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South African research in the Southern Ocean: New opportunities but serious challenges

South Africa has a long track record in Southern Ocean and Antarctic research and has recently invested considerable funds in acquiring new infrastructure for ongoing support of this research. This infrastructure includes a new base at Marion Island and a purpose-built ice capable research vessel, which greatly expand research opportunities. Despite this investment, South Africa's standing as a participant in this critical field is threatened by confusion, lack of funding, lack of consultation and lack of transparency. The research endeavour is presently bedevilled by political manoeuvring among groups with divergent interests that too often have little to do with science, while past and present contributors of research are excluded from discussions that aim to formulate research strategy. This state of affairs is detrimental to the country's aims of developing a leadership role in climate change and Antarctic research and squanders both financial and human capital.

The arrival of South Africa's new polar research and supply vessel, the SA *Agulhas II* (Figure 1), in early May 2012, marked a significant step forward for the country's potential contributions to Antarctic and subantarctic marine science. The new ship has far greater research capabilities than its predecessor, the SA *Agulhas*. By facilitating state-of-the-art research and the establishment of collaborations with international organisations and institutions, these world-class facilities strengthen South Africa's capacity to fulfil legal obligations under key international agreements such as the Antarctic Treaty System,¹ the Protocol on Environmental Protection to the Antarctic Treaty,² the Convention on the Conservation of Antarctic Marine Living Resources,³ the Agreement on the Conservation of Albatrosses and Petrels,⁴ the Convention for the Conservation of Antarctic Seals,⁵ and the Convention for the Regulation of Whaling.⁶ Furthermore, the facilities will strengthen key international collaborations which South Africa is party to including the Southern Ocean Observing Programme and the Scientific Committee on Antarctic Research. The vessel comes equipped with eight fixed and six removable container laboratories specifically designed for oceanographic, climate change, meteorological, biodiversity, marine geology or geoscience (including deep coring facilities) and marine engineering research.⁷ A large hangar door on the side of the ship allows the lowering of deep-water sampling probes and a moon pool can be used for sampling when the ship is working in ice conditions.⁷ A drop keel containing transducers for the measurement of plankton density and ocean currents can be lowered through the bottom of the ship to a depth of 3 m below the keel.⁷ The ship's stern also has a hydraulic A-frame for towing sampling nets and dredges⁷ with an associated research poop deck including laboratory access for sample handling. A specially constructed masthead lookout station facilitates underway observations of seabirds and marine mammals.



Figure 1: The SA *Agulhas II* moored in Cape Town harbour (photo: Anne Treasure).

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These scientific capabilities create opportunities for South Africa to take the lead in Southern Ocean research. The region is recognised as key to understanding and perhaps mitigating global climate change,⁸ and holds key resources, which will come under increasing international pressure.⁹ As the African nation closest to the Southern Ocean and Antarctica, the relative ease of access means that South Africa has an important role to play in providing a springboard for African Antarctic science. Climate change science was one of the main reasons used to justify the acquisition of the SA *Agulhas II*.¹⁰ As stated by Dr Monde Mayekiso, Deputy-Director General: Oceans and Coasts in the Department of Environmental Affairs (DEA), on arrival of the vessel:

*All of South Africa should join us [in] being very proud of this new ship, a wise and worthy investment of our government, that will create opportunities for our young scientists, but more importantly carry out research that will improve our country's ability to predict climate change impacts.*¹⁰

Such research opportunities align directly with the Grand Challenges identified by the Department of Science and Technology (DST) for steering South Africa's resource-based economy towards a knowledge-based economy.¹¹ In particular, one of these five Grand Challenges is global-change science with a focus on climate change, aiming to improve scientific understanding as well as to develop innovations and technologies to respond to such change. The vision for South Africa in 2018 is world leadership in climate science and the responses to climate change.¹¹ Recognition is given to the strategic position of South Africa as a gateway to the south and a major focus is placed on science related to the Southern Ocean, Antarctica and Marion Island.¹¹ These ambitions are reflected in significant recent investments by the government in these regions, including the acquisition of the new ship for over ZAR1.3 billion and the completion of a new multimillion rand research base on Marion Island in 2011. The planning of a long-term observational platform across the Southern Ocean will contribute to the success of the five DST Grand Challenge outcomes listed under their Climate Change thrust, namely¹¹:

1. *An internationally recognised science centre of excellence with climate change research and modelling capability, benefiting the entire continent.*
2. *Robust regional scenarios for the rate and impact of climate change and extreme weather conditions for South Africa and the continent.*
3. *Initiated climate change adaptation and mitigation actions.*
4. *An internationally recognised centre of excellence focused on the Southern Ocean and its contribution to global change processes.*
5. *Strengthened research and global monitoring capabilities on Marion Island, Antarctica and the Southern Ocean in partnership with other nations.*

With the meeting of these outcomes, South Africa can start to address the concerns raised by the Southern Ocean Observing System Secretariat, which has highlighted that a critical gap in understanding the causes and consequences of change in the Southern Ocean, and developing informed management and mitigation strategies, is the absence of long-term sustained observations.⁸ For this, integrated, multidisciplinary, circumpolar observations are essential to detect, interpret and respond to change.⁸

South Africa is therefore well positioned to play a leading role in Southern Ocean and Antarctic science and opportunities exist for research into a number of pressing questions in the physical, biological, oceanographic and geological sciences, including significant interdisciplinary challenges that span the full suite of the sciences, across a broad range of spatial and temporal scales. Further development of such an integrated approach will also provide enhanced opportunities for key international collaborations and for building African capacity in polar sciences. South Africa has a long and very successful history of research in this area, with

contributions from many experienced, well-published and internationally renowned scientists, several of whom started their careers within the South African National Antarctic Programme (SANAP). The country also has an excellent record of education and training, well-established national and international collaborations, and research interests covering a broad range of fields with long-term data sets. With a new state-of-the-art research vessel, the stage is set for South Africa to be at the forefront of interdisciplinary research to understand the Southern Ocean and Antarctic in an earth systems context, to the benefit of South Africa and its global partners.

However, despite these opportunities, the potential for ongoing South African research contributions to Southern Ocean science is threatened. Of great concern is the current inadequate management of the science together with the difficulty in securing dedicated scientific time on the new ship. Although the SA *Agulhas II* was built for both scientific and logistic purposes, scientific research, as was the case in the past, is frequently regarded as an activity adjunct to logistical support. Securing ship time both during and outside of logistic voyages is difficult, thus restricting potential marine research. The ship therefore spends considerable time in port in between her three principal logistic voyages: resupplying bases on Gough Island, Marion Island and Antarctica once each per year.

The Department of Environmental Affairs' 'SANAP Voyage Schedule' for 2012–2013 (issued 18 October 2012) allocates a total of 154 days at sea in support of these three primarily logistic voyages, with no planned dedicated research time between these voyages. Although the SA *Agulhas II* was built to boost scientific research, this schedule has not improved on that of the old SA *Agulhas*, constituting just 42% of the 12-month period and comparing poorly with other countries. For the same period, Australia's *Aurora Australis* is scheduled to work a 7-month Antarctic schedule, spending 86% of this period at sea, and is contracted for the rest of the year.¹² The two British Antarctic Survey ships work a full 7- to 9-month Antarctic season and are likewise contracted out for the rest of the year.¹³ Perhaps the best example of an efficiently used ship is the German polar vessel, the RV *Polarstern*, which is scheduled to spend 90% of the 2012–2013 period at sea.¹⁴ Accepting that this is the first full year of operation of South Africa's new ship, that the country is still developing and that the current economic times are challenging, the present schedule seriously underutilises a valuable and expensive research platform, raising the question of whether the investment in the new 'ship for science' was worthwhile. Until science and logistics are appropriately balanced and the broader marine science community effectively involved, South Africa's marine Antarctic programme will remain compromised. Already some groups have been obliged to make alternative arrangements for their research. For example, the older SA *Agulhas* was commissioned by scientists from various research groups for a 2012–2013 summer voyage to Antarctica to continue the collection of observations for long-term data sets.

