Australian Centre *for* Excellence in Antarctic Science

A Special Research Initiative of the Australian Research Council

Strategic Plan 2021-2025

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RESEARCH *in the national interest ~ enabling the future*

Executive Summary

The Australian Research Council (ARC) **Australian Centre for Excellence in Antarctic Science (ACEAS)** will be a national-scale, University-led, international centre focused on this goal:

To help the world community prepare for climate risks emerging from East Antarctica and the Southern Ocean by integrating knowledge of the ocean, atmosphere, cryosphere and ecosystems, and their interplay.

ACEAS aspires to make significant contributions in four ways:

1. **Research impact** — developing knowledge that will reduce the chance of surprises and passing of unexpected tipping points in East Antarctica and the adjacent Southern Ocean.
2. **Establishing fundamental datasets and tools of international significance** — revealing key processes, observations of state and change, and developing new capability for predicting the future of East Antarctica and the Southern Ocean.
3. **Partnership and stakeholder engagement** — working with key stakeholder groups across industry and government, and international policy-informing and regulatory agencies.
4. **Workforce development** — developing a new generation of Antarctic graduates and early-career researchers trained broadly in Antarctic science, law, governance, and policy, and ready for jobs in industry, government, and academia.

The Centre will take five strategic approaches by:

1. Undertaking world-class integrated research;
2. Maximising strong national and international partnerships;
3. Employing a diverse workforce;
4. Leveraging and creating national research infrastructure; and
5. Creating pathways to local, regional, and circumpolar impact.

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ACEAS Overview

The ARC Australian Centre for Excellence in Antarctic Science is a collaboration between universities and government agencies committed to delivering new knowledge of East Antarctica and the adjacent Southern Ocean to the community, governments, industry, and academia.

The future evolution of East Antarctica and the Southern Ocean will affect a large proportion of the global population, through exacerbating or mitigating climate change with consequent impacts on physical environments and ecosystems, including sea-level rise. Industries, infrastructure, housing, and lifestyles will be changed as the ice sheet increasingly discharges more ice into the Southern Ocean, and as heat and carbon are exchanged between the atmosphere and the ocean. The exact changes that will emerge, the timescale over which they will emerge, and the impact they will have, remain highly uncertain.

Decades of human endeavour in Antarctica have regularly revealed surprises, including, that parts of the continent may now have passed unnoticed through tipping points. For example, where too much ice is lost from ice shelves causing irreversible retreat in glaciers. Many of these tipping points remain poorly understood and more will no doubt emerge — including from the Australian Antarctic Territory in East Antarctica. However, humanity needs to avoid such surprises, requiring a confident understanding of such tipping points, the timescales over which they could be passed, and the consequences of passing them.

ACEAS brings together 39 Chief Investigators (CIs) from across eight Australian universities — all of whom are experts in Antarctic and/or Southern Ocean studies — with experts in government agencies in Australia as well as from leading universities and research agencies overseas. ACEAS is led by the University of Tasmania, and includes the Australian National University, the University of New South Wales, the University of Melbourne, the University of South Australia, Curtin University, the University of Western Australia, and the University of Canberra. Funded by $25M of ARC and university contributions, ACEAS will commence in late 2021 and run for initially 4 years. It will undertake high impact research on East Antarctica and the Southern Ocean, to build fundamental knowledge and research capacity, to train early career scientists for broad careers, and to engage with domestic and international stakeholders.

The focus of ACEAS is on excellence in research and in seeking to understand a deeply coupled and complex environmental system. There are many aspects of Antarctic research where there is little or no knowledge. For example, the spatial limits of the ocean and ice, and pathways for ocean heat to melt the ice are not yet defined in some of the most vulnerable sectors of the continent, and without them projections cannot reliably be made of future sea level.

The research will be planned with a clear eye on making an impact on decisions made by domestic and international governments, recommendations made by policy-informing bodies, and preparations made for the impact of climate change by all sectors of society.

Where does the Centre want to be in 2025?

