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THE 1990 GREENLAND FIELD SEASON AFTER OPERATIONS REPORT FOR NSF-SPONSORED PROJECTS

Prepared by:

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PICO
OR 90-2

December 1990

PICO is operated by UAF under contract to the National Science Foundation, Division of Polar Programs.

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FOR

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Prepared by:

Steven Peterzen
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To:

Division of Polar Programs
National Science Foundation
Washington, D.C. 20550

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ACKNOWLEDGEMENTS

On behalf of the National Science Foundation Division of Polar Programs and all NSF-sponsored participants, the Polar Ice Coring Office at the University of Alaska Fairbanks (PICO/UAF) extends its appreciation to the many individuals, organizations and colleagues for their continued support and assistance. The success of the 1990 National Science Foundation Greenland field season is largely due to support provided by the following groups and organizations:

Danish Commission for Scientific Research in Greenland
Headquarters United States Air Force (HQ USAF)
Headquarters Military Airlift Command (HQ MAC)
Headquarters USAF Space Command (HQ AFSPACECOM)
The 109th Tactical Airlift Group (109th TAG)
Sondrestrom Air Base, Greenland (1015th ABS)
Thule Air Base, Greenland (1012th ABG)
McGuire Air Force Base, NJ (WRI)
Alaska Air Command, Eielson AFB
US Army, Fort Wainwright
US Army CRREL
4700 Operations Support Squadron (4700 OSS)
Felec Services, Inc. (FSI)
Dewline Station Dye 3 (DYE3)
GreenlandAir A/S (GLAIR)
GreenlandAir Charter A/S (GLACE)
The Royal Greenland Trade Department (KNI)
The Danish Meteorological Institute
STATOIL
Science Management Office

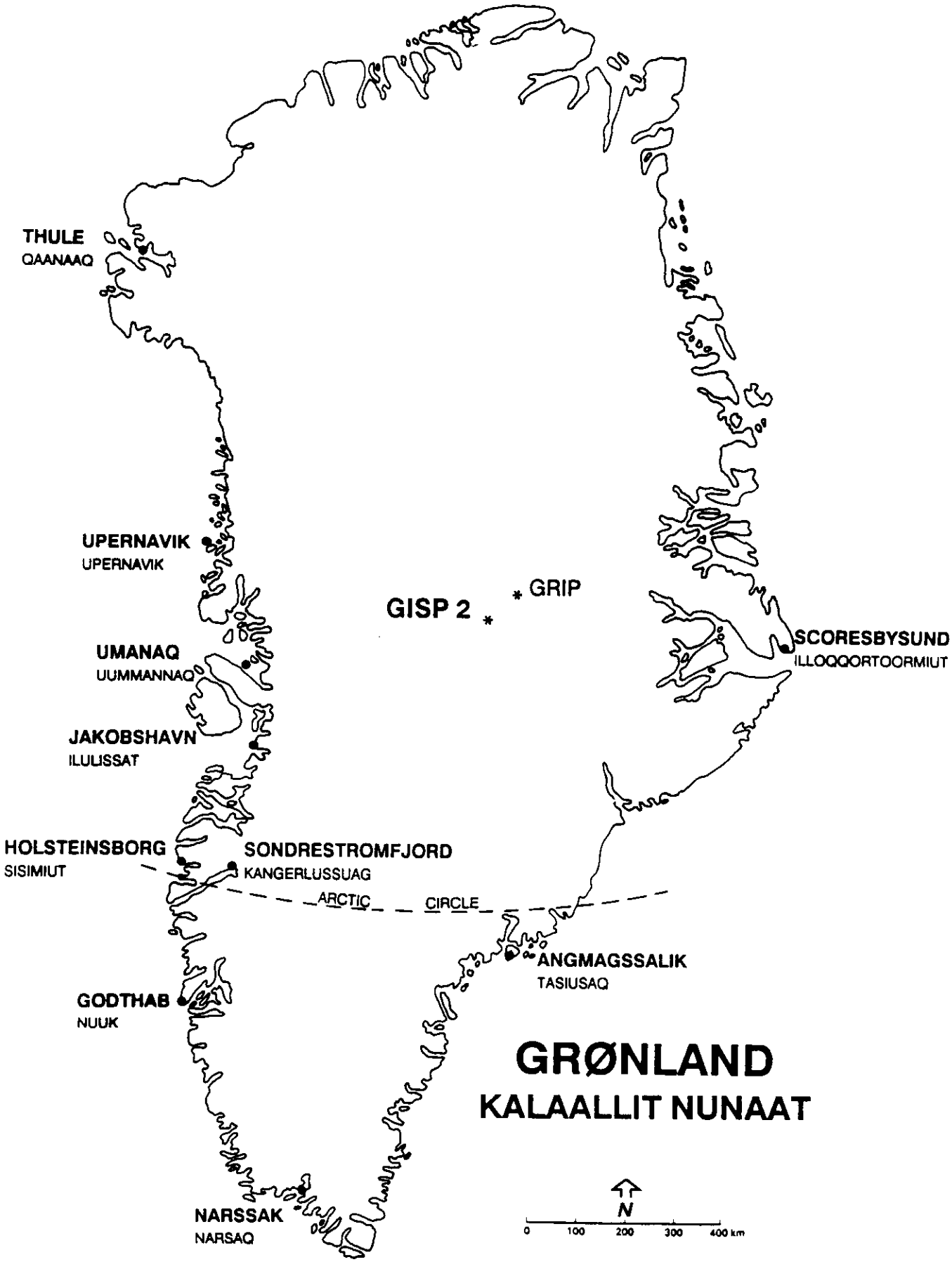
I. INTRODUCTION

"The 1990 Greenland Field Season After Operations Report for NSF-Sponsored Projects" has been prepared to summarize the field activities of, and logistical support for, 1990 National Science Foundation Division of Polar Programs (NSF-DPP) sponsored research projects in Greenland.

The Polar Ice Coring Office (PICO) at the University of Alaska Fairbanks (UAF) provides administrative support, field operations management and coordination of logistical requirements for NSF-sponsored projects under NSF contract DPP88-20948. PICO's primary responsibilities are to support NSF Division of Polar Programs (DPP) glaciology projects and, secondarily, to support other DPP projects and those sponsored by other Divisions within NSF.

