

National Report to SCAR for year: 2005-2006

MEMBER COUNTRY: USA

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| <b>National SCAR Committee</b>                     |                        |   |                          |                  |  |          |
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| <b>SCAR Delegates</b>                              |                        |   |                          |                  |  |          |
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| <b>Standing Scientific Groups</b>                  |                        |   |                          |                  |  |          |
| <b>Life Sciences</b>                               |                        |   |                          |                  |  |          |
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| 5) Deputy Chief<br>Officer - will step<br>down after SCAR XXIX<br>Mtg | Lawrence A. Palinkas | Vice Chief, Division of Family<br>Medicine Department of<br>Family and Preventive<br>Medicine University of<br>California, San Diego 9500<br>Gilman Drive La Jolla, CA<br>92093-0807 | 619 543-5493   | 619 543-5996   | Email: lpalinkas@ucsd.edu                                |          |
| 6) Special Program<br>Planning Group on<br>SALE                       | John Priscu          | Department of Land<br>Resources and<br>Environmental Sciences<br>Montana State University 334<br>Leon Johnson Hall Bozeman,<br>MT 59717  | 406-994-3250   | 406-994-5863   | <a href="mailto:ubijp@montana.edu">ubijp@montana.edu</a> |          |

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#### Geosciences

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| 3)  | Paul Mayewski                 | Climate Change Institute<br>University of Maine Bryand<br>Global Sciences Center<br>Orono, ME 04469-5790   | 207/581-3019   | 207/581-1203   | <a href="mailto:paul.mayewski@maine.edu">paul.mayewski@maine.edu</a> |          |
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| <b>Scientific Research Program</b>                               |                     |  |                |                |  |          |
| <b>ACE</b>   |                     |  |                |                |  |          |
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| <b>1) Steering<br/>Committee</b>                                 | Paul Mayewski       | Climate Change Institute<br>University of Maine Bryand<br>Global Sciences Center<br>Orono, ME 04469-5790   | 207/581-3019   | 207/581-1203   | <a href="mailto:paul.mayewski@maine.edu">paul.mayewski@maine.edu</a>             |          |
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| <b>3) Steering<br/>Committee/Thematic<br/>Action Group C</b>               | Scott Palo             | Aerospace Engineering<br>Sciences University of<br>Colorado at Boulder Boulder,<br>CO 80309-0429  | 303-492-4289                | 303-492-7881   | <a href="mailto:palo@colorado.edu">palo@colorado.edu</a>               |          |
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| <b>ACTION GROUPS</b>  |                        |   |                          |                |  |          |
| <b>1) Biological Monitoring</b>   | Mahlon C. Kennicutt II | Geochemical and Environmental Research Group Texas A&M University 833 Graham Road College Station, TX 77845 | (409) 862-2323, ext. 111 | (409) 862-2361 | <a href="mailto:m-kennicutt@tamu.edu">m-kennicutt@tamu.edu</a>   |          |
| <b>2) Circum-Antarctic Census of Marine Life</b>                              | Alison Murray          | Division of Earth and Ecosystem Sciences Desert Research Institute 2215 Raggio Parkway Reno, NV 89512       | 775/673-7300             |                | <a href="mailto:Alison.Murray@dri.edu">Alison.Murray@dri.edu</a> |          |
| <b>3) SCAR-MarBIN - the Antarctic Marine Biodiversity Information Network</b> | Alison Murray          | Division of Earth and Ecosystem Sciences Desert Research Institute 2215 Raggio Parkway Reno, NV 89512       | 775/673-7300             |                | <a href="mailto:Alison.Murray@dri.edu">Alison.Murray@dri.edu</a> |          |
| <b>1) Standing Committee on the Antarctic Treaty System</b>                   | Mahlon C. Kennicutt II | Geochemical and Environmental Research Group Texas A&M University 833 Graham Road College Station, TX 77845 | (409) 862-2323, ext. 111 | (409) 862-2361 | <a href="mailto:m-kennicutt@tamu.edu">m-kennicutt@tamu.edu</a>   |          |

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| <b>EXPERT GROUPS</b>                   |                      |  |                   |                   |  |                            |
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| <b>28) Operational Meteorology</b>                            | Kathie Hill          | Raytheon Polar Services 7400 South Tuscon Way Centennial CO 80112-3938   | 720-568-2344      | 03-792-9066       | <a href="mailto:Kathi.Hill@usap.gov">Kathi.Hill@usap.gov</a>                         |                 |

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**JCADM**

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### SCAR Database

The US is responsible for the Antarctic Master Directory which is part of the Global Change Master Director run by NASA. The AMD can be found at [http://gcmd.gsfc.nasa.gov/KeywordSearch/Home.do?Portal=amd&MetadataType=0freetext/ft\\_search.html](http://gcmd.gsfc.nasa.gov/KeywordSearch/Home.do?Portal=amd&MetadataType=0freetext/ft_search.html)

SDLS - Hosted by the U.S. Geological Survey Western Coastal & Marine Geology (WCMG) Team and U.S. National Science Foundation Office of Polar Programs

### A BRIEF SUMMARY OF SCIENTIFIC HIGHLIGHTS:

Ten-meter telescope. A foundation was built for a new 10-meter telescope at the South Pole to investigate properties of the dark energy that pervades the universe and accelerates its expansion, to constrain the mass of the neutrino, to search for the signature of primordial gravitational waves, and to test models of the origin of the universe.

