4. Research Support, Logistics, Facilities, Data, and Information

4.1 Research Support and Logistics

IARPC will use new resources targeted for Arctic logistics to enhance the leadership role of the U.S. in Arctic research. The focus on logistics entails:

- Establishment, development, and maintenance of national Environmental Observatories;
- Technology and instrument development;
- Expansion of marine platforms and aircraft support capabilities;
- Integration of research, education, and Arctic community interests; and
- Further international collaboration in the support of research.

The use of the new resources will be guided by the Arctic Research Commission's report *Logistics Recommendations for an Improved U.S. Arctic Research Capability*. The general recommendations of the report are:

- Ensure access to the Arctic over the entire year;
- Increase availability and use of remote/autonomous instruments;
- Protect the health and safety of people conducting research in the Arctic;
- Improve communications and collaboration between Arctic people and the research community; and
- Seek interagency, international, and bilateral logistics arrangements.

Planning will be done in partnership with Native groups and other advisory bodies and will respond to merit-reviewed proposals.

The development of additional Environmental Observatories (EOs) is a major component of the proposed plan for logistics enhancement and is also an identifiable component of the NSF theme "Biocomplexity." Candidates for Arctic Environmental Observatories include:

- Toolik Lake, Alaska, an NSF LTER site where the agency has already supported upgrades;
- Barrow, Alaska, Environmental Observatory, where NSF has initiated a cooperative agreement with the Barrow Arctic Science Consortium; and
- Summit, Greenland, a site for which NSF is exploring joint year-round operations with Denmark and other European countries.

As proposals are received for these sites, they will provide the core of an Arctic network for use in distance learning programs, science projects, and related logistics support. By working through the International Arctic Science Committee (IASC), the U.S. hopes to link its EOs with those of other countries (for example, Abisko, Sweden; Svalbard, Norway; and Zackenburg, Kangerlussuaq, Denmark/Greenland) to assure that scientists have access to the full range of Arctic environments and to promote distance learning on an international scale.

The NOAA/CMDL Barrow Observatory, a manned atmospheric baseline facility located six miles northeast of Barrow, has been in continuous operation since 1973. The Barrow Observatory focuses on research relating to atmospheric constituents that are capable of forcing change in the climate of the earth through modification of the atmospheric radiative environment, as well as those that may cause depletion of the ozone layer. This facility conducts scores of continuous monitoring activities, including hosting 21 cooperative programs with universities and other government agencies. NOAA operates a three-station network of solar UV measurements with sites at Barrow, St. Paul Island, and Nome. The Barrow Observatory has expanded its research activities over its lifetime and expects to be monitoring climate change in the Arctic through the next century. Information on CMDL and the Barrow Observatory can be found at http://www.cmdl.noaa.gov.

In response to concerns about Arctic ozone loss and increased UV-B radiation, NSF is considering establishing increased UV measurement projects at the same three EO sites. Also, the atmospheric and space weather observatories at existing U.S. facilities at the Sondrestrom Radar (Greenland) and Spitsbergen may be upgraded.

Research applications of aerosondes (drone aircraft) also will be examined.

Another major logistics issue in the Arctic is developing full access and capability to conduct research on all aspects of the Arctic Ocean. The U.S. plans to facilitate this by funding:

- Research use of the new USCGC *Healy*;
- Tomographic arrays; and
- Improved sensors for the Arctic drifting buoy program, moorings, and autonomous underwater vehicles.

For both marine and terrestrial research the U.S. will improve basic health and safety by providing access to a pool of emergency beacons, satellite phones, and GPS receivers. There is also a need to better integrate traditional knowledge of Arctic residents with research to broaden our capability in the Arctic. The U.S. plans to increase the duration of measurements (especially during the winter) by providing remotely operated instruments linked with individual researchers in their labs, with other Environmental Observatories, and with distance learning centers at community colleges and elementary schools involved with the Alaska Rural Systemic Initiative and the College of Rural Alaska.

4.1.1 Ships and Ice Platforms

Vessels supporting research in ice-covered areas fall into four categories, based on their ice-going capability:

- Icebreakers operated by the Coast Guard;
- Ice-capable and ice-strengthened vessels for research and survey purposes;
- Manned drifting ice stations; and
- NOAA's National Undersea Research Program (NURP) capabilities and expertise with unmanned deep-diving vehicles.