PICO operations support includes: 1) arrangements for personnel and equipment transportation between the U.S. and Greenland, 2) military clearances for personnel access to air base facilities in Greenland, 3) on-site coordination of field activities originating at Sondrestrom Air Base, 4) control and maintenance of an inventory of field camp equipment that includes: oversnow vehicles, shelter/tents, kitchen supplies, radios, generators and fuels, and 5) liaison between NSF, the scientists and civilian and military support subcontractors. PICO also provides: 1) ice core and hot water drilling services, 2) the loan of non-technical drilling equipment, and 3) borehole logging equipment and services to NSF-DPP glaciological and geophysical projects.

A location map of Greenland is provided as Figure 1. Coastal sites of NSF-sponsored research include Sondrestrom AB, Thule AB, Ilulissat (Jakobshavns), Nuuk (Godthaab); and Kangerdlugssuaq fjord and Angmagssalik on the north and east coasts. Sites on the ice sheet include Dye 2, the Summit region of central Greenland.


THULE
QAANAAQ
UPERNAVIK
UPERNAVIK
GISP 2
GRIP
SCORESBYSUND
ILLOQQORTOORMIUT
UMANAQ
UUMMANNAQ
JAKOBSHAVN
ILULISSAT
HOLSTEINSBORG
SISIMIUT
SONDRESTROMFJORD
KANGERLUSSUAG
ARCTIC CIRCLE
ANGMAGSSALIK
TASIUSAQ
GODTHAB
NUUK
NARSSAK
NARSAQ
GRØNLAND
KALAALLIT NUNAAT
N
0 100 200 300 400 km

II. NSF-DPP GLACIOLOGY AND OTHER NSF-SPONSORED PROJECTS

There were several NSF-sponsored field projects participating in the 1990 Greenland season. Included were the Greenland Ice Sheet Project II (GISP2) investigators. A total of 136 individuals were involved in field activities. Table 1, provides a list of projects by category:

A. NSF-DPP Sponsored Polar Coordinated Science Programs
B. NSF-DPP Sponsored Polar Glaciology Programs
C. NSF-DPP Sponsored Polar Earth Sciences Programs
D. Other NSF-Sponsored Programs
E. Distinguished Visitors

Figure 2, presents a timetable for NSF-sponsored projects fielded during the period April through September.

For additional information regarding science activities at GISP II, forward your requests to the Science Management Office, Dr. Paul Mayewski, Department of Earth Sciences, University of New Hampshire, Durham, NH 03824.

NSF-DPP POLAR GLACIOLOGY PROJECTS

1990 marks the second field season of the GISP2 project. The major thrust of the GISP2 project is to drill and recover an ice core from the entire thickness of the Greenland Ice Sheet, over 3000 meters. This is the most ambitious ice core drilling program in Greenland to date, and will provide researchers with the longest paleoenvironmental record ever achieved in the northern hemisphere. GISP2 shares similar goals with the European "Greenland Ice Core Program" (GRIP) deep drilling effort. The GRIP camp and drilling operations are located approximately 30 Km east of the GISP2 site and began operations in 1989. The GRIP Operations Center (GOC) is located on the civilian side of Sondrestrom. Coordination of field operation is performed through this facility.

Science activities at GISP2 this season involved researchers from several universities or institutes from across the United States. Institutions involved include: University of New Hampshire; University of Wisconsin; University of Washington, The Desert Research Institute; New York Institute of Health; University of Miami; University of Rhode Island; Carnegie-Mellon University; University of Colorado; Cold Regions Research Engineering Lab (CRREL); and Pennsylvania State University. The GISP2 Science Management Office (SMO) is housed at the University of New Hampshire (UNH), with drilling and operations support provided by PICO at the University of Alaska Fairbanks. The point of contact for SMO is Dr. Paul Mayewski and for PICO is Jay Sonderup and Dr. John Kelley.

All ice core samples, along with other surface, snow pit and atmospheric samples, were returned to the Continental United States (CONUS) for detailed chemical and physical studies. The last hole drilled in 1989 to 90 meters was re-entered in 1990 to begin deep drilling operations expected to continue on a seasonal basis through the summer of 1992. A report on the drilling activities is available from PICO at 205 O'Neill Building, Fairbanks, Alaska 99775-1710. A summary list of GISP2 science activities with the Principal Investigators is provided in Appendix A.

NON-U.S. PROJECTS

Non-U.S. collaborative or cooperative projects that received PICO support include ETH-Zentrum with communications and information transfer between their field camp and Ziruch, Jakobshavn Ice Stream project; the University of Copenhagen Geophysical Institute, and to the GRIP Operations Center. PICO support to the GRIP program includes the coordination of United States Air Force air support provided by the 109th TAG, as well as other minor base services provided by the 1015th ABS, Sondrestrom Air Base, Greenland.

Table 1. NSF-DPP, Other NSF-Sponsored Projects and Non-U.S. Projects
Greenland 1989 1990

Institution/Principal Investigator	Project Title	Project Summary
A. NSF/DPP Polar Coordinated Science Projects		
1. Polar Ice Coring Office Univ. Alaska Fairbanks (PICO/LG) Dr. Luis Proenza	Coordination of Greenland 1989 Operations and Logistics	Coordination of field operations for DPP and Non-DPP sponsored field programs (April 20 - Sept. 24)
B. NSF/DPP Polar Glaciology Projects		
1. Geophysical Institute Univ. of Alaska Fairbanks (UAF/GI) Dr. Keith Echelmeyer	Determination of the Mechanisms of Rapid Flow on Jakobshavns Glacier Greenland by borehole measurement	Seismic investigations and recovery of data loggers. No further drilling is planned. (June 9-28)
2. Institute for the Study of Earth, Oceans & Space (GISP2) Dr. Paul Mayewski	GISP 2	A group of individual projects conducting paleoclimatic, atmospheric and glaciological studies from ice cores obtained in central Greenland. (May 7 - Sept. 18) ** See table 2 for complete list of GISP2 principle investigators and projects.
3. The Ohio State University (BPRC-OSU) Dr. Gunter Faure	Search for Meteorites in northern Greenland: A preliminary feasibility study	An aerial reconnaissance flight from Thule AB to locate ice fields, supraglacial moraines and nunataks in northern Greenland where meteorites may be accumulating; and to test a portable ice radar which could be used to determine ice thickness during future investigations. (March - April)
C. NSF/DPP Polar Earth Sciences		
1. Boise State University Dept. Geology/Geophys. (BSU) Dr. Craig White	A Study of co-existing mafic and silicic magmas in the Vandfaldsdalen macrodike, East Greenland	A continuation of petrologic study of one of the three very large dikes; to address the mechanism by which silicic magmas overlie magic magmas, compositional zoning, and mixing between silicic magmas and mafic liquids. (August 1-20)
2. Stanford University Dept. of Geology (SU) Dr. Dennis Bird	Geochemical and structural evolution of gabbro-hosted magma-hydrothermal systems: East Greenland	A continuation of studies of metamorphism, hydrothermal alteration, and the possible influence of magmatism during early stages of continental rifting. (TBA)
D. Other NSF-Sponsored Projects		
1. Stanford University SRI (SU) Dr. Robert Clauer	Back Scatter Radar Communication Research	Meteor burst recording from Central Greenland.

