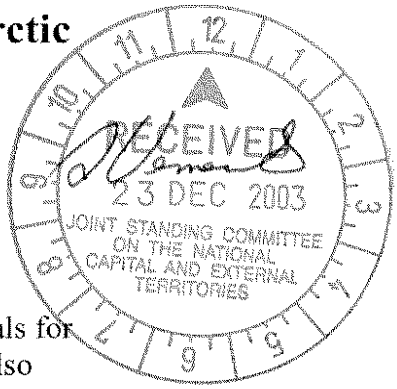
SUBMISSION 15



The Adequacy of funding for Australia's Antarctic Program:

Submission from Geoscience Australia

Summary

Marine science research will be central to many of the highest priority goals for Australia's Antarctic program for at least the next 5 years. Australia has also extensive areas of Southern Ocean Exclusive Economic Zone and potential Extended Continental Shelf for which there are limited data to underpin management of the environment and resources. The present Australian research fleet will be limited in its capacity to undertake the research needed unless Australian Antarctic Division is able to charter a dedicated research vessel with the full range of equipment that is now part of routine marine science activities.

Importance of the marine science in the Australian Antarctic Program

Many of the issues of importance in Antarctic science and in conservation of the Antarctic environment are questions of marine science. Australian Government Goals for Antarctic science are:

1. to maintain the Antarctic Treaty System and enhance Australia's influence within the System;
2. to protect the Antarctic environment;
3. to understand the role of Antarctica in the global climate system; and
4. to undertake scientific work of practical, economic and national significance.

In addressing these goals, the Australian Antarctic Science Advisory Committee (ASAC) review of Antarctic science in 2002 has identified four major themes that should form the framework for the next five years of scientific research in the Antarctic. They are:

1. Ice, Oceans, Atmosphere and Climate
2. Southern Ocean Ecosystems
3. Adaptation to Environmental Change
4. Impacts of Human Activities in Antarctica

Each of these has a strong marine science component.

Theme 1, Ice, Oceans, Atmosphere and Climate, is directed at understanding the interaction of the ice sheet, sea ice, the atmosphere and the Southern Ocean, and how they establish local and more distant weather patterns. Better prediction of future climates requires the development of better models and better data to feed into those models. Although satellite and land based observations will continue to be important, major advances will still require ship-based observations with new and existing technology. Observations of the modern ocean and the atmosphere above it will need to be supplemented by the long-term records of climate change contained in sea floor

sediments. Sampling such records requires ships with appropriate sea floor imaging capabilities to find the right deposits and the coring equipment to retrieve the sediment. Understanding the response of the ice sheet to past climate change also requires sea bed imaging technology to map the extent of past ice sheets.

Theme 2, Southern Ocean Ecosystems and Theme 3, Adaptation to Environmental Change are largely concerned with issues of the marine environment. Most Antarctic wildlife are in fact marine animals so understanding and protecting them requires a major marine science effort. The Southern Ocean represents a vast international and national resource to Australia. The high productivity of the Antarctic Convergence is amongst the highest found in the world's oceans. Australia is a leading nation in the Commission for Conservation of Antarctic Marine Living Resources (CCAMLR) and underpins its policy position with a sound scientific program of research. Southern Ocean and Antarctic marine ecosystems are still poorly documented and little is known about the effects of climate change and natural variability Southern Ocean biology. Ship-based sampling of water, research fishing and acoustic imaging of fish and plankton populations will need to be carried out to build a sound basis for managing the Southern Ocean. Likewise, some habitats are controlled by sea floor topography. Modern, multibeam echo sounders can map such features (Figure 1).

Theme 5, Impacts of Human Activities in Antarctica, has a significant component of marine research because most human activity takes place on coastal ice free areas and Antarctic tourism is mostly by ship.

UN Convention on the Law of the Sea Issues

Australia already has an Exclusive Economic Zone (EEZ) around Heard and Mac Donald Islands and Macquarie Island. Subject to Cabinet approval, the Australian Government intends to make a submission to the Commission on the Limits of the Continental Shelf for areas of Extended Continental Shelf (ECS) around Macquarie, Heard and Mac Donald Islands, under the terms of the United Nation Convention on the Law of the Sea (Figure 2).

The UN Convention on the Law of the Sea includes a responsibility to sustainably manage the resources of the water column and sea bed in the EEZ and the sea bed in areas of ECS. Sustainable management of these regions will require significant amounts of ship-based research to understand the resources and the ecosystems to be protected. Australia will need to maintain a significant presence in the Southern Ocean to support its management responsibilities.

