



Summary of Recommendations

The recommendations detailed in the previous section and summarized here reflect the research opportunities and needs for the Barrow area. They are directed to the National Science Foundation and other potential funding agencies and to those who will carry out the recommended actions. Improvements to the research support currently available in the Barrow area should be well-coordinated and should use existing resources whenever possible. Both the needs for support and the effectiveness of providing that support should be evaluated on a regular basis.

Because some recommendations could be implemented in the next few years, while others will depend on completion of requisite improvements or additional planning, the recommendations have been identified as short term or mid term. Many of the mid-term recommendations follow up on planning or infrastructure recommended in the short term. Six recommendations have been identified (with ★★) as highest priority either because of urgent needs or because other recommendations cannot be implemented until these items are completed. In addition, five overarching recommendations on improving coordination and communication are relevant to all major research areas and to improvements in research support. A table on the following pages summarizes and provides estimated costs for many of these recommendations.

Overarching Recommendations: Applicable to all Aspects of Improving Research Infrastructure

A major problem identified by workshop participants was the lack of coordination among research programs in the Barrow area. Better communication among researchers and community members would improve

Recommendations

(★★ indicates highest priority recommendations)

Overarching Priorities Supporting All Research

- ★★ Fund an organization to provide research support. ▼ Evaluate needs for and utility of current support regularly. ▼ Seek and promote opportunities for integrating research and results. ▼ Promote interactions between arctic communities and researchers.
- ▼ Provide educational opportunities for young researchers and local residents.

	Buildings, Sites, and Facilities	Est. Cost	Field Equipment and Transportation	Est. Cost	Technology and Information	Est. Cost	Human Resources	Est. Cost	Interagency Coordination	Est. Cost
Implement within 2 years	★★ Maintain the Arctic Research Facility	\$200K/yr	▼ Assess needs, identify suppliers, and develop procurement agreements for field equipment	\$220K	★★ Establish high-capacity, high-speed data link	\$220K	▼ Develop a plan and budget for centralized support	\$36K	▼ Develop MOAs among agencies and organizations to centralize permitting and coordinate agency research and support efforts	\$67K
	★★ Plan a new general-purpose facility, including design fees and personnel support	\$ 200K	▼ Assess needs, identify suppliers, and develop agreements for providing research transportation, including mechanisms for improved air support	\$1M	▼ Install differential GPS system	\$400K	▼ Establish a local liaison position	\$51K		
Implement within 5 years	★★ Develop a Master Plan for the Barrow Environmental Observatory	\$75K		\$50-100K	▼ Develop a web site with basic logistical information	\$50-100K	▼ Develop training materials and classes for specialized needs			
	▼ Build a new research support facility	\$10-20M	▼ Develop MOAs with local suppliers for a variety of goods and services	\$100K	▼ Complete GIS coverages for base features of the area	\$100K				
	▼ Develop, maintain, and improve utilities and road access		▼ Build a sufficient inventory of goods and a repertoire of services not available elsewhere so a reliable supply is available	\$50-100K	▼ Develop approaches for using traditional knowledge	\$50-100K				
				\$120K	▼ Identify and adopt metadata standards	\$120K				
					▼ Develop and maintain a more complex interactive web site with logistics and resource information for researchers		▼ Fully implement centralized support structure		▼ Expand and refine MOA among agencies and organizations as coordinated logistics and science implementation advance	
					▼ Install satellite downlink for real time retrieval of satellite remote sensing data		▼ Implement ongoing liaison activities			
							▼ Offer ongoing training, as needed			

efficiency and increase educational opportunities. A great deal of the necessary communication and coordination can be done most efficiently by appropriate uses of technology (see Technology and Information, next page), but the level of coordination envisioned by workshop participants will require a dedicated science support organization. The overarching recommendations to improve communication and coordination are:

- ★★ **Identify and fund an organization and personnel based in Barrow to provide research support, infrastructure development, and coordination** by carrying out the activities recommended below or by coordinating and overseeing their implementation.
- ▼ **Regularly evaluate the needs for support and adequacy of available facilities and resources** to ensure that facilities and other research support evolve adequately, and that research support investments are effectively shared among appropriate agencies.
- ▼ **Promote the coordination of research programs and sharing and coordination of data** so that our understanding of the arctic system is enhanced through integrated multi-disciplinary and interdisciplinary studies.
- ▼ **Promote interactions between the community and researchers** to disseminate research plans and results, incorporate community participation, promote the use of traditional knowledge, and develop collaborative projects.
- ▼ **Provide educational opportunities for young researchers and local residents** through internships and fellowships to encourage local involvement as well as the development of local scientific capabilities and a strong cohort of arctic researchers in the future.