One reason for the difficulty in securing ship time for scientific research appears to relate to recent reshuffling of the Cabinet and responsibilities within government ministries, resulting in a mismatch between funding and supervising agencies. Antarctic, subantarctic and Southern Ocean scientific research takes place under the auspices of SANAP, which historically fell within the Department of Environmental Affairs and Tourism (DEAT). In 2003, Cabinet approved the transfer of the science and funding area of SANAP from DEAT to the DST.¹⁵ DEAT retained responsibility for all logistics and infrastructure, including operating the SA *Agulhas II* (and previously the SA *Agulhas*), whereas the National Research Foundation (NRF) became the agency responsible for the scientific management and grant making for SANAP on behalf of DST.¹⁶ Subsequent to this, a Cabinet reshuffle in 2009 resulted in the tourism portfolio of DEAT being removed and the fisheries management portfolio being transferred to the Department of Agriculture and Forestry, which became the Department of Agriculture, Forestry and Fisheries. Consequently DEAT became the Department of Environmental Affairs or DEA. The logistical management of Antarctic operations has been retained within DEA under Antarctic and Southern Ocean Support and the DEA Division, Oceans and Coasts, manages the non-fisheries components of the marine environment. The Oceans and Coasts division has recently

released the Oceans Policy Green Paper¹⁷ for the management of non-fisheries aspects of the marine environment. This paper has extended their domain into the Southern Ocean, suggesting that DEA's mandate now allows them to run parallel to the SANAP programme research objectives. This then raises the question of whether Southern Ocean management within Oceans and Coasts will be in direct competition with the SANAP programme. If so, this highlights the need for coordination and collaboration between government departments, science councils and academic institutes involved in SANAP.

For researchers at academic institutions and science councils, the process of submitting project proposals to SANAP remains unchanged. The process is essential to ensure that taxpayers are investing in the most scientifically significant and practicable research of that proposed in any given call. However, approval for SANAP project proposals (a list titled 'Successful grant awardees and their projects listed for funding from 2012–2014' can be found on www.nrf.ac.za; accessed 2012 June 07), does not confer access to ship time and a further application for vessel research time needs to be submitted to DEA. In particular, there is only limited DST involvement in decisions concerning the availability and accessibility of the state-of-the-art research platform for one of its main groups of end-users. Some marine scientists could therefore be forced to suspend or postpone approved projects because they cannot be executed without access to ship time. Some projects approved for the period 2012–2014 are already threatened. For example the deployment of the South Atlantic Mooring Basin Array – the mooring component behind the internationally recognised South Atlantic Meridional Overturning Circulation SA line – is currently under question because of a lack of funding despite the fact that this project was approved by SANAP in 2012. Of further concern is the fact that the timing for approval of research proposals and the deadline for applying for ship time differ between academic institutions and science council scientists, and government departments. This difference results in a split mandate in the management of Southern Ocean sciences.

The misalignment in communication and purpose between the two government departments tasked with overseeing and supporting the use of the SA *Agulhas II* for South African science and logistics is having a seriously negative impact on research. Consequently, DST's goal of increasing South Africa's contributions to Southern Ocean and climate change science is being compromised. South Africa's strategic geographic position and important role in Southern Ocean and Antarctic research have been recognised by DST.¹⁸ DST aimed to have an Antarctic strategy and research plan implemented by 31 March 2013, following an envisaged planned approval by 31 March 2011.¹⁹ However, the approval was not achieved and the process was halted to prioritise the work of the Astronomy Desk.²⁰ The DST Annual Performance Plan (2012–2013) indicates that planned approval of the Antarctic research strategy has been pushed to 30 June 2014, but no indication of planned implementation of the strategy is given.²¹ No mention of the Antarctic strategy and research plan is made at all in the latest DST Annual Report (2011–2012), even though in the introduction of this report, the large number of scientific publications under the Antarctic Research Programme is mentioned as a notable achievement.²² Any intention of DST to restrict Antarctic and Southern Ocean science needs broader scrutiny given the significance of the region both to South Africa and the global community.