The Coast Guard maintains icebreaking facilities with due regard to national defense and for icebreaker support to other Federal agencies pursuant to interagency agreements. The Arctic Research and Policy Act (ARPA) confirms the Coast Guard's role as manager of the Nation's icebreaker fleet to serve the Nation's interests in the heavy ice regions of the Arctic. This includes security, economic, and environmental interests. Coast Guard icebreakers support research in these regions in two general ways: on dedicated science deployments and, as opportunities arise, in conjunction with other missions. The Coast Guard has three icebreakers, which are available to users on a partial-reimbursable basis. Daily fuel costs and a portion of the helicopter and ship maintenance costs are charged to users, as mandated by OMB. The Arctic Icebreaker Coordinating Committee (AICC) of UNOLS, the University–National Oceanic Laboratory System, coordinates science community and Coast Guard planning for science missions.

Drift stations and other ice platforms including international opportunities will be utilized as research needs dictate.

The NOAA National Undersea Research Program has extensive expertise and experience in conducting deep-diving efforts in all types of aquatic environments. The National Undersea Research Center in Fairbanks, Alaska, can provide vehicles for seafloor exploration or experiments. The center can also work through the ice with ROVs, as was done in Antarctica.

4.1.2 National Ice Center

The National Ice Center (NIC) is a unique interagency organization with oversight from the Department of Defense (DOD), Department of Commerce (DOC), and Department of Transportation (DOT) and responds to both Defense and U.S. national interests as outlined in Annex II to the 1995 Navy–NOAA Umbrella Memorandum of Agreement (MOA). The Naval Ice Center (NAVICE) comprises the largest component of NIC and represents the Naval Meteorology and Oceanography Command through the Naval Oceanographic Office. The second leg of the triad, DOC, is represented under the National Oceanic and Atmospheric Administration's (NOAA) Office of Satellite Data Processing and Distribution. The U.S. Coast Guard's (USCG) Director of Operations Policy represents the third member of the triad, DOT.

NIC's mission is to provide the highest quality operational global, regional, and tactical-scale sea ice analyses and forecasts, tailored to meet the requirements of U.S. national interests. It provides this support to U.S. armed forces, U.S. government and international agencies, academic and scientific institutions, and civil interests.

Weekly global and regional-scale ice extent and coverage products are produced in support of mission planning, vessel operations, and scientific research. More frequently produced tactical-scale ice analyses and forecasts are tailored to customer-specified spatial and temporal requirements. Sea ice features of most frequent interest to operations include ice edge position, ice thickness, ice concentration, areas of compression or heavy deformation, and the location and orientation of open

water or thin-ice-covered leads and polynyas. All NIC ice extent and coverage products are derived from a blend of remotely sensed and in-situ oceanographic and meteorological data.

NIC ice analyses are crucial to both the safety of navigation in ice-covered waters and as a U.S. contribution to international global climate and ocean observing systems. Real-time raster and digital ice products are distributed via the Internet using the NIC home page (http://www.natice.noaa.gov) and over military networks comprising the Defense Information Infrastructure. The NIC's climatological data atlas, developed under the auspices of the Environmental Working Group (EWG) of the U.S.–Russian Binational Commission on Economic and Technological Cooperation, features climatologies of sea ice chart data from Russian and U.S. ice centers. It is based on individual observations collected over the period 1950 through 1994 from U.S. and Russian satellite data, ice stations, icebreakers, and airborne ice surveys. Additionally, U.S. submarines operating in the Arctic over the period from 1977 through 1993 collected data used for a previously classified ice climatology. The atlas is available from the National Snow and Ice Data Center.

NIC legacy (1972–1994) Arctic ice information is available on CD-ROM in digital geographic information system (GIS) -compatible format from the World Data Center for Glaciology–Boulder and the National Snow and Ice Data Center. Arctic ice information for 1995–1996 and Antarctic ice information (1972–1997) are available as of 2001. More-recent Arctic and Antarctic sea ice data sets (1997 to present) are in digital format and available via the NIC web page. NIC has a program in place to finish the conversion of the remaining legacy Arctic and Antarctic information into ARC/INFO GIS format in the 2000–2002 time frame.