Short-term Recommendations: Appropriate for Implementation within Two Years

Some of the short-term recommendations are for planning and development, in cases where there are technical or other obstacles to immediate implementation. Others are for specific improvements that can and should be completed within two years.

Buildings, Sites, and Facilities

The space that is available to researchers in the Barrow area is at capacity in the busy summer season. The physical facilities of the ARF were not designed for many research uses and are degrading with time and heavy use. Currently, the North Slope Borough Department of Wildlife Management pays for the ARF and makes it available to visiting researchers. This arrangement will end soon due to budget cuts within the North Slope Borough, and outside support will be necessary to keep the ARF operating, even at its current level of use. To provide adequate living and work space in the short term:

- ★★ **Contribute to the maintenance of the Arctic Research Facility (ARF)** so that it can continue to provide modest living and working space for visiting researchers as well as a workshop and storage space for basic field clothing and equipment.

★★ **Identify and fund an organization and personnel based in Barrow to provide research support, infrastructure development, and coordination by carrying out the recommended activities or by coordinating and overseeing their implementation.**

★★ Contribute to the maintenance of the Arctic Research Facility so that it can continue to provide modest living and working space for visiting researchers as well as a workshop and storage space for basic field clothing and equipment.

★★ **Plan a new general-purpose research facility** with expanded capability to provide adequate living and working space for visiting researchers. The planning process should address not only the physical structure but the ways in which it will be funded, including core funding and fees collected from visiting researchers.

★★ **Develop a master plan for the Barrow Environmental Observatory (BEO)** to address land-use and planning requirements related to access, permits, utilities, structures, coordination of various activities undertaken on the BEO, road maintenance, and other aspects of managing the land through the cooperation of the North Slope Borough and the Ukpeagvik Iñupiat Corporation.

Field Equipment and Transportation

Researchers' equipment and transportation needs vary with the type of project and time of year. Safe access to field sites is a critical component of research support. To improve field equipment and transportation in the short term:

- ▼ **Assess field equipment needs, identify suppliers, and develop requisite agreements for procurement**, as part of planning for, providing, and maintaining the necessary equipment, including safety equipment, to researchers.
- ▼ **Assess transportation needs, identify suppliers, and develop necessary agreements for services**, to provide transportation services to researchers. This action includes exploring mechanisms for improved air support, such as sharing helicopter time.

Technology and Information

Barrow lacks a modern data link essential to high-capacity, high-speed computing and data transfer; further improvements depend on the installation of an appropriate link. Several other technology investments are needed to increase efficiency and comprehensiveness of data acquisition. To improve technology and information in the short term:

- ★★ **Establish a high-capacity, high-speed data link to the lower 48 states** to allow access to databases located throughout the U.S. and the world so that needed data can be accessed from Barrow. The link also would allow the transfer of data from Barrow to high-speed computing facilities elsewhere, making modeling and analysis possible during, as well as after, the field season.
- ▼ **Build a differential global positioning system (GPS) station** in Barrow to allow highly accurate mapping and plotting of research sites, to facilitate data entry during field work, and to enhance the safety of field teams.
- ▼ **Install a fiber-optic cable across the shore-ocean boundary** to allow access to moored ocean observing systems providing year-round, real-time oceanographic data needed for a broad spectrum of studies ranging from climate change to acoustic monitoring of bowhead whales.

- ▼ **Develop a preliminary web site with logistical support information** for the Barrow area to help researchers plan their activities and find the goods and services they require.
- ▼ **Develop a GIS data catalog** and complete GIS coverages for base features, for the BEO in large geographic scale and the North Slope in small geographic scale, so that researchers will have access to common base features, allowing better integration of data sets and more accurate recording of spatial data.
- ▼ **Develop approaches for using traditional knowledge** in research contexts to encourage greater use of this extensive source of observations and understanding.
- ▼ **Identify and adopt appropriate metadata standards** so that data sets can be integrated for analysis and interpretation within and across disciplines.