While understanding of Antarctica and the Southern Ocean has dramatically advanced over recent decades, a great deal remains to be discovered, and unexpected findings are not uncommon. For the community, businesses, and policy makers, this represents uncertainty, for example in climate and sea-level change, and related impacts on fisheries and aquaculture, agriculture, ecosystems, housing, infrastructure, and way of life.

ACEAS aims to deliver outputs and outcomes that will have a recognisable influence on the climate awareness and preparedness of the public, national and international agencies, governments, and businesses. New fundamental knowledge of Antarctica and the Southern Ocean generated by ACEAS will change the way the world sees the southernmost latitudes and leave a legacy upon which further research must be built and decisions made. By training early career experts in not just science, but also policy, law, and governance, ACEAS alumni will be employable in government and industry, and will be equipped in advanced data handling and skills required to engage widely across many sectors of the economy.

ACEAS aspires to make significant contributions in four ways:

- Research impact
- Fundamental datasets and tools of international significance
- Partnership and stakeholder engagement
- Workforce development

Research impact

By the end of 2025, ACEAS researchers will have developed a new understanding of key processes underway in and around Antarctica. New observations of change will have been made and models used to inform observational strategies, and observations will in turn be used for model development and validation. New analysis methods will have been pioneered and taken up by colleagues elsewhere.

ACEAS will make substantial progress in line with the Australian Antarctic Science Strategic Plan, most substantially in "ICE, OCEAN, ATMOSPHERE AND EARTH SYSTEMS: Understanding the role of Antarctica and the Southern Ocean on Australia and the World".

The research will advance the knowledge, approach and methods used by the research community globally, across disciplines of climate science broadly, sea level, ecosystems, geology, biogeochemistry, and others, including those working outside polar regions.

Establishing fundamental datasets and tools of international significance

By the end of 2025, ACEAS researchers will have collected or produced new and improved datasets from the field. These would have been implemented in unique predictive models, and used to develop new predictive tools, that will inform decision-making around the future of East Antarctica and the Southern Ocean. These will be generated through Research Programs 1-3. These predictive tools will be distributed in an open framework and promoted through international bodies to maximise their uptake.

The Research Programs will provide mechanisms for the collection of observational paleoclimate and model datasets through Antarctic fieldwork in areas previously un-sampled using sensors on autonomous platforms, seals, and satellites. Predictive models will be built on international collaborative efforts already underway and will be shared to maximise uptake.

The Centre will train dozens of early career researchers in the use of these datasets and models and in advanced data analytics.

Partnership and stakeholder engagement

By the end of 2025, ACEAS will have identified and built robust and meaningful partnerships with research and stakeholder groups across universities, domestic and international government agencies, and industry. Research impact plans will be developed, and stakeholder workshops will be held on a regular basis to report and communicate research results. Pathways to impact for select stakeholder needs will be identified, mapped, and actioned, and relationships will be developed to build trust. Stakeholders will co-design and collaborate in aspects of research activities. Regular summaries of research for policymakers will be published in collaboration with key partners, e.g., the Australian Antarctic Program Partnership (AAPP), and individually by ACEAS (e.g., an annual state of East Antarctica report).

New research partnerships will be developed, through cooperative fieldwork, sharing of data, coordinated research, and research visits. Researchers will be included in major international research programs that inform the forums of the Antarctic Treaty, notably through the Scientific Committee on Antarctic Research (SCAR) and the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Research of the Centre will have been used as evidence in policy-informing documents at the national and international level, including the United Nations Intergovernmental Panel on Climate Change (IPCC).

Workforce development

By the end of 2025, ACEAS will have supported the graduation of dozens of PhD, Masters, and Honours students, with training beyond Antarctic science but also governance, law, and policy — led by an ACEAS Graduate Training Coordinator. All students and researchers will be trained to communicate in different contexts, to prepare them for careers in industry and government, as well as in academia. Students will have access to training in outreach and media and advanced data analytics. Students and Early Career Researchers will be encouraged and supported to undertake internships in industry and government.

Measures of success

The Director will lead an annual review of ACEAS progress against key performance indicators which will be developed during the first six months of operation. Detailed plans will be developed for stakeholder engagement, graduate training, gender and ethnic diversification, employment, and others by the end of the first year of the Centre. Each Research Program and portfolio of effort (e.g., Graduate Research, Communications) will develop, update, and review progress against implementation plans.