The U.S. Interagency Arctic Buoy Program (USIABP), managed by NIC, collects and distributes surface meteorological and ice drift data. A historical quality-controlled archive of these data is available for the World Data Center–A or via the Internet (http:// iabp.apl.washington.edu) from the Applied Physics Laboratory of the University of Washington.

The NIC science program, operating with fiscal support from ONR, NOAA, and NASA, is aimed at expanding the use of NIC's products within the science community and providing a route for migration of scientific techniques (such as algorithms) into the operational environment but was recently expanded to include five post-doctoral fellows. The NIC Science Plan (available at http://www.natice.noaa.gov) summarizes the activities, interests, and goals of this polar science program. Current areas of in-house research include improvements to the next generation of ice forecast models, study of Antarctic hydrography, evaluation of passive and active microwave remote sensing algorithms, refinement of data assimilation techniques, and improvements to long-term sea ice forecasting techniques. The science program also involves oversight of external activities, such as the University of Colorado's work to improve the MODIS sea ice algorithm and the Jet Propulsion Lab's work to develop a sea ice-mapping algorithm for ENVISAT. Other areas of applied research include the improvement of SSM/I-derived ice concentration products, implementation of 85-GHz ice motion products, improved ice forecast models, and ice detection using data from new satellite sensors like the TERRA Moderate Resolution Imaging Spectrometer (MODIS), the ENVISAT dual-polarized SAR, and the QuikSCAT SEAWINDS scatterometer.

4.1.3 Land-Based Facilities

Under contract to NSF, the VECO Polar Resources (VPR) provides logistics support for research in Greenland. By arrangement with NSF, other agencies can also use the services of VPR. The logistics support for the NSF facilities in Kangerlusuaq have changed dramatically since Greenland was granted Home Rule and since September 1992, when the U.S. Air Force terminated operations at Sondrestrom AFB. The logistics support, which was provided by the Air Force, is now done through arrangements negotiated with the Greenland Home Rule Government and the Danish Polar Center.

The VPR provides logistics support as required for NSF in Kangerlussuaq, Greenland. The New York Air National Guard ski-equipped LC-130s operate from Kangerlussuaq principally to Summit.

U.S. investigators have access, on a cooperative or reimbursable basis or both, to land-based facilities in Canada and Nordic countries. Cooperative arrangements with the Polar Continental Shelf Project Office in Canada provide logistics support in the Canadian High Arctic. Facilities in Svalbard are available through the Norwegian Polar Institute, Norwegian universities, and other national programs.

Small seasonal camps are maintained in the Alaskan Arctic by individual agencies or groups of agencies to support field programs. The Toolik Field Station, operated by the University of Alaska and now being upgraded with NSF/VPR support, and the NSF-funded facilities operated by the Barrow Arctic Science Consortium (BASC) at Barrow and facilities at Prudhoe Bay operated by VPR provide fixed bases for land-based research (DOC/NOAA, DOE, DOI/FWS/NPS/GS, NSF).

DOC/NOAA has available hangar facilities for two H-1N helicopters at Fort Richardson, Anchorage, Alaska. These facilities have some additional space for field equipment, scientific instruments, and Arctic gear. NOAA fleet ships have previously worked above latitude 60°N, ice and weather permitting. NOAA aircraft have flown Arctic research projects while basing out of Elmendorf AFB, Eielson AFB, and Thule AFB. NSF, ONR, and the New York Air National Guard have taken over the SPAWAR Arctic Logistics infrastructure at Thule AB.

A memorandum of understanding between the National Science Foundation and the U.S. Army Corps of Engineers has been implemented which allows NSF-supported engineering and scientific researchers to use USACE laboratory facilities. Many of these state-of-the-art facilities are dedicated to cold-regions research and engineering thrusts and are described below.

An aggregation of unique facilities that are nationally and internationally recognized exists at the Cold Regions Research and Engineering Laboratory (CRREL). The main complex is in Hanover, New Hampshire. In addition, a permafrost research tunnel and additional coldrooms are located near Fairbanks, Alaska. Industry and academia often use CRREL's unique experimental facilities. This is evidenced by the high number (80) of cooperative research and development agreements that the laboratory has put in place over the last seven years.