IceCube. Work will continue on the world's largest neutrino detector, which —after 6 years of work — will occupy a cubic kilometer of ice beneath South Pole Station, deploying 4,800 photomultiplier tubes into holes that a hot water drill will make in the ice. Neutrinos are special but hard to detect astronomical messengers that can carry information from violent cosmological events at the edge of the universe or from the hearts of black holes. The history of astronomy is that work in new energy regions invariably has discovered unexpected phenomena. By peering through a new window on the universe, IceCube could open new frontiers of understanding. During the 2005-06 austral summer, participants will drill 10 ice holes and deploy 10 IceCube strings and 20 Ice-Top tanks.

International Graduate Training in Antarctic Biology. This NSF-sponsored international course will be held at McMurdo Station for one month, starting in January 2006. Up to 20 graduate students, postdoctoral fellows, and other research scientists interested in studying extreme environments and the biology of antarctic organisms will participate. The course's emphasis is on integrative biology, with laboratory- and field-based projects focused on adaptations in an extreme polar environment. A diverse teaching faculty will offer students the possibility of working on a wide range of antarctic organisms (bacteria, algae, invertebrates, and fish), as well as working at several different levels of biological analysis (molecular biology, physiological ecology, species diversity, and evolution).

Long-term ecological research (LTER). Two sites in Antarctica — in the McMurdo Dry Valleys and along the west coast of the Antarctic Peninsula centered on Palmer Station — are among the world's 25 NSF-sponsored LTER sites being investigated to increase understanding of ecological phenomena over long temporal and large spatial scales (all but one of the other sites are in the United States).

Weddell seal population dynamics. Weddell seals in McMurdo Sound have been studied since 1968—one of the longest intensive field investigations of long-lived mammals anywhere. More than 15,000 animals have been tagged, and 145,000 resightings have been recorded. The project is a resource for understanding the population dynamics of not only Weddell seals, but also other species of terrestrial and marine mammals. New work this season includes assessing the role of food resources in limiting the populations.

Foraminifera studies by remote control. Research divers have detailed summer "snapshots" of the ecology of giant (>1mm) foraminifera in McMurdo Sound, but winter observations are needed when algae are not growing. This project has installed an unmanned underwater observatory connected to shore by fiber optic cable and linked through the Internet to a lab in the United States for operation and data collection all year long.

Genomic study of invertebrates. Cold-ocean ecosystems are 72 percent of Earth's biosphere by volume, yet they are sparsely inhabited and relatively unexploited. Environmental adaptations of the few animals that manage to exist on this verge of intracellular freezing are ideal subjects for exploration at the genomic level. This project is quantifying gene expression in sea stars and sea urchins to find out if it is more or less difficult for an organism to grow in a polar extreme. To interest students in the developing field of environmental genomics, the project has an intern program for minority students and a K-12 education program.

DMSP and DMS in the Ross Sea. Phytoplankton blooms spectacularly in spring and early summer in parts of the Southern Ocean. A dominant species, *Phaeocystis antarctica*, is a prolific producer of the organic sulfur compound DMSP, which degrades to dimethyl sulfide, or DMS. The sulfur in DMS transfers to the atmosphere, where it can affect the chemistry of precipitation, influence cloud components, and possibly influence climate. This project during a cruise of the research icebreaker Nathaniel B. Palmer from New Zealand to McMurdo is investigating the biogeochemical cycling of DMSP and DMS during the height of the bloom. The goal is to find out how light and nutrients influence DMS production and to examine the role of DMSP in the carbon and sulfur cycles of the Ross Sea.

| <b>Activity</b> | <b>Contact Name</b> | <b>Address</b> | <b>Telephone</b> | <b>Fax</b> | <b>Email</b> | <b>web site</b> |
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Influence of UV radiation on Ross Sea productivity. The antarctic ozone hole has increased the amount of ultraviolet radiation reaching the surface of the Southern Ocean, and earlier studies have indicated reduced biomass productivity and other damaging effects. This project, aboard the research icebreaker Nathaniel B. Palmer, is examining the impact on productivity in the Ross Sea, an area of intense interest because open water and continuous daylight occur in a location well within the ozone hole. The project will provide a valuable comparison with prior work in the Weddell Sea and near Palmer Station.