E. DISTINGUISHED VISITORS

PICO, the U.S. Air Force and Greenland Home Rule Government were hosts to a Greenland site visit by the following individuals:

Herman Zimmerman	NSF-DPP
Julie Palais	NSF-DPP
Bill Bryant	NSF-DPP
Gary Staffo	NSF-DPP
Jack Talmadge	NSF-DPP
Luis Proenza	PICO
John Kelley	PICO
Tom Gosink	PICO
Juan Roederer	Arctic Research Commission
Philip Johnson	Arctic Research Commission
Vladimir Kotlyakov	Soviet Academy of Science
Victor Zagarodnov	Soviet Academy of Science
Elizabeth Leighton	State Department
William Booth	Washington Post
Fumihiko Yoshida	Asahi Shimbun (Japanese Press)
Louis (Ed) Link	CRREL
Rudy Abramson	L.A. Times
Roland Schmidt	National Academy of Science
Ken Jesik	Polar Research Board
Jorgen Taagholt	Danish Scientific Liaison, Officer for Greenland
Karsten Secher	Director, Danish Polar Center

The site visits included a dinner with a GISP2 presentation by Dr. Paul Mayewski of the Science Management Office, tours of the 1015th AB, site visits to both the GISP2 and GRIP summit camps and travel to Nuuk (Godthaab) for meetings with Greenland Home Rule Government officials.