Current Australian Research fleet

The present Australian research fleet comprises the *RSV Aurora Australis*, the *RV Southern Surveyor* and a number of smaller vessels that operate mostly in tropical or inshore waters.

RSV Aurora Australis is an ice breaker and resupply vessel that is also set up for fisheries and oceanographic research. It is used by Australian Antarctic Division for logistics and for marine research. It has long range and ice strengthening making it

suitable for many activities. It has deep sea trawling equipment, and high frequency echo sounders suitable for studying fish and plankton concentrations. It also has oceanographic sampling equipment. It has a full ocean depth sounding echo sounder and an Acoustic Doppler Current Meter for measuring ocean currents while under way. Geoscience Australia has been able to install sea bed coring equipment and a small scale seismic reflection system for mapping sediments beneath the sea bed but the vessel has no further space for additional hull-mounted instruments without major modifications and additional large expenditure; in the order of $3 million.

RV Southern Surveyor is a National Facility managed by CSIRO. Researchers bid for time through a peer-reviewed proposal system. Several months per year, the vessel is chartered by CSIRO and Geoscience Australia for survey work that is related directly to their research programs. The vessel has equipment for fishing, oceanography and is being upgraded for marine geoscience with the installation of a multibeam echo sounder and sub-bottom profiler. Geoscience Australia also installs small scale seismic equipment as required.

Present capabilities and future needs

The great importance of marine science in achieving government goals in Antarctic research mean that both large amounts of ship time and appropriate marine science equipment are needed. Major omissions in the capabilities of the *RSV Aurora Australis* are a multibeam bathymetric echo sounder and sub-bottom profiler, severely limiting its use for geoscience research and studies of the biology of the sea floor and the interaction of ocean currents with seabed topography. Safe navigation of Antarctic waters by tourist vessels would also be enhanced by the ability to collect multibeam bathymetry. Such equipment is almost standard on research vessels of other nations.

Though the re-equipped Southern Surveyor will have many of the capabilities needed for the next decade of marine science, the vessel is not ice strengthened, and it is more intended as a cost-effective platform for work around the Australian mainland and thus has only 28 days range; less than what is required for most Antarctic and Sub-Antarctic surveys. Also, applications for surveys around the Australian mainland exceed the amount of ship time available, so that, even if it were capable of working in the Antarctic, the ship would be unlikely to be available often.

Geoscience Australia and university researchers have attempted to obtain the use of marine science equipment lacking in the Australian program by developing cooperative projects with foreign institutions who have suitable vessels. Though these projects have been valuable, their success in serving Australian research priorities have been strongly related to the financial contribution by Australian institutions. Because of our long standing interest in the Antarctic continent and EEZ and ECS in the Southern Ocean, Australia needs to maintain a significant presence in the Southern Ocean.

The proposed intercontinental air link may enhance the efficiency and cost effectiveness of marine surveys by enabling marine science technicians and scientists to fly down to Antarctic to meet the ship, carry out a survey over several weeks then

fly back. However, the fundamental issue will continue to be access to a dedicated and fully equipped research vessel for sufficient days per season to achieve research outcomes.

Recommendation

If marine science is to remain a priority for Australian scientific research in Antarctica, then Geoscience Australia recommends that a fully equipped marine science vessel, capable of operating in Antarctic waters, is essential.

Appendix 1.
Role of Geoscience Australia in Antarctic Science

Geoscience Australia is Australia's national agency for geoscience research and geospatial information. It is located within the Industry, Tourism and Resources portfolio. Our research and information contributes to enhanced economic, social and environmental benefits to the community - by providing input for decisions that impact upon resource use, management of the environment, and the safety and well-being of Australians.

In the Antarctic program, Geoscience Australia is the Lead Agency for geosciences. We:

1. Provide a Program Leader who coordinates geoscience research, and represents Australia on international committees involved in Antarctic Geoscience such as the Scientific Committee for Antarctic Research (SCAR).
2. Maintain seismological observatories at Australian Antarctic and sub Antarctic stations to monitor earthquakes and nuclear tests.
3. Maintain geomagnetic observatories at Australian stations to monitor changes in the earth's magnetic field to help with navigation and communications.
4. Geoscience Australia provides geodetic infrastructure needed to support all Australian Antarctic activities via a network of permanent Global Positioning System (GPS) observatories at Australian stations and temporary field GPS units as required.
5. Carry out some marine geoscience projects as required by Government priorities.

Geoscience Australia provides most of the technical advice for the Australian Government's submission of marine boundaries under the UN Convention for the Law of the Sea.