Risk mitigation

All plans will include the identification of risk and approaches to mitigate it. Risk is particularly evident in the fieldwork components of the programs, where delays or cancellation of fieldwork will have substantial impact on downstream research plans. Such risks are common in Antarctic research, and contingency plans will be developed as such risks become clear. COVID-19 is a particular risk in providing as yet unknown restriction to international recruitment of staff and students; in dissemination of results and networking; and in the effect on fieldwork, including the commissioning of RSV *Nuyina*.

Beyond 2025

The vision for ACEAS is that it becomes a Centre that has the expertise, scale, and duration to deliver the outcome of *helping the world community prepare for climate risks emerging from East Antarctica and the Southern Ocean by integrating knowledge of the ocean, atmosphere, cryosphere and ecosystems, and their interplay*.

The widespread societal importance of the climate risks emerging from these regions makes the work of ACEAS urgent.

By 2025, ACEAS will have successfully made major strides toward building improved understanding of Southern Ocean and Antarctic systems through integrated knowledge of the ocean, atmosphere, cryosphere and ecosystems and their interplay; building the workforce; developing new and deeper partnerships and communication pathways; and developing fundamental datasets and tools of international significance and value.

As a stepping stone, by 2024 ACEAS will have developed clear pathways to impact and a road map for the future, begun to develop new predictive capabilities regarding the future of the Southern Ocean and ice sheet, and trained a further generation of experts in Antarctic science, governance and policy.

However, the depth and breadth of the unknowns in East Antarctica and the Southern Ocean mean the goal of ACEAS will only be met through resourcing beyond the funding provided out to 2025. As such, the period to 2025 is, in part, building a platform for the advances that will follow while also delivering important advances and impact immediately.

Strategic Objective 1: Undertaking world-class integrated research

Improving the robustness of predictions of the future of East Antarctica and the Southern Ocean requires a new understanding of the coupled ice-ocean-atmosphere-sea ice-solid Earth system advanced through model development, process understanding, laboratory analysis, and field and satellite observations.

1.1 The Centre will have three research programs.

Program 1: Circum Antarctic and East Antarctica — will focus on the following overarching question:

> *How can shifts in carbon, heat and moisture transport in the Antarctic and Southern Ocean system be better constrained to improve projections of future climate and sea level changes?*

Program 2: Regional East Antarctica and its provinces — will focus on the following overarching question:

> *What are the causal linkages between atmosphere, ocean, cryosphere, and their consequent effects on open water and under ice biogeochemistry and ecology in East Antarctica for past, present and future conditions?*

Program 3: Sub-regional and Regional Antarctic Margin — will focus on the following overarching question:

> *What is the risk of ice mass loss from key subglacial basins over the next decades to centuries, and what are the consequences for the local oceans and ecosystems?*

1.2 Undertake world-class integrated research.

The Centre will be underpinned by world-class research undertaken with integrity and with a commitment to excellence. The primary focus will be on the Centre's collective research outputs and outcomes.

1.3 Visibility of research outputs

The Centre's research outputs, from datasets to publications, will be freely available via public repositories. Datasets and model outputs will be available according to FAIR (findable, accessible, interoperable, and reusable) principles immediately upon publication.

1.4 Research designed for impact

Through collaboration with stakeholder groups the research will be co-developed within the ACEAS funding timeframe and beyond it. A robust understanding of stakeholder needs, including the relative importance and priority of different areas of research, and required types of outputs, will be vital in the development of plans to address these needs.

1.5 Structures that build collaboration

The Centre will establish policies that promote 'leaning in' to the goals of the Centre and the operation of an integrated centre, including cross-institutional supervision of researchers, working groups, workshops, and informal gatherings.

1.6 Playing a leading role in the realisation of the Australian Antarctic Science Strategic Plan.

The Centre will lead in realising the Australian Antarctic Science Strategic Plan in the categories of "ice, ocean, atmosphere, and Earth systems" and, will contribute to the strategic plan in the category of "digital integration". The Centre will provide important input to inform future reviews of strategy, and engage with the National Committee for Antarctic Research and the Australian Antarctic Science Council.