Demonstration ocean-bottom drilling in the James Ross Basin. Scientists will deploy a drill rig on the research icebreaker Nathaniel B. Palmer to test the feasibility of ship-based diamond coring along the antarctic continental margin. If successful, this Shaldril mobile system will be able to explore the "no man's land" between the nearshore (where the fast-ice-based Cape Roberts Project was successful) and the upper slope (where ODP's JOIDES Resolution becomes most efficient).

Seismograph. The world's quietest earthquake detector is 8 kilometers from the South Pole, 300 meters beneath the ice sheet surface. Completed in 2002, the station is detecting vibrations four times smaller than those recorded previously. Other seismographs have been there since 1957, and long-term, high-latitude data have helped to prove that the Earth's solid inner core spins faster than the rest of the planet. Also, Antarctica is the continent with the fewest earthquakes, so the new station will record small regional earthquakes, leading to new insights into the Antarctic Plate.

Behavior of the world's largest icebergs. This research team will investigate the basic principles governing the calving, drifting, melting, break-up, and environmental impact of large icebergs. Because the northward drift of large tabular icebergs represents a natural "climate change" experiment on an accelerated time-scale, the melting of the icebergs being studied over the next decade will foretell events that may occur in parts of Antarctica as climate conditions change over the coming century. Understanding the natural drift patterns and regions where icebergs accumulate near inhabited parts of the globe may someday prove useful for supplying fresh water to populations in need, as far-fetched as that may be with current technology.

WAIS Divide. This 5-year science program, involving a dozen research teams, will develop a detailed record of greenhouse gases for the last 100,000 years; determine if changes in the Northern and Southern Hemispheres initiated climate changes over the last 100,000 years; investigate past and future changes in the West Antarctic Ice Sheet; and study the biology of deep ice. During the 2005-2006 austral summer, the camp infrastructure for the drilling program will be assembled at a site on the West Antarctic ice sheet divide. Construction crews will establish a skiway and a camp capable of supporting approximately 45 personnel, which will eventually support the science and drilling teams who will collect a 3,400-meter ice core to bedrock. A 200-foot steel arch will be constructed that will house the drilling and core processing facilities for the deep drilling project.

A mobile sensor web for Polar Ice Sheet Measurements (PRISM). PRISM research objectives are to develop sensors (imaging and sounding radars), wireless communications, intelligent systems, robotics, and ice-sheet modeling, using innovative radar sensors that image the ice-bedrock interface, measure ice thickness, and map internal layers in the ice. The sensors will provide key glaciological measurements for studying the contribution of polar ice sheets to sea-level rise. Researchers integrate and operate the radar sensors from an autonomous rover and a tracked vehicle equipped with communication and navigation systems. An intelligent system determines an optimum sensor configuration for imaging the ice-bedrock interface and the operational requirements for the rover.

Tidal influence on ice stream flow. Ice from the West Antarctic Ice Sheet flows to the sea through a number of ice streams, but the factors controlling the flow of the ice streams are not well understood. Earlier work at the Whillans Ice Stream on the Siple Coast demonstrated that the flow of these ice streams is surprisingly sensitive to changes in the tide beneath the Ross Ice Shelf. By measuring the rise and fall of the tide, researchers hope to improve their understanding of the controls on ice streams and gain information important for modeling the ice sheet.

Old buried ice. Ice has covered Antarctica for millions years, but the ice is not that old; most of it arrives as snow and leaves as icebergs within a few hundred thousand years. Buried ice in the McMurdo Dry Valleys thus is a rare archive of atmosphere and climate potentially extending back millions of years. This project will study the surface processes that preserve ice, test ways of dating tills above buried ice, assess ways to date buried ice, and use these data to help resolve a debate over whether the deposits are as old as some scientists think they are.

Infrared measurement of the atmosphere. Winter measurements of atmospheric chemistry are providing data for predicting ozone depletion and climate change. Since most satellites do not sample polar regions in winter, these ground-based measurements are expected to make important contributions.

Surface carbon dioxide in the Drake Passage. The Southern Ocean is an important part of the global carbon budget, and the Drake Passage is the narrowest place through which the Antarctic Circumpolar Current goes. This chokepoint is an efficient site to measure the latitudinal gradients of gas exchange, and the ice-strengthened research ship Laurence M. Gould will support a project to measure dissolved and total CO<sub>2</sub>, providing data that, with satellite images, will enable estimates of the net production and export of carbon by oceanic biota.

Antarctic Artists and Writers Program. Seven artists and writers will deploy to Antarctica this season. Six of them will deploy to the McMurdo area between August and January and one, a writer, is part of a research team at Palmer station. Among them are two photographers, a sculpture, two writers, a poet, and a painter.

Ice Coring Drilling Services. This project, one of the technical services in support of antarctic science, provides ice core drilling to the U.S. Antarctic Program and NSF's Arctic Research Program.