Contact Officer: Dr Philip O'Brien
Phone: 62499409
Email phil.obrien@ga.gov.au

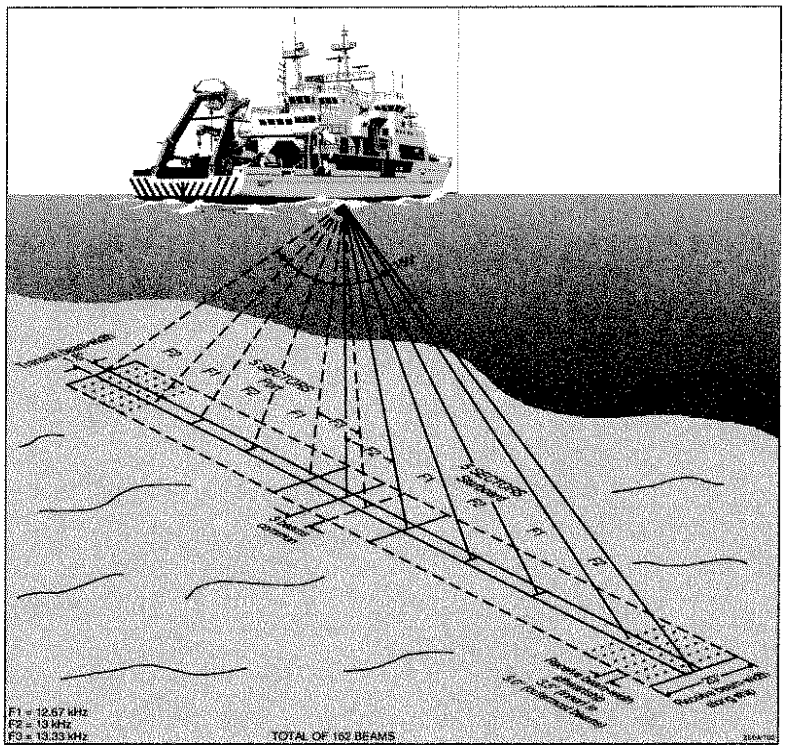


Figure 1a. Principle of multibeam echo sounders. Hull-mounted transducers produce "pings" in a fan-shaped swath then detect the return echos from the sea floor, mapping a strip up to 7 times water depth.

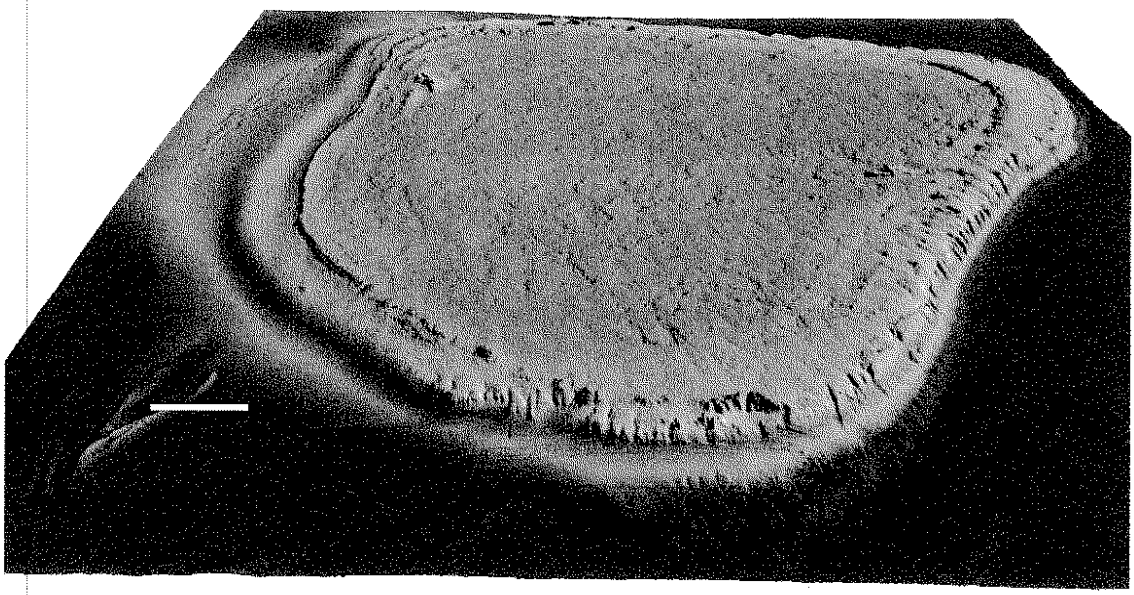


Figure 1b. An example of how multibeam echo sounder data can provide important new insights into the marine environment. This feature in the Gulf of Carpentaria was known as a "bank" and shown on hydrographic charts but multibeam mapping and underwater video surveys by Geoscience Australia in 2003 showed that it is a coral reef, the first "new" coral reef reported globally in many years. The image is a shaded relief view of the bathymetric grid. The reef is about 8 km across (white bar is 1 km) and is around 20 m high.