Figure 2. 1990 Greenland Field Schedule

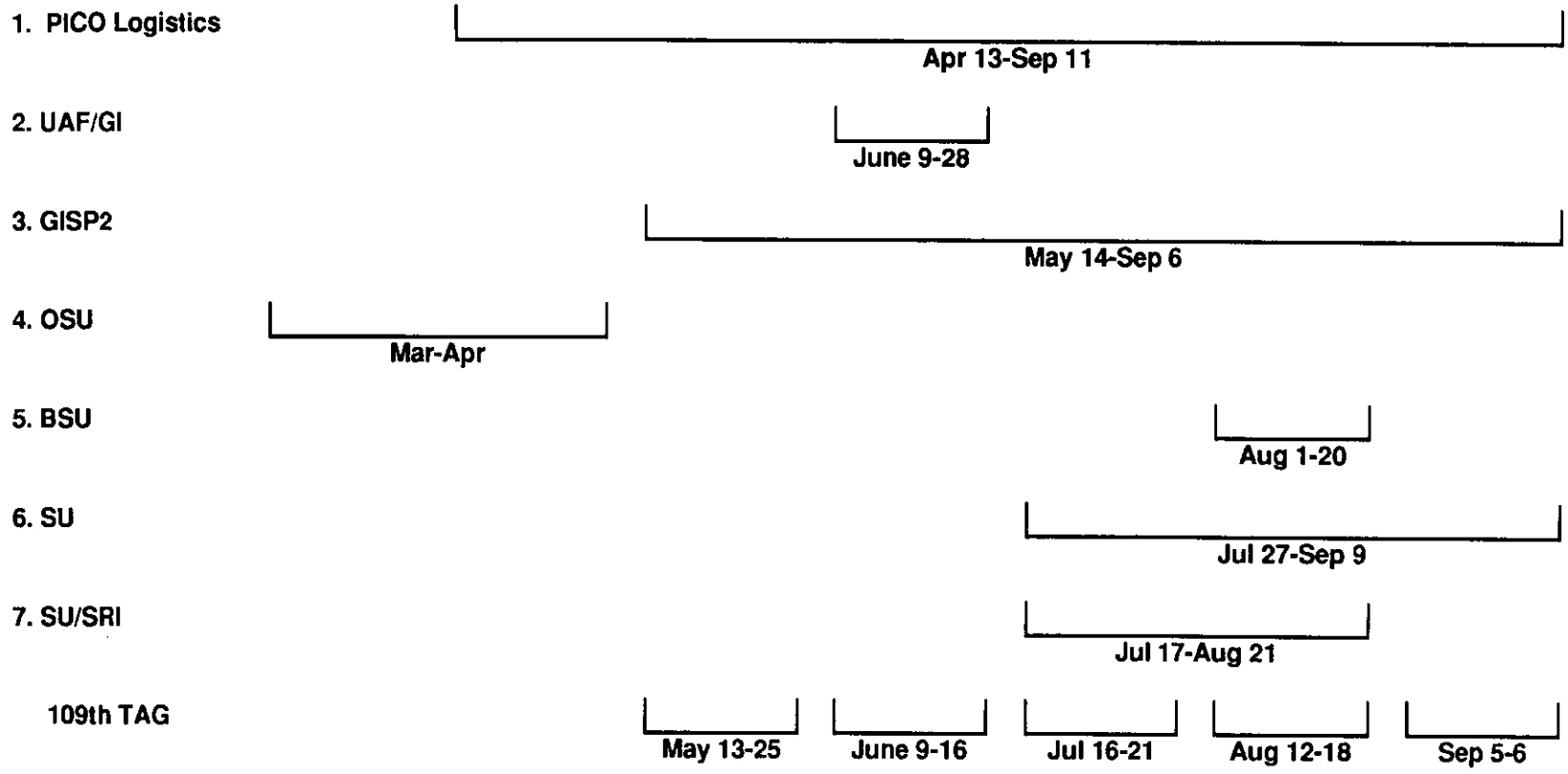


Table 2. 1990 GISP2 Principal Investigator List

Investigators	Institution/Address	Properties
Alley, Richard	Penn State University 248 Deike Building University Park, PA 16802	Physical properties of core. Continuous visual logging of core, density, texture, and fabric.
Barry, Roger Armstrong, Richard	University of Colorado Campus Box 449 Boulder, CO 80309-0449	Data management.
Bender, Michael	University of Rhode Island School of Oceanography Narragansett, RI 02882-1197	Occluded gas analysis. $\delta^{18}O$ of O_2, $\delta^{15}N$ of N_2, O^2/Ar ratio, N_2/Ar ratio.
Bolzan, John	Ohio State University Byrd Polar Research Center 125 South Oval Mall Columbus, OH 43210	Surface strain net, velocity, accumulation, ice flow modelling.
Borys, Randy	Desert Research Institute Atmospheric Sciences Center P.O. Box 60220 Reno, NV 89506	Crystal habits and rime chemistry.
Boyle, E.	E34-200 MIT Dept. Earth, Atmospheric and Planetary Sciences Cambridge, MA 02139	Trace metal chemistry.
Davidson, Cliff	Carnegie Mellon University Dept. Civil Engineering Pittsburgh, PA 15213	Major ions and trace metals of aerosols and snow.
Dibb, Jack	University of New Hampshire Durham, NH 03824-3525	Radionuclides in aerosol and snow.
Gow, Tony Meese, Debra	Cold Regions Research and Engineering Laboratory 72 Lyme Road Hanover, NH 03755	Physical properties of core. Annual layering, core relaxation mechanisms, and precision density measurements.
Grootes, Pieter Stuiver, Minze	University of Washington Quaternary Isotope Laboratory Seattle, WA 98195	$\delta^{18}O$ record of ice.
Hodge, Steve	U.S. Geological Survey, University of Pudget Sound Tacoma, WA 98416	Airborne ice radar determination of the Surface and Bed Topography.

Investigators	Institution/Address	Properties
Mayewski, Paul Spencer, Mary Jo Lyons, Wm.Berry	University of New Hampshire Durham, NH 03824-3525	Major anions and cations, total acidity, and ionic balance.
Mayewski, Paul	University of New Hampshire Science Management Office Durham, NH 03824-3525	GISP2 Science Management Office.
Mosher, Byard	University of New Hampshire Durham, NH 03824-3525	INAA analysis of aerosols and snow.
Palais, Julie	University of New Hampshire Durham, NH 03824-3525	Insoluble particulates. Mass concentration, size distribution, chemical composition, and morphology.
Ram, Michael	State University of New York Dept. Physics and Astronomy Buffalo, NY 14260	Continuous particulate concentrations.
Salzman, Eric	University of Miami 4600 Rickenbacker Cswy. Miami, FL 33149	Methanesulfonic acid (MSA) and Iodine (Iodidie and Iodate) in ice.
Stearns, Charles	University of Wisconsin Dept. of Meteorology 1225 West Dayton Street Madison, WI 53706	Automatic Weather Station.
Taylor, Ken	Desert Research Institute P.O. Box 60220 Reno, NV 89506-0220	Continuous electroconductivity of core.
Wahlen, Martin Broecker, Wallace	Wadsworth Center for Labs and Research New York State Dept. of Health P.O. Box 509 Albany, NY 12201	CO_2/Air ratios, $\delta^{13}CO_2$ in occluded gas, total gas content, CH_4 and N_2O concentrations, bubble volume.
White, James	University of Colorado Institute of Arctic and Alpine Research Campus Box 450 Boulder, CO 80309	δD ($^2H/^1H$ ratio) of ice.
Wilson, Alex Donahue, D.J.	University of Arizona Dept. of Geosciences Tucson, AZ 85721	^{14}C dating of core from occluded CO_2.
Wilson, Alex	University of Arizona Dept. of Geosciences Tucson, AZ 85721	Concentration and $\delta^{13}C$ of CO_2 in occluded gas.

III. LOGISTICAL COORDINATION AND MANAGEMENT

In September of each year, PICO establishes a field operations management schedule which outlines the administrative process and requirements for the coordination of the following Greenland field season.

The 1990 schedule was supported by the distribution or transmittal of the following documents:

1) "1990 Greenland Field Requirements and Personnel Information" memorandum dated December 1, 1989 and the "Facilities and Services Available to NSF-Sponsored Projects in Greenland" were distributed by PICO to all PIs who submitted proposals to NSF-DPP involving Greenland fieldwork.

2) "Preliminary Logistics Support Requirements and Cost Projections for 1990 NSF-Sponsored Greenland Research" was transmitted by PICO to the NSF-DPP Program Manager, Polar Earth Science Programs on January 30, 1990. The document presents PICO's preliminary support requirements and cost projections for the non-GISP related research grants proposed for 1990.

3) PICO submitted on February 27, 1990, a proposal and budget for Amendment No. 5 to NSF Contract DPP88-20948 to provide logistical support for Greenland fieldwork in response to NSF-DPP tasking letters.

4) A "Field Operations Plan for NSF-Sponsored 1990 Greenland Programs" dated May 1, 1990 was distributed to PIs and support contractors participating in the 1989 NSF-sponsored Greenland program. This document defined the scope, schedule and support requirements of the year's field activities and was the final planning report prior to commencement of the 1990 field season.

5) NSF-DPP's authorization to proceed with support of the 1990 Greenland field activities, as outlined in Amendment No. 5 above, was sent from the NSF-DPP Program Manager for Polar Coordinated Science Programs in July, 1990.

Administration of field operations and support functions provided by PICO include the following activities:

1) Clearances for individuals to work within and travel through U.S. military installations. These include Military Airlift Command (MAC) travel authorizations, Foreign National Clearances, DEW Line Clearances and Sondrestrom and Thule Air Base Clearances;

2) Coordination of personnel and cargo movements to, from and within Greenland with regular updates to agencies and personnel utilizing both scheduled and chartered air service;

3) Distribution of briefing packets which include clearances, itineraries and general travel information to all participants prior to departure to the field;

4) Research and procurement of field equipment and supplies to include shelters, oversnow and wheeled vehicles, generators, camp support and communications equipment; and

5) Maintenance of third party support documents between NSF-DPP and the U.S. Air Force and the subcontracted agents, as well as applications for single-side band and other radio frequency clearances from Danish authorities.

PICO stations one Field Operations Manager (FOM) and two assistants at Sondrestrom AB to provide project and air support coordination of cargo and personnel, expedite resupply requests and maintain remote field party communications. In addition, PICO serves as a liaison between the various NSF science groups and base support functions.
An administrative assistant remains at PICO/UAF to provide project coordination and military travel arrangements prior to projects departing the Continental United States (CONUS).