One of the desired outcomes of DST's Grand Challenges is:

An internationally recognised centre of excellence focused on the Southern Ocean and its contribution to global change processes; and strengthened research and global monitoring capabilities on Marion Island, Antarctica and the Southern Ocean in partnership with other nations.¹¹

However, it is unclear how this goal can be achieved if approved research projects cannot be implemented and role players at tertiary institutions, who are primarily responsible for training the next generation of scientists, are given limited opportunities to make use of the SA

Agulhas II. In the recent past, South Africa emerged at the forefront of international Southern Ocean research and training. The vessel is an ideal training platform for students and emerging scientists, who are needed to allow South Africa to contribute effectively to future international science and other dialogues. It is important that these and future training and education opportunities are carried out within the framework of approved research projects that have been subjected to a strict peer-review process. Furthermore, international collaboration is an important part of research in the Southern Ocean, and sharing the ship with research groups from other countries will complement South Africa's science outputs and enhance knowledge exchange and capacity development.

SANAP has played a crucial role in the development of Antarctic, subantarctic and Southern Ocean science in South Africa across physical, biological (terrestrial and marine), oceanographic and geological disciplines. However, its future role needs to be consolidated and strengthened within the new government structures. The present management structure for SANAP across two departments is confusing; one way to make SANAP more effective is to establish it as a National Research Facility (as for the South African Observatory and others). The 'big picture' science planning, essential to achieve DST's Grand Challenges, as is understood and supported in the context of astronomy, is missing. Therefore, it is imperative that such a National Research Facility be led by an excellent scientist with a substantive national and international track record in the general field of Antarctic, subantarctic and Southern Ocean research. The incumbent must understand the international and domestic contexts and the management required for logistic support of Antarctic research, and be able to give effect to a new South African Antarctic and Southern Ocean science vision. This realisation would benefit all research programmes across the physical, biological, oceanographic and geological sciences. Second, better use needs to be made of the SA *Agulhas II*'s research capabilities by increasing the days at sea for dedicated research time. For the successful implementation of such an increase, an improved system of planning and broader participation in decision-making regarding the allocation of ship time is crucial and research proposals from all interested parties should be subjected to a strict peer-review process. In addition, strategic planning for the use of shipboard equipment is also needed. We suggest that meetings are held where scientific priorities and research strategies for the forthcoming year are discussed and planned. These meetings should be attended by past and present principal investigators working in the region to ensure that all have some say in the future research activities as well as in the allocation of dedicated ship time. It is also vital to ensure that the three research bases, facilities equal in importance to the new ship, are efficiently utilised and that expedition members and equipment are properly supported. The present confusion and lack of direction is demoralising and can too easily result in loss of expertise as scientists turn their attention to other areas of research.

Could the SA *Agulhas II* become an embarrassing white elephant? Not if swift action is taken to address the current problems and to support long-term investment in Southern Ocean research, which contributes to South Africa's national and international obligations and commitments. For this to happen, DST needs to provide sufficient financial support to meet their Grand Challenges, especially as SANAP was described as a national priority in the NRF Annual Performance Report 2010–2011.²³ It is promising that a strategy meeting was held on the 19 November 2012 to identify shortfalls in the current Antarctic programme and to develop a collaborative strategic plan between DEA and DST, but disappointingly few Antarctic and Southern Ocean scientists were informed of the meeting – only two were invited. While follow-up meetings were discussed in November 2012, to date (March 2013), no other meetings have been planned. Furthermore, the question of how the Antarctic Research Strategy for South Africa (developed as a blueprint strategy for South African Antarctic research by DST over 3 years) will be incorporated into the collaborative strategic plan needs to be addressed. In addition, while the intentions of a collaborative strategic plan are promising, the future outcomes and actions will take some time to materialise. Such timing issues are likely to have a knock-on effect on the success of current

SANAP projects that may not be able to fulfil their objectives with the current situation, thus jeopardising future funding.

Overall, the current situation implies that while South Africa has long appreciated the strategic significance of the Southern Ocean and the need for science leadership in the area, it has recently lost sight of the need for strategic organisational integration to realise its ambitions. Consequently, South Africa is rapidly eroding its ability to understand threats to the regional economy associated with climate change, the extent to which marine resources in its own Exclusive Economic Zone might be affected by changes in the Southern Ocean, and its capacity to maintain its leadership role in international climate change and marine conservation agreements. Such a transition from regional power to bit player is in no citizen's interests.

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