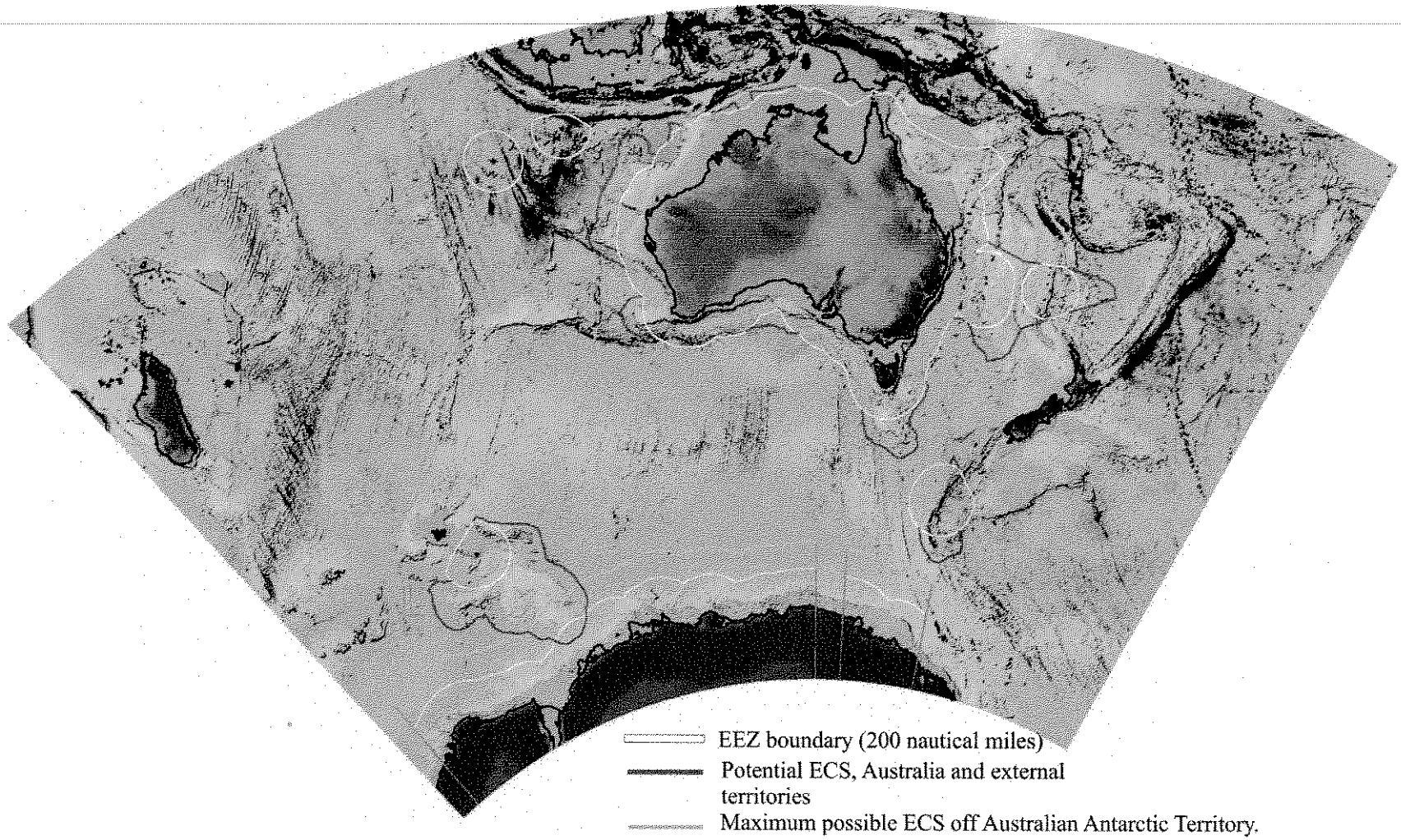


Figure 2. Sea bed topography around Australia and the Southern Ocean showing Australian EEZ and potential extended continental shelf. Water depths derived from satellite data. (Blue is deepest).