IV. LOGISTICAL SUPPORT FACILITIES

A. Sondrestrom Air Base

Sondrestrom Air Base has been the primary staging area for the majority of NSF-sponsored projects in Greenland over the past 15 years. The air base and the accompanying civilian community offer the widest range and greatest availability of logistical support materials and services in Greenland.

1. 1015 Air Base Squadron (1015ABS).

The 1015ABS provides NSF-sponsored projects with the majority of required materials, supplies and services. This support is provided under an Interservice Support Agreement (ISSA) between the U.S. Air Force Headquarters Space Command (HQ AFSPACECOM) and the NSF-DPP. The Sondrestrom AB ISSA became effective 1 September 1985 and will remain the active document of support authority through May 1991 unless otherwise renegotiated under the provisions stated within the ISSA.

Under the guidelines of the ISSA, the 1015ABS and its civilian contractors, Greenland Contractors (GC) and Felec Services, Inc. (FSI) provide third party reimbursable support to NSF-sponsored programs which includes: space-available billeting, open mess privileges, commissary services, equipment rental, cargo handling, vehicle maintenance, base supply items, fuels and warehouse/office space.

Field operations during 1990 utilized the following major reimbursable support items:

a) Petroleum/Oil/Lubricants (POL):

Shop-Vehicle Use

MOGAS:	1,014 gal.
DFA:	304 gal.

GISP2 Fuel from Sondrestrom

MOGAS:	1,800 gal.
DFA:	26,600 gal.

Other Remote Camp/Field Use

MOGAS:	250 gal.
DFA:	55 gal.

b) Commissary: foodstuffs were procured to supply GISP2 and central Greenland operations to support 4,218 personnel days on site.

c) Base supply: materials and supplies procurements in support of the NSF sponsored research programs.

2. NSF/PICO Support Facilities.

PICO continues to maintain two support facilities provided by the USAF at Sondrestrom Air Base. Since 1974, PICO has maintained the old fire station (Building T-436), as a staging and warehouse space. PICO has occupied building #387 as the primary support facility and field center since 1988. Administrative offices, storage, communications center and maintenance shop are the primary uses of this heated, secure space.

Remodeling and facilities upgrades were ongoing for the 1990 season with lockable storage units, new windows and doors, lighting, painting, setting up a shipping and receiving room, layout of a kitchen/wash area, and a deck built of the rear of the building. Projects for 1991 include expansion of the radio room, a sewing center, and completion of the kitchen area. The T-436 warehouse received new shelving, organization of inventory, and security improvements.

Additional Facilities: PICO continually requires additional freezer space on base to support the ice core programmed for transport and storage from GISP2. The on base freezer currently being used has never failed but is limited in size, is a considerable distance from the runway ramp, and with the phase down of military services the future of its availability is unknown.

Although use of this facility on base is greatly appreciated, a variety of self contained transportable freezer units are being investigated for the 1991 season.

3. NSF/PICO Vehicles

PICO maintains three wheeled vehicles: a 1987 Ford 3/4-ton crew cab pickup, a 1976 Ford 1/2-ton pickup and a 1956 Dodge M-37 4-wheel drive personnel carrier. The 1987 Ford is operational and without major mechanical difficulties. It is anticipated that the 1976 Ford 1/2-ton will require an overhaul in 1991. The Dodge M-37 will be operational for the 1990 season.

The long-standing requirement for a 10-15,000 lb. forklift capable of loading and off-loading C-130 aircraft has been met with the provision of a 15K Taylor forktruck acquired by the GRIP Operations Center (GOC). This vehicle, purchased by GRIP, is intended for joint general use and ground support of Sondrestrom based air operations. Maintenance and general upkeep is shared by PICO and GOC.

PICO has acquired from USAF salvage a 4,000 lb. forklift to support warehouse and staging operations. Although operational for 1990, this vehicle will require minor maintenance and modification prior to the start of the 1991 season.

The 1640 series Tucker Sno-Cat and 2 (ea) 2-ton cargo sleds remain in operation supporting central Greenland operations after being cached and thus completely buried near Summit between August 1987 and May 1989. 1989 upgrades include 6-way U blade and VHF land mobile radio. This vehicle will remain at GISP2 to support camp, skiway and remote traverse operations.

The Caterpillar LGP 931 was deployed to GISP2 in May of 1989 to support camp construction and skiway development. After a full season of operation in 1989, electrical and hydraulic problems persisted throughout the season requiring continued maintenance. The 1990 season saw a substantial increased demand of the 931 making it necessary to go over the machine, replacing worn parts at the beginning of the 1991 season. The vehicle was left at the GISP2 site after the 1990 season.

The Bombardier SkiDozer remains in Sondrestrom. This vehicle has not been actively used on the ice since conclusion of GISP1 operations at Dye 3 in 1982. Old and tired, this vehicle will require a complete inspection and rebuild prior to its upgrade in status to a field worthy vehicle. There are no current requirements at GISP2 or any other site for this vehicle. A cost analysis was done and this vehicle will be rebuilt in 1991.

4. Field Camp Equipment

New items added to the support equipment inventories for 1990 included custom made wind gear, sleeping bags, and remote camp kitchens. The GISP2 field site will require additional structures, communications, first aid and fueling/refueling equipment to meet the projected requirements through 1992.

5. Sondrestrom Baseloading

In past seasons, Sondrestrom AB has been faced with severe overcrowding during the summer months. However, since the phase-down of USAF-sponsored personnel beginning in 1988, berthing of NSF-sponsored personnel on base has not been a concern, nor is it likely to be so in the future. During this past season, crowding on base only became a concern on one occasion when base loading went up unexpectedly.

6. Off-Base Support

Off-base support for 1990 was provided by Gronlandsbanken (funds transfer), the Greenland Trade Department-KNI (materials handling, civilian sealift), STATOIL (POL products and containers), GreenlandAir-GLAIR (passenger and air cargo service), Scandinavian Airlines-SAS (passenger and air cargo service, ground equipment repair), NUNA-TEK, and Danish Arctic Contractors-DAC (heavy equipment services).