At the Hanover campus the main laboratory houses 24 low-temperature research laboratories capable of achieving temperatures as low as –50°F, special-purpose ice test facilities, cleanrooms, a chemical laboratory, and two specialty low-temperature materials laboratories. The Material Evaluation Facility can simulate snow and icing conditions and can simulate static and cycling temperatures ranging from –50° to 120°F and has the capability to conduct full-scale tests on automotive vehicles. The High Performance Materials Laboratory is used for strength and thermal testing of many types of materials, including construction, road, bridge, and composite materials. Specialized testing machines, such as the Split Hopkinson Pressure Bar, enable low-temperature, high-strain materials evaluation to temperatures as low as –80°C. Other equipment includes thermal cycling chambers that allow for thermal cycling from –100° to 100°C and a specially fabricated UV–radiometry system for exposing testing materials to controlled doses of radiation.

The 73,000-square-foot Ice Engineering Facility has three special-purpose research areas: a large low-temperature towing tank, a 100-foot-long refrigerated flume for modeling rivers, and a large hydraulic-model room for studying ice effects on civil works facilities, primarily locks and dams. The Ice Engineering Facility also houses a snowdrift wind tunnel.

The Frost Effects Research Facility (FERF) allows full-scale research on the impact of freeze–thaw cycles on pavements, foundations, and utility systems. This 29,000-square-foot facility contains a 182- by 75-ft soil testing area that can be maintained at temperatures below 30°F and 12 large test cells where soil can be frozen and thawed at temperatures ranging from as low as –35°F to as high as 120°F. Six to eight natural freeze–thaw cycles can be simulated in a single year. The newest addition to the CRREL's experimental capability, the Heavy Vehicle Simulator (HVS), is housed in this facility. The HVS can simulate the effect of heavy vehicles on roads and pavements.

At the Alaska campus in Fairbanks, CRREL has a research permafrost tunnel and maintains a 133-acre permafrost research site. The CRREL facilities in Alaska include two coldrooms capable of –30°F temperatures, a heavy equipment maintenance shop, a woodworking shop, a soils laboratory, a shock laboratory, and several Small Unit Support Vehicles (SUSVs) used as research vehicles.

The Technical Information Analysis Center (TIAC) serves DOD and the Nation as the most comprehensive source of cold-regions information in the world. The 24,000-square-foot TIAC provides a gateway to the world's information and research resources for cold-regions science and engineering. The Cold Regions Science and Technology Information Analysis Center (CRSTIAC) serves as the Nation's corporate repository for cold-regions science and engineering data. This center houses the CRREL library, which contains 30,000 books, 160,000

reports, 450 journals, 450 rolls of microfilm, 250,000 pieces of microfiche, 40 CD-ROM reference titles, and topographic maps of all 50 states. The Bibliography on Cold Regions Science and Technology, comprising 53 volumes dating from 1951, is prepared for CRREL by the Library of Congress and contains approximately 250,000 citations, including cumulative author and subject indexes.

4.1.4 Atmospheric Facilities and Platforms

Because of the strategic location of the Arctic for observing space-related phenomena, an extensive infrastructure has been established over the past four decades to observe the Arctic upper atmosphere and ionosphere. The Arctic is the site of many ground-based radio, radar magnetic, and optical observing sites. These sites and many other smaller facilities have been an important aspect of the Arctic social structure, providing economic benefits in remote regions and educational opportunities for indigenous people.

Among the major upper atmospheric research facilities in the Arctic are the Sondrestrom Radar in Greenland, the High Frequency Active Auroral Research Program (HAARP) radar in Alaska, the Poker Flat Rocket and Research facility near Fairbanks, the Resolute Bay Observatory in Canada, the Longyearbyen Optical Station in Norway, and the SuperDARN radar network with sites spanning the Western Hemisphere Arctic. These and other smaller sites are operated in collaboration with international partners, including academic and research institutions in Canada, Denmark, Norway, and Japan.