1.7 Investing in careers and development

Career mentoring and development will be provided for all staff and students. New appointees will be inducted into Centre policies, procedures, and culture. All mid-to-senior career staff will be trained and provided with opportunities to mentor early career staff.

Career development will also be provided in relation to stakeholder engagement skills, engaging with the media and policymakers, preparing grant applications, and education and outreach.

A mentoring plan will be developed within the first six months of the Centre's full operation.

The activities in Objective 1 will be coordinated by the Director in together with the Program Leaders, Graduate Training Coordinator, and Media Officer.

Strategic Objective 2: Maximising strong national and international partnerships

2.1 Developing cross-institutional partnership

The Centre will develop, through policy and practice, cultures of cross-institutional partnership, through postdoctoral and student supervision, training, and career development. Centre-wide working groups, expert groups, seminar series and structures for sharing datasets and analytical techniques will be developed.

2.2 Activities that develop partnership

Partners in Australia (including Government agencies) and overseas will be included in the activities and lifecycle of the Centre, including in student supervision, fieldwork planning and activities, and through participation in the Management Committee.

2.3 Fieldwork and research that is collaborative

ACEAS will work with the Australian Antarctic Division (AAD) and aligned centres, notably the Australian Antarctic Program Partnership (AAPP), and Safeguarding Antarctica's Environmental Future (SRI SAEF), to optimise fieldwork and research resources to achieve maximum outputs and leverage greater outcomes.

Research activity across AAPP and SAEF will be mapped to provide clarity around boundaries and collaborative activities.

Fieldwork collaborations will be developed for mutual benefit with other agencies which have aligned activities, for example the German EASI2/3 voyages.

2.4 Community enabler model

Australian researchers outside the Centre will be encouraged to collaborate with research and fieldwork to optimise the Centre's scale and reach. A structure will be developed for such researchers to be affiliated with and contribute to the Centre.

2.5 Visiting Fellowships

The Centre will host visiting fellows, mainly from overseas. These will include existing and prospective new research partners. Hosted visits will be prioritised based on impact across the Centre's research and training activities, and will generally have multi-institutional relevance.

2.6 Advisory structures

The Centre's Advisory Board and the international Scientific Advisory Panel will provide advice, guidance, and connections, particularly in strategic planning and paths to impact.

2.7 Utilisation of online meetings

The advent of widespread videoconferencing will be used to enhance efficient ACEAS engagement in a full range of international meetings, working groups, stakeholder events, and research programs.

2.8 Leading and contributing to international programs and agenda setting. Researchers will be involved in leadership, and participate in, international coordinating programs, notably within the SCAR Scientific Research Programs (e.g., AntClimNow and INSTANT).

The activities in Objective 2 will be coordinated by the Director together with the Deputy Director (Partnerships), and fieldwork lead researchers.

Strategic Objective 3: Employing a diverse workforce

3.1 Towards a positive change in gender and ethnic diversity

Momentum will be generated towards achieving gender balance in Antarctic physical sciences through recruiting a diverse researcher cohort, supporting the career development of women and minority groups, and advancing leaders from diverse backgrounds.

While PhD and ECR cohorts in Antarctic and Southern Ocean sciences are mostly from diverse backgrounds, many senior staff cohorts are not. ACEAS will work to address barriers to academic careers in Australian universities through providing mentoring and training to support ECRs as they pursue external roles. Training will be provided for ACEAS interview panels to improve the understanding of unconscious bias.

3.2 Activities that are safe for all

A culture of respect will be encouraged. Cultures that support fieldwork that is safe for all will be established, including by working with AAD and participating institutions to publicise appropriate reporting mechanisms.

3.3 Training

Early career researchers will be trained in Antarctic science, in Antarctic science fields outside their speciality, and also in governance, law, and policy. All researchers will be introduced to pathways to academic and non-academic careers.

3.4 Diverse and excellent leadership

The Centre will promote gender diversity of leadership, as well as ongoing development of all leaders through relevant management experience and training.