B. Thule Air Base

Thule AB, located on the northwest coast, is the larger of the two U.S. air bases in Greenland. Equally equipped as Sondrestrom to provide bulk products and support services to field research teams, Thule has often been a staging point for NSF-sponsored projects conducting studies in North Greenland. Moreover, because of its ample hangar space and related services, Thule is often the preferred location to base research aircraft. However, lacking commercial scheduled air service, Thule is more isolated in terms of commercial and governmental services, with charter air services limited to a permanently stationed GreenlandAir Bell 212 helicopter.

Logistical support at Thule is provided to NSF-sponsored projects under the same provisions governing the Sondrestrom ISSA. A separate support document for Thule is still under consideration.

C. Dye 2

PICO established, maintained, and manned a skiway/remote camp as a training facility for the 109th TAG. This facility was located at the closed Dye 2 Station. The skiway was maintained during flight periods at which time the 109th TAG was air supporting the GISP2 project. This is a mobile camp consisting of one 15x20 weatherport and support equipment. At the end of the season, the camp is transported and stored in Sondrestrom.

D. GISP2 Site

The GISP2 site (N 72° 34 35; W 38° 27 47) was established May 22, 1989, after put-in by the PICO field crew. The exact deep drilling site was located by a PICO survey team using Doppler satellite survey techniques based on coordinates supplied by the GISP2 Science Management Office (SMO). The survey team remained on site to layout a 200x10,000 ft. skiway and flag lines to the atmospheric sampling site ("Clean Air," 29 Km, bearing south 24° 02 11) and to the GRIP camp approximately 30 Km to the east. Facilities, equipment and supplies positioned in support of 1990 operations include:

Facilities:

2 ea. 15x30 Weatherport (berthing)
2 ea. 15x40 Weatherport (berthing)
3 ea. 15x20 Weatherport (berthing)
1 ea. 16x16 Jamesway (berthing)
1 ea. 15x40 Weatherport (storage)
1 ea. 15x30 Weatherport w/Addition (workshop)
1 ea. Lab Van (workshop)
1 ea. 10x100 Science Trench/Core Processing Trench (trenches)

facilities cont...

1 ea. 8x12 Weatherport (fresh air site)
1 ea. Drillers Dome
1 ea. 56x25 Big House (elevated structure)
1 ea. 8x8x30 Bath Modules
1 ea. 8x8x30 Generator Modules w/2 3116 Cat Generators

Vehicles/Equipment:

Tucker Sno-Cat 1640
2 ea. 2-ton traverse sleds
Caterpillar LGP 931
2 ea. Ski-doo, Alpine
4 ea. Ski-doo, Skandic
1 ea. Maxey Groomer

Fuel:

GISP2 fuel from Sondrestrom

MOGAS:	1,800 gal.
DFA:	26,600 gal.

1990 GISP2/central Greenland Programs fuel consumption:

MOGAS:	1,450 gal.
DFA:	10,160 gal.

GISP2 on-site fuel inventory

MOGAS:	1,537.5 gal.
DFA:	22,030 gal.

In addition to GISP2 related drilling activities, the camp and facilities provided support to the ATM sampling site, the installation of three automatic weather stations in the Summit region and SRI from Stanford University.

The phrase "short intense field season" takes on considerable stature. With a tight time frame and minimal personnel, several major and a host of minor building projects were brought on line.

Prior to the 1990 put-in, the following seven structures were prefabricated in Sondrestrom then labeled, dismantled, stacked, and banded for air shipment.

1. Lab Van Addition
2. Shop Annex
3. Two Emergency Huts
4. Drillers Boutique
5. Out Fall Building
6. Dumb Waiter Shaft

All the buildings were designed around a 4'x8' panel consisting of a 2"x4" framework and 1/2" outer skin. Heated buildings had fiberglass insulation, vapor barrier and interior panelling. Floor systems generally had 3/4" plywood on the interior and 3/8" exterior skins. All panels had flanges that allowed them to tie into each other for structural integrity and weather proofing. Wherever possible, all windows and doors were pre-hung before going into the field.

Additional projects in Sondrestrom included remodelling the existing lab van for transport to GISP2. Walls and doors were rearranged and new cabinets, counters and shelving was built and installed.

Seventy-two new floor panels were constructed for flooring in the weatherports. These interchangeable panels consisted of a top and bottom plywood skin, a 2"x2" framework, 1 1/2" of board foam insulation and twelve cam-locks per panel. Their panels were then given three coats of sealer to each side.

As the science teams began arriving in Sondrestrom, so did the work orders for additional shelving, storage units, and instrument stands. For projects destined for field camps that could not be prefabed in Sondrestrom, materials were assembled, labeled and banded for shipment.

At GISP2, four major construction projects had priority this season. They were erection of a drilling dome and an administration/galley building, set up and tie in the generator and bath house modules, and the excavation/construction of the science trench complex. All projects were successfully brought on line during the 1990 field season.

The Dome package from Natural Spaces was a 42' diameter by 35' high structure. The frame work consisted of 2"x6" struts and aluminum hubs. The base was an eight foot high perimeter wall with three sets of double doors. This was set on all weather wood pads placed at each wall intersection. The skin was wood fiber board with an exterior covering of white PVC plastic. The panels were first nailed then bolted to the frame and caulked. The final pentagon at the peak was left open for the drill tower. The package came with the invaluable assistance of a factory representative. This structure is not insulated or heated. Construction was delayed due to high winds which make the 7 and 9 foot panels difficult to handle and the extreme cold which affected the fitting of wood struts to the aluminum hubs. The Drillers' Boutique was erected inside the Dome and there are plans of building a storage loft inside the dome for 1991.

In preparation for continued GISP2 operations in 1990, construction began on an elevated Galley/Administration building in 1989. This 56x25 facility, based on a concept design by Wayne Tobiason of the US Army Cold Regions Research Laboratory (CRREL), now houses offices and messing facilities for up to 40 personnel. The steel support structure built upon a 4-foot compacted snow surface elevates the structure approximately 18 feet above the existing 1989 snow surface. Based on calculated accumulation rates, this height should provide unrestricted access to the facility through 1993. At the conclusion of 1989 operations the snow surface, steel structure and plywood deck were completed, with the single-story panelled building delivered to the site.

The administration and galley building was dubbed in the Big House by the PICO staff. This 25"x56" foot building is a 2"x6" stressed skin panel structure from Winter Homes of Brattleboro, Vermont and consists of insulated wall and roof panels and a site applied waterproof membrane on the roof. PICO provided an elevated floor platform, doors, windows, stairways, interior partitions and electrical, plumbing, and heating systems. An arctic entry way was also added by PICO staff. Winter Homes technicians and several camp staff erected the basic structure in approximately 4 working days with several weather related hold ups in between for a total time of 7 days. Installation of all the systems mentioned above plus cabinets, appliances, and flooring took approximately three weeks. The Big House sits on the steel girder and piling system and was erected by Reliable Welding of Laconia, New Hampshire and PICO staff during the 1989 filed season.