NASA is establishing a Network for Detection of Stratospheric Change (NDSC) program at Thule and Sondrestrom, Greenland, to provide long-term data on a variety of stratospheric constituents.

NASA and NSF cooperated in a program called the Program for Arctic Regional Climate Assessment (PARCA). This involved satellite and airborne surveys of different regions of the ice sheet to establish patterns of ice sheet thickening and thinning, along with ground-based surveys to establish reference data for interpreting airborne and satellite observations. Ground observations included the deployment of automatic weather stations and the analysis of shallow snow pits and deep ice cores. The results have, for the first time, shown clear regional patterns in the mass balance of the ice sheet.

4.1.5 Central Coordination and Logistics Information Clearinghouse

The Department of the Interior supports an Alaska Office of Aircraft Services (OAS), which coordinates aircraft services on a reimbursable basis.

An electronic bulletin board, ALIAS, is being developed on the Internet (http://www.arcus.org/ALIAS/index.html) to provide information on logistics resources throughout the Arctic.

4.1.6 Data Facilities

Archiving and distribution functions for data required in support of Arctic research are distributed among all the U.S. national data centers. Disciplinary data for the Arctic are held in global archives at the National Climatic Data Center (climatology and meteorology), at the National Oceanographic Data Center (oceanography), at the National Geophysical Data Center (seismology, geomagnetism, marine geology and geophysics, solar and ionospheric studies, ecosystems, topography, and paleoclimatology), and at the National Center for Atmospheric Research (upper atmosphere and ionospheric studies). Data sets for a vast array of cryosphere-specific variables in the Arctic (sea ice, snow cover, permafrost, etc.), are archived and distributed through the National Snow and Ice Data Center (NSIDC) and the World Data Center–A (WDC–A) for Glaciology in Boulder, Colorado. These include satellite-derived measurements, in-situ observations, and ancillary information that have been supported by NASA, NOAA, and NSF. Global satellite data archives for polar-orbiting satellites are held by NOAA/NESDIS/ National Climatic Data Center (NCDC) in Asheville, NC. Included in these archives are:

- Global infrared and visible digital imagery from the advanced very-high-resolution radiometer (AVHRR) instruments;
- Atmospheric temperature and moisture data and derived soundings from the high-resolution infrared radiation sounder (HIRS) instruments; and
- Global passive microwave data from the special sensor microwave/imager (SSM/I).

Electronic access to recent AVHRR and HIRS data is available through the NESDIS Satellite Active Archive (http://www.saa.noaa.gov). Global satellite data archives for the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS) data are held by the National Geophysical Data Center. The National

Oceanographic Data Center (NODC)/WDC–A is the lead agency in the United Nations Intergovernmental Oceanographic Commission (IOC) Global Oceanographic Data Archaeology and Rescue Project (GODAR). The goal of this project is to locate and rescue historical oceanographic data that are in jeopardy of being lost, including Arctic oceanographic data.

The Alaska SAR Facility (ASF) also operates a DAAC under contract to NASA/EOSDIS. The facility receives and processes polar imagery from SARs onboard Canadian (Radarsat) and European (ERS-2) satellites. The ASF also carries out a range of tasks in support of the data, including calibration and the development of data analysis tools. A major data analysis project underway at the ASF involves implementation of the Radarsat geophysical processor system (RGPS), which is designed to generate high-level products from Radarsat, including ice drift, ice deformation, and ice thickness histograms using a novel Lagrangian tracking system.

Without archives, Arctic data would in time be lost. Without a method to locate data in the archives, scientists would have no access to the data required for Arctic and other research. NOAA's Environmental Services Data Directory (NESDD) is a vital windows into the U.S. national data archives, providing a means for scientists to locate the data they require.

4.2 Arctic Data and Information

4.2.1 Arctic Data

This year completes a decade of service to the polar science community at the Alaska SAR Facility (ASF), NASA's facility for archiving and distributing SAR data.

Some of the major projects served this year include the second joint U.S.–Canadian Applications Development Research Opportunity (ADRO-2, see section 3.1.2); the Radarsat Geophysical Processing System project (section 3.2.1); operational support with near-real-time data (averaging less than three hours turnaround) for the National Ice Center; and the NOAA Coast Watch and Alaska Demonstration projects. Sub-Arctic research projects supported include the Alaskan Volcano Observatory and the Boreal Forest Mapping Mission. In addition to these projects, ASF supports other projects, which together represent an estimated user community of 1400 individual PIs and co-PIs.