The activities in Objective 3 will be coordinated by the Director together with the Deputy Director (Training) and the Graduate Training Coordinator.

Strategic Objective 4: Leveraging and creating national research infrastructure

4.1 Access Antarctic logistics platforms

Fieldwork will be undertaken primarily within the Australian Antarctic Territory and the adjacent Southern Ocean, and will leverage Australia's current investments in RSV *Nuyina* and the new oversnow traverse capability. ACEAS will also work with other national Antarctic programs through data sharing and joint modelling research.

4.2 Capitalise on investment in equipment

Substantial use will be made of investments in equipment through deploying the UTAS *nupiri muka* polar-class Autonomous Underwater Vehicle (AUV) and the UTAS Rapid Access Isotope Drill (RAID), both funded through the ARC SRI for Antarctic Gateway Partnership. ACEAS will also work with the recently established Centre for Antarctic and Southern Ocean Technology (CAST), a joint venture between UTAS, AAD and CSIRO.

4.3 Access world-class computing

The National Collaborative Research Infrastructure Strategy (NCRIS)-funded National Computing Infrastructure (NCI) will be used to provide the computational scale required to realise our ambition in numerical modelling and to provide visualisations for the media and public of key outputs. Links will be developed with the Australian Community Climate and Earth System Simulator (ACCESS) National Research Infrastructure project.

4.4 Collaborate with research infrastructure bodies

The Centre will leverage support through the NCRIS-funded Integrated Marine Observing System (IMOS) in deploying oceanographic sensors and obtaining data streams, and through NCRIS AuScope's recent new investment in Antarctic geophysics.

4.5 Create new infrastructure

ACEAS will collaborate to build new, shared infrastructure as a legacy, including in model codes, model outputs, and baseline datasets and expertise.

The activities in Objective 4 will be coordinated by the Director and lead CIs in fieldwork and computing.

Strategic Objective 5: Creating pathways to local, regional, and circumpolar impact

5.1 Understand and meet stakeholder needs

Primary and secondary stakeholder groups will be identified and workshops will be conducted with primary stakeholder groups and partners to gain an understanding of needs and, where appropriate and feasible, co-design pathways to impact that can be achieved within the lifetime of ACEAS and continue beyond it. At least annual major stakeholder engagement events will be held.

Stakeholder needs will be identified that will form the Centre's focus in developing a purposeful plan to meet these needs.

5.2 Partner in stakeholder engagement

ACEAS will work closely with the Australian Antarctic Program Partnership (AAPP) and CSIRO Oceans and Atmosphere to engage effectively with stakeholder groups, to ensure consistency in communications, and to identify gaps and impact pathways where ACEAS can uniquely and effectively contribute. Experiences of other groups in effective engagement will also be sought.

5.3 Collaborate in Ocean and Antarctic governance, law, and policy

Partnerships will be built and projects will be developed with researchers with expertise in national and international Ocean and Antarctic governance, law, and policy.

5.4 Enhance national and international influence

Collaborations will be built with AAD, SCAR, IPCC, CCAMLR, WCRP, and other organisations and agencies to provide conduits for research to inform and influence national and international policy and regulatory frameworks. ACEAS scientists will seek to be involved in leadership and other positions of influence within international coordinating bodies. Relationships will be developed with key individuals, through one-on-one meetings, and workshops. Position papers and research summaries will be published to inform discussions and policymaking.

5.5 Leverage community interest in Antarctica

Public enthusiasm for Antarctic research will be supported through participation in public events and festivals, delivery of public lectures, social media, and hosting community visits to our partner organisations. Partners and other bodies (e.g., The Australian Meteorological and Oceanographic Society) will collaborate to engage school students in Antarctic science.

5.6 Promote positive media coverage

The Media Officer will develop and implement strategies and procedures to build a high national and international profile and support for the work of the Centre. Activities and findings will be communicated through conventional media and social media platforms. All researchers will be trained in working with these platforms.

5.7 Understand graduate destinations

Having trained graduates with diverse skills, a record will be kept of employment destinations including in industry, government, and academia.

The activities in Objective 5 will be coordinated by the Stakeholder Engagement Manager with the support of all CIs and Centre researchers.