The Big House was tied into the bath house and generator stacks. These prefabricated modules are 8x8x40 feet each. They were located on a berm adjacent to the Big House. Turn key units ready for immediate use suffered some shipping damage and required repairs before coming on line. The generator shack has two Cat Diesel 3116 generators and an exterior snow melter. The electricians and mechanics worked with these units all season in an effort to switch power over from the old Lister generator, to get the bugs out of the new system, and to accommodate unanticipated power needs. Thousands of feet of arctic transmission lines were laid to service the entire camp and successfully brought on line by season end.

One hundred feet of insulated water line was laid between the Bath House and the Big House and two-hundred feet of insulated sewer line was laid between these two structures and the sewer outfall buildings. Snow berms, pads, and tripods, were built to carry the lines at the correct grade.

This season excavation was a combined effort of the science personnel and PICO staff. Re-opening the main science trench, which was dug in 1989, and carving out the six new alcoves was carried out by science personnel. Excavation of the new slime trench and core storage trench was completed by PICO staff. Roofs were placed over the new trenches, an entry-way was constructed over the emergency ramp, and a stairway was constructed from the science trench to an entry-way weatherport.

Camp operations concluded with the final pull-out of camp support personnel on August 4, 1989. All facilities, equipment and supplies remain on site.

E. Communications

1. **Telecommunications.** The NSF/PICO administrative office at Sondrestrom is serviced by both commercial and USAF telephone systems. These systems provide internal communications within Greenland, including ship-to-shore, as well as long distance service to the U.S. and Europe. NSF-sponsored personnel in Greenland can be accessed as follows:

   DSN: 834-1211 Extension 2565
   Commercial: Country Code (299) 11153 Extension 2565
   Telefax: Country Code (299) 11247

   In addition, a telex system has been installed at Sondrestrom. This has proved to be an invaluable form of communication.

2. **High Frequency Single Side Band (HF-SSB).** At present, PICO maintains an HF radio inventory of six Southcom SC-120 crystallized field radios, and one Southcom SC-130 synthesized field radio. The base station in Sondrestrom is a Shipmate 9000, 200 Watt marine radio belonging to UCPH with an ICOM M-700 providing base camp communications for GISP2.

   Several efforts have been made to improve HF communications in support of NSF-sponsored programs in Greenland.

   The most significant improvements were made in 1988 with the installation of new multi-band dipole and trapped vertical antennas in Sondrestrom, and the construction of new field dipole antennas and porta-masts for remote camps. Both the base station and field dipole antennas are configured as inverted Vs erected on a single fiberglass mast. These configurations have provided a remarkable improvement in field communications, especially for camps along the west coast. At the end of the 1990 season an additional multi-band dipole was erected in Sondrestrom for the 1991 season.

3. **VHF-Band.** PICO continues to maintain both Terra and ICOM VHF-Band radios. Each field party is issued a minimum of two VHF-band radios.

4. **VHF-Land Mobile.** VHF land mobile systems comprised of both hand-held and base station radios make up the "local" network for GISP2 communications. 45 watt base stations provide direct communications between GISP2, the ATM site, GRIP and the Tucker traverse vehicle. Hand-held radios are also available to other projects that require line-of-site communications.

5. **Emergency Locator Transmitters.** All NSF-sponsored programs are issued Emergency Locator Transmitters (ELT or EPIRB) operating on 121.5 and 243 Mhz.

6. **Satellite Communications.** After successful field trials of the new INMARSAT Standard C format in 1989 a Standard C terminal was deployed at GISP2 to provide store forward Telex capability from site.

7. **Equipment Upgrades.** Originally planned as an upgrade for 1990, Sondrestrom and GISP 2 will be equipped with two new 150 watt HF data packet systems for text and non-text data transmission in 1991. The system unit will be modified by adding the successful telex card and program used in 1990 resulting in a dedicated communication package.

V. FIELD OPERATIONS AND LOGISTICS

A. Personnel In Greenland

Table 2, provides a summary of actual mandays of personnel participating by project and location during the 1990 Greenland field season. Actual personnel days spent were: 1871 at Sondrestrom AB, 56 at Dye 2, 4,162 at GISP2, 1,375 at GISP2, and at remote camps in Jakobshavn, east Greenland and Nuuk, a total of 129.

B. Air Operations

Air support for the 1990 Greenland field season was provided by MAC Channel, 109th TAG, GreenlandAir Commercial, GreenlandAir Charter, Scandinavian Airlines and Icelandair. A summary of air operations is provided in Table 4. Air cargo transported over 1,000,000,000 lbs during the 1990 season.

1. MAC Channel. The MAC Channel system was used by PICO to support the majority of personnel and cargo transported between McGuire AFB and Sondrestrom and Thule Air Bases. A total of 142 passengers and over 200,000 lbs. of cargo were transported during the season.

2. 109th TAG. The 109th TAG provided LC-130 transport to NSF-sponsored projects between CONUS, Sondrestrom, Thule, and GISP. A total of 132 passengers and over 800,000 lbs. cargo were transported by the 109th TAG.

3. GreenlandAir Commercial. GreenlandAir Commercial flew transient support for coastal operations via regularly scheduled passenger and cargo flights.

4. GreenlandAir Charter A/S. GLACE provided NSF-sponsored projects with both fixed-wing and helicopter support. KingAir support was provided between Sondrestrom and Nuuk. Helicopter charter include Bell 206, Bell 212, and Sikorsky 61.

5. Commercial air and ship transport. SAS and Icelandair provided passenger and cargo movements to both Sondrestrom and Keflavik. Local KNI ship transport was utilized to ship nominal amounts of cargo to coastal villages in support of west coast programs.

6. British Antarctic Survey. Twin Otter Air support was utilized by the GRIP Operations Center from June 28 through August 3 between the GRIP camp and Sondrestrom. PICO jointly shared use of this craft to move limited number of passengers and cargo. PICO utilized a total of seven flights.