Human Resources

The personnel currently dedicated to science support in the Barrow area are not sufficient to meet demands. To fill the gap, researchers frequently require help from others, such as the staff of the DWM, placing a large burden on those not specifically employed to provide their time and expertise for logistical support. Improvements in research support will require the assistance of additional personnel. To improve human resources available for research support in the short term:

- ▼ **Prepare a detailed plan for centralized support, including personnel needs**, so that the agencies and organizations supporting research in the Barrow area can plan their activities and budgets to meet the common needs of researchers.
- ▼ **Establish a local liaison position** to help community members and researchers interact smoothly and effectively, as described in the overarching recommendations.
- ▼ **Develop training materials and classes** to cover safety in field research, survival in arctic conditions, handling of hazardous material in the field, and other aspects of field research.

Interagency Coordination

Much of what is needed to support research in the Barrow area is already present, but spread among several federal, state, and local agencies. Effective interagency coordination will do much to address the logistical needs of researchers and facilitate collaborations. For example, obtaining the necessary permits to do research in the Barrow area is confusing and can be difficult because of the many overlapping agency jurisdictions. To improve interagency coordination in the short term:

- ▼ **Develop a centralized permitting process** so that researchers can submit the required information and obtain the necessary permits efficiently, with input from appropriate land managers.
- ▼ **Coordinate the support efforts of the agencies involved in research in the Barrow area** through Memoranda of Understanding (MOU) or Memoranda of Agreement (MOA). The NSF Office of Polar Programs should take the lead in developing and coordinating such agreements.

★★ Plan a new general-purpose research facility with expanded capability to provide adequate living and working space for visiting researchers. The planning process should address not only the physical structure but the ways in which it will be funded, including core funding and fees collected from visiting researchers.

★★ Develop a master plan for the Barrow Environmental Observatory to address land-use and planning requirements related to access, permits, utilities, structures, coordination of various activities, road maintenance, and other aspects of managing the land through the cooperation of the North Slope Borough and the Ukepeagvik Iñupiat Corporation.

Mid-term Recommendations: Appropriate for Implementation in Two to Five Years

Mid-term recommendations include the implementation of tasks that require further planning or development in the short term, as well as the continuation and expansion of activities initiated in the first few years.

Buildings, Sites, and Facilities

Implementing the recommended major improvements to the research facilities in the Barrow area will require time for careful planning. During the planning for a new facility, short-term support of the ARF (recommended on page 49) will be necessary to provide temporary living and work space. In the longer term, the following improvements to research infrastructure should be completed:

- ★★ **Build a new research support facility**, with the capacity for expansion and including the work and storage spaces needed for the variety of field projects and disciplines based in the region.
- ▼ **Develop, maintain, and improve utilities and road access** to research sites and facilities as necessary and in accordance with the BEO master plan.

Field Equipment and Transportation

Assessment of researchers' equipment and transportation needs in the short term should be followed by coordinated provision for those needs:

- ▼ **Develop Memoranda of Understanding (MOU) and Memoranda of Agreement (MOA) with local suppliers for a variety of goods and services**, in order to promote efficiency and reduce the burden on the central facility, where appropriate. Longer-term agreements with suppliers will help to achieve more reliable and less cumbersome support for research projects.
- ▼ **Build a sufficient inventory of goods and a repertoire of services** for which there will be a significant demand and that are not available elsewhere so that a reliable supply is available when needed.

Technology and Information

Implementing the recommended short-term investments in technology and information should enable increasing efficiencies in data acquisition and research support. Continued development of these capabilities in the mid term should include:

- ▼ **Install a satellite downlink receiver** to make real-time remote sensing data available to support current research projects and mission planning.
- ▼ **Expand the web site** to include additional relevant information as well as an interactive capability for researchers and logistics providers to access and update their information.

Human Resources

Implementation of the short-term human resources planning and budgeting recommendations should ensure that additional research support personnel will be in place to meet researchers' needs in the mid term. Continued and expanded activities in the mid term should include:

- ▼ **Fully implement centralized and coordinated support** so that the agencies and organizations supporting research in the Barrow area can meet the common needs of researchers.
- ▼ **Continue local liaison activities to facilitate communication** among research projects and communities and to disseminate information about such topics as funding opportunities.
- ▼ **Continue to offer training materials and classes** as needed to cover safety in field research, survival in arctic conditions, handling of hazardous material in the field, and other aspects of field research.

Interagency Coordination

Cooperative efforts among agencies will require ongoing modification and expansion, therefore:

- ▼ **Further develop Memoranda of Agreement and Memoranda of Understanding** between funding agencies and organizations capable of providing research support as coordination of activities and research needs develop.

★★ Build a new research support facility, with the capacity for expansion and including the work and storage spaces needed for the variety of field projects and disciplines based in the region.