-orange, and thus immediately became known as the *Orange Roughy*. This example of co-operation between the USARP and NZARP provided an opportunity for another New Zealand hero to make the trip down to "The Ice". Accordingly, the heroic and well-known Wal's Dog of Footrot Flats was nominated to join the southern VIP visits. Being a first in a number of respects, there were permissions to obtain and red tape to complete. First of all, permission had to be sought from the Dog's master, Wal of Footrot Flats Dog Squadron. When the suggestion was put to Wal he replied with great enthusiasm.

The next job was to get the dog set up in the Orange Roughy Huey for visiting the huskies and going around the field sites in a RNZAF military aircraft. The question "Who do you go to get permission to paint your own graffiti onto a military aircraft?" was considered a bit of a challenge. After some subtle and tactful questions around the bars and shuffleboards of Mac Town, it quickly became apparent that the higher the rank, the less they wanted to hear of Dog's needs. Indeed, after a number of visits to huts and bars, and more cans, it turned out that not even the pilots were able to give such permission, as it happens that it's the crewman who is the one who "owns" the aircraft and is responsible for its maintenance and well-being. The pilots only fly it. Once the crewman was contacted there was an end to such problems.

To prepare a place for Dog, templates, paints, and brushes were brought over to the Mac Town helipad, where the crewman helpfully took the co-pilot's door off to make the delicate painting job easier. The temperature was only about -5 °C, so the paint behaved. And there were no visits by any curious provosts. Where else could you paint up a military aircraft?!

Once Dog's flying position had been completed, he was off daily to the field sites. Dog was happy to travel out in the breeze, sniffing in the wafting from the sledge dogs, seals, and penguins. On the Orange Roughy, Dog got to travel around the historic huts and camps, including Cape Bird (a great place for Dog, with hundreds of penguins to be chased, so that he had to be restrained). Later he visited the Dry Valleys, but was not too fussed about the bleak scenery or about Vanda Station, as it as it had no snow to nibble at and nothing to smell, and the sharp rocks hurt his paws; but most of all there were no posts and definitely no trees.

Dog arrived back at Footrot Flats well pleased, as indicated in a letter from Wal, and the chopper door was put away in the Auckland RNZAF base.



Dog's arrival at Cape Bird.
Photo courtesy of Trevor Chinn.