7. Charter Flight. This was the first season PICO utilized a commercial chartered LC-130 to carry primarily cargo (drill equipment) from Fairbanks. Two personnel from the PICO engineering field staff accompanied the cargo charter which carried 42,000 lbs. This direct flight from Fairbanks took 9 flight hours and was chartered from Markair.

C. Ship Operations

1. Sealift. A total of 84,300 lbs. were transported in 1990 through the WPLO (Water Port Logistics Office), Bayonne, New Jersey.

A. NSF-DPP POLAR COORDINATED SCIENCE PROJECTS

1. Coordination of Greenland 1990 Operations and Logistics
   Polar Ice Coring Office
   University of Alaska Fairbanks
   Principal Investigator: Dr. Luis Proenza

Permanent Field Staff: Kent Swanson
Bruce Koci
Mark Wumkes
Jay Klinck
Steven Peterzen
Terry Gacke

UAF Office Personnel: John Kelley, Director
Jay Sonderup, Asst. Director
Bonnie Hughes
Michelle Johnson
Lori Smith
Dorothy Keith

Seasonal Field Staff: Tyler Burton
Walt Hancock
Lesia Prestridge
Sarah Sturgis
Bill Barber
Pat Smith
George Cameron
Karin Martin
Paul Stoner
Steven King
Bill Danford
Rob Coats
Mark Harrington
Michael James
Debra Enzenbacher
John Giles
James Goranson
James Hall
Joseph Kalous
Dave Koester
Sam Lamont
Laila Fleischer
Jake Matulka
Catherine Melville
Cliff Mercer
Doug Roberts
Paul Saulnier
C.A. Demoski
Larry Eardley

Dates In Field: April 14 - September 11

Location: Sondrestrom AB, Thule AB, Dye 2, Summit Region, Jakobshavn, Keflavik, Constable Pynt

Table 3. Personnel Site Loading (man days) by Project -- Greenland 1990

	Sondrestrom	Thule AB	DYE 2	GISP2	Remote Camp
A. NSF/DPP Polar Coordinated Science Projects					
1. PICO Operations	918		56	1208	
2. PICO Drilling	95			594	
SUBTOTAL	**1013**		**56**	**1802**	
B. NSF/DPP Polar Glaciology Projects					
1. Ohio State University, G. Faure		10			
2. University of Alaska, K. Echelmeyer	16				60
3. GISP2/UNH, P. Mayewski	645			2265	
SUBTOTAL	**661**	**10**		**2265**	**60**
C. NSF/DPP Polar Earth Science Projects					
1. Boise State University, C. White					20
2. Stanford University, D. Bird					44
3. Stanford University, R. Clauer	84			32	
SUBTOTAL	**84**			**32**	**64**
E. Distinguished Visitors					
1. National Science Foundation	94	3		8	
SUBTOTAL	**94**	**3**		**8**	
F. NSF Project Visitors	9				
SUBTOTAL	**9**				
TOTAL	**1861**	**13**	**56**	**4107**	**124**

Table 4. Project Air Support Summary

MAC Channel	Total PAX	Total Cargo
PICO	42	1555414
UNH	24	9364
CRREL		1297
UWA	5	567
CMU	4	1220
OCU	5	830
UAF-GI-ETH	3	
MIT	6	4629
UMI	4	
PSU	2	383
DRI	3	2349
SUNY-B	3	2620
Falconers	28	
SRI	5	4522
USGS		134
UAZ	1	
UWIS	2	30
DV's	5	
OSU		608
Total MAC Channel	**142**	**183,967**

109th TAG	Total PAX	Total Cargo
PICO	158	
UNH	72	
UWA	11	
CMU	7	
UCO	5	
USGS	3	
UMI	14	
PSU	6	
DRI	13	
MIT	6	
SUNY-B	15	
URI	4	
MFG-REP	2	
Falconers	1	
SRI	13	
CRREL	8	
UWIS	8	
UAZ	2	
UCB	6	
NYH	3	(Total cargo figure
Danish Commission	2	does not include
DCAA-FIC	2	weights for cargo
NSF	2	brought into GRNLD
Military	4	by 109th.)
DV's	74	
Total 109th TAG	**441**	**900,678**

* There was a total of 156.5 flight hours for the 109th.

Project Air Support Summary cont.

Scandinavian Air	Total PAX	Total Cargo
UNH	2	
UAF-GI-ETH	2	
CMU	4	
DV's	2	
Total Scandinavian Air	**11**	

Markair Charter	Total PAX	Total Cargo
PICO	2	42,000
Total Markair Charter	**2**	**42,000**

727 Charter	Total PAX	Total Cargo
PICO	15	
UNH	2	
UCO	1	
UMI	1	
SUNY-B	1	
Falconers	3	
SRI	1	
UAZ	1	
NYH	1	
USGS	1	
Total 727 Charter	**27**	

Glair	Total PAX	Total Cargo
UAF-ETH	6	1800
Total Glair	**6**	**1800**

Glace	Total PAX	Total Cargo
UAF-ETH	6	4400
Total Glace	**6**	**4400**

BAS Twin Otter	Total PAX	Total Cargo
PICO	20	
SRI	5	
UMI	1	
UNH	3	
Total Twin Otter	**29**	**7317**

Table 5. GISP2 FLIGHT SCHEDULES

MAY:

5/14 - 2 flights
5/15 - 3 flights
5/16 - 2 flights
5/17 - 2 flights
5/18 - 2 flights
5/19 - 2 flights
5/30 - 2 flights
5/31 - 1 flight

JUNE:

6/10 - 2 flights
6/11 - 2 flights
6/14 - 3 flights
6/26 - 1 flight (BAS Twin Otter)

JULY:

7/18 - 2 flights
7/20 - 2 flights
7/21 - 1 flight
7/25 - 1 flight
7/27 - 2 flights

7/01 - 1 flight (BAS Twin Otter)
7/04 - 1 flight (BAS Twin Otter)
7/09 - 1 flight (BAS Twin Otter)
7/15 - 1 flight (BAS Twin Otter)
7/21 - 1 flight (BAS Twin Otter)
7/23 - 1 flight (BAS Twin Otter)
7/31 - 1 flight (BAS Twin Otter)

AUGUST:

8/13 - 1 flight
8/14 - 2 flights
8/15 - 1 flight
8/16 - 2 flights
8/17 - 2 flights

SEPTEMBER:

9/05 - 2 flights
9/06 - 2 flights

All flights are LC-130 with the exception of the BAS Twin Otter flights in July.