ASF has facilitated research and applications development through involvement with the science community, participating in workshops, attending conferences, and producing and distributing new products. This year ASF hosted a visiting scientist, continued participation in NASA's ESIP Federation, and participated in IGARSS, AGU, and other meetings.

With the recently signed U.S.–Canadian IMOU extending the relationship between NASA and CSA to acquire and exploit Radarsat data, ASF plans to increase the user community by a minimum of 5% and provide continuity of the data record needed by the polar research scientists in order to track the ongoing global changes in the earth system. ASF also plans to continue reception of ESA's ERS-2 SAR data and to negotiate with ESA and NASA to participate in the reception, archive, and distribution segments of their future missions (Envisat, CryoSat, ALOS). ASF will also continue to stand ready for the launch of ADEOS-2. ASF plans to expand near-real-time services to the operational communities to support business-as-usual requirements, disaster mitigation protocols, and the commercial applications community for aid in effective and responsible policy decisions at the state and local level. ASF is also working to produce a public CD-ROM with an ERS-1 SAR mosaic of Alaska.

The National Snow and Ice Data Center (NSIDC) Distributed Active Archive Center (DAAC) provides access to cryospheric data for both northern and southern hemispheres, with the present emphasis on the Arctic. NSIDC is chartered and partially funded by NOAA, through the Cooperative Institute for Research in Environmental Sciences (CIRES), to provide snow and ice data services. The Center is under contract to NASA's Earth Observation System Data and Information System (EOSDIS) project as a DAAC, providing snow and ice data and information services. The DAAC processes, archives, and distributes sea ice and snow cover data from visible, infrared, and passive microwave sensors, in particular from the special sensor microwave imager (SSM/I), the moderate resolution imaging

spectrometer (MODIS), and advanced very high resolution radiometer (AVHRR) sensors and related in-situ data. The DAAC's passive microwave data sets include a 20-plus-year time series of sea ice extent and concentration for both polar regions.

The EOS TERRA satellite was launched in late 1999, and snow products from the MODIS instrument were released to the general scientific community in mid-October 2000. Sea ice products from the MODIS instrument are expected to be released in early 2001. In addition to the MODIS snow and ice products from the TERRA and AQUA satellites (to be launched in mid-2001), the DAAC will ingest and distribute all passive microwave products from the advanced microwave scanning radiometer on AQUA. Altimetry and aerosol data sets from the Geoscience Laser Altimeter System (GLAS) instrument on ICESat will also be distributed by the NSIDC DAAC. ICESat is scheduled for launch in late 2001.

Non-EOS satellite data include the Near Real Time Ice and Snow in EASE grid (NISE) daily product, gridded passive microwave brightness temperatures and sea ice data on CD-ROM, AVHRR polar subsets at 1.25- and 5-km grids, and other in-situ data. Information on all NSIDC DAAC data sets may be found at http://www.nsidc.org/.

The National Snow and Ice Data Center (NSIDC) was chartered by NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) in 1982 to provide a focus for cryospheric data management activities. NSIDC operates under a cooperative agreement between NOAA and the University of Colorado's Cooperative Institute for Research in Environmental Sciences. Within NOAA, NSIDC is affiliated with the NESDIS National Geophysical Data Center. NSIDC is also the home of the World Data Center for Glaciology, Boulder. At present the majority of funding for NSIDC data management activities comes from NASA for operating a Distributed Active Archive Center (DAAC) for cryospheric data collected by the Earth Observing System (EOS) program.

The NSIDC DAAC provides access to EOS satellite data, as well as ancillary in-situ measurements, baseline data, model results, and algorithms relating to cryospheric and polar processes. These activities are evolving from existing practices at NSIDC DAAC to permit a smooth implementation of the EOS Core System Version 2 and beyond. NSIDC archives and distributes snow and ice products from the moderate resolution imaging spectroradiometer (MODIS) instrument aboard the NASA TERRA satellite. MODIS snow cover extent, sea ice extent, and sea ice surface temperature products are available in orbital and gridded formats. These products extend the existing 30-year record of passive-microwave-derived snow and sea ice products at greatly improved spatial and spectral resolution. Other DAAC products are the Near Real Time SSM/I EASE-Grid Daily Global Ice Concentration and Snow Extent, and global brightness temperatures from the Defense Meteorological Satellite Program's special sensor microwave imager. In addition to work with data sets, NSIDC compiles the DAAC Yearbook, a collection of articles on applications of DAAC data, written for the general public.

As part of a larger joint NOAA/NASA program, NSIDC works closely with NOAA's NESDIS Long Term Archive team to develop a prototype long-term archive of snow and ice data, metadata, and products from EOS satellites. This effort will determine the resource requirements for a level of service to the user community that is comparable to the current level of service provided by NSIDC for EOS cryospheric data and by the National Geophysical Data Center for Defense Meteorological Satellite Program data and products.

The Arctic System Science (ARCSS) Data Coordination Center (ADCC) at NSIDC will provide ARCSS data and information to the scientific community well into the 21st century. The ADCC is the permanent archive and access point for data collected by investigators in the National Science Foundation's ARCSS program and serves as a catalyst for ARCSS integration through data and information management. Of note is ADCC's work to develop an automated system for climate model output data requests. ADCC averages well over 600 megabytes of data and information downloaded per month. These data sets are mostly in-situ and small data groupings rather than NSIDC's more typical large, multisensor collections.

Funding from the Environmental Services Data and Information Management program has resulted in the publication of over 30 snow, glacier, and sea ice data sets that had been in danger of loss. Many of these are from the former Soviet Union. NSIDC's participation in the joint U.S.–Russian Environmental Working Group's Arctic Climatology Subgroup to produce Arctic Atlases on CD-ROMs has strengthened connection to data repositories in Russia.

The User Services staff responds to inquiries made to NSIDC and its subsidiary data centers. Examples include students requesting information for school projects and reports, media and textbook publishers requesting photographs and interviews, and science researchers requiring information about data holdings, processing, formats, and science algorithms. Educational and research users represent more than half of all users, with the remainder split among government, commercial, and the general public. The rising number of requests for information from the general public has led NSIDC to develop educational "theme pages" on subjects such as glaciers and snow.

Investigators associated with NSIDC bring a polar scientist's perspective to data management. Work is being conducted under approximately 30 grants at any time, and topics range from studying variation in the timing and extent of snowmelt on the Greenland and Antarctic ice sheets with passive microwave data to documenting Inuit knowledge of climate change. NSIDC also seeks to synthesize and interpret research for the general public. For example, "State of the Cryosphere" web pages present aspects of snow cover, sea ice, glaciers, and sea level changes as they relate to climate change.

NSIDC served as co-chair of a World Climate Research Programme (WCRP) Task Group to develop a Climate and Cryosphere (CliC) Science and Coordination Plan. The plan, which lays a path for the coordination of the cryospheric elements of existing projects of the WCRP, was adopted in March 2000, and a joint Arctic Climate System (ACSYS) –CliC Science Steering Group was established. The CliC project addresses interactions among all land and oceanic components of the cryosphere (snow cover, glaciers, ice sheets, permafrost and seasonally frozen ground, freshwater ice, and sea ice) and the climate system, as well as the role of the cryosphere as a climatic indicator for monitoring. Significant questions concern the contribution of glacier melt to sea level rise, the effects of changes in snow and ice cover on water resources, and the impacts of climate change on polar sea ice and on frozen ground. The text of the CliC plan is available at http://www.npolar.no/acsys/CLIC/clic_may.pdf.

4.2.2 Arctic Information

Arctic and Antarctic Regions is available for Windows, DOS, and Internet use from NISC. Comprehensive polar coverage on this CD offers over 800,000 records compiled by the major polar regions research organizations in the U.S., Canada, and the U.K.

A Polar web site, a collaborative project of the Polar Libraries Colloquy and others, provides a guide to Internet resources. The address is http://www.urova.fi:80/home/arktinen/polarweb/polarweb.htm.