SCAR WG-GGI NATIONAL REPORT

Report of Current Activities of the United States for 2000-2002

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The US Geological Survey, in cooperation with the National Science Foundation, developed working programmes to conduct research or operational support work in Antarctica in the field of Geodesy, Photogrammetry, Remote Sensing, Geographic Information, Digital Mapping and Atlas for Antarctic Research.

1. FIELD ACTIVITIES

1.1 Introduction

Geodesy, aerial photography and mapping comprise a variety of activities necessary for the successful operation of a multifaceted scientific research and exploration efforts in Antarctica. Geodetic projects conducted contribute to building a continent wide geodetic infrastructure (GIANT) that supports a wide-range of international scientific research objectives through: establishment and maintenance of a framework of permanent geodetic observatories, extending and strengthening the existing network of stations linked to the International Terrestrial Reference Frame (ITRF), and providing base reference station in supporting control for airborne remote sensing (e.g. LIDAR) projects.

1.2 Projects and accomplishments

Projects carried out include work performed in three primary areas: (1) McMurdo, Ross Island, Cape Roberts, and South Victoria Land, Transantarctic Mountains, (2) Amundsen-Scott Station, South Pole, and (3) Palmer Station.

1.3 McMurdo, Ross Island, Cape Roberts, and South Victoria Land, Transantarctic Mountains

1.3.1 Antarctica remote GPS observatories (ARGO) – Cape Roberts station ROB1

In December 2000, a low-power GPS observatory was installed on station ROB1 at Cape Roberts. The GPS observatory system was funded by Land Information New Zealand (LINZ). Station ROB1 is tied to the nearby tide gauge operated and maintained by LINZ, and collocated with station ROB0 (the primary station of the TAMDEF network), the Cape Roberts absolute gravity station, and with a broadband seismic station of the Transantarctic Mountains Seismic Experiment (TAMSEIS). The mark for ROB1 was set in bedrock in 1996 and is included in the network of about 30 stations established in support of the TAMDEF project.

Operating starting 18 December 2000, the receiver system deployed was a Topcon Positioning System model Legacy E, dual-frequency GPS/GLONASS receiver with an enclosed GPS/GLONASS Regant dual depth choke ring antenna. The receiver operated on 3.5 watts of power. The receiver was configured to interface with a specially engineered microprocessor controlled hard disk drive (HD). The HD included a 16 Mb buffer to minimize power drawn by the HD. The total maximum power required was estimated to be about 6.5 watts.

Power to the system came from bank of six 86 amp-hour gel cell deep cycle batteries. The batteries were charged by four 40-watt solar panels while sunlight was available or before the sun went below the horizon at the end of March. A low voltage disconnect device was used to shut down the power to the system when the voltage dropped to below 11 volt DC. The system was designed to allow for restoration of power to the system when the voltage rose to above 12.5 volts DC. The system worked much better than had been anticipated – exceeding estimated date by more than 30 days when we expected the system to power down and powering up sooner than had been expected. As far as can

be determined, this was the first time a remote GPS observatory in Antarctica successfully shut down and turned back on after batteries were recharged.

Data were successfully logged at ROB1 from 18 December 2000 to 4 May 2001, followed by a gap in the logged data during when the receiver/logging system shut down due to battery voltage going below 11 volts. Power to the system was automatically restored on 30 Sept. 2001, and then was continuous until 9 December 2001. High quality 24-hour daily L1/L2 carrier phase data sets were successfully acquired at the 30-sec sampling rate for a total of 205 days of about 356 possible observing days.

The system was powered down on 9 December to prepare for replacement of the Legacy E receiver and antenna, and upgrades to the battery system. The battery capacity was doubled from six 86 amp-hour batteries (512 amp hours) to twelve 86 amp-hour batteries or a total of 1024 amp hours. The receiver was swapped with a new Javad Navigation Systems (JNS) model EURO-80 GD receiver. The TOPCON antenna was replaced with an Ashtech Dorne Margolin choke ring antenna covered with a SCIGN antenna radome (see following figures).

The new JNS model EURO80 GD receiver requires less than 2.2 watts of power (peak) and features the capability of logging data to a 512 Mb compact flash memory card manufactured by SanDisk. This new system uses no mechanical devices since we are using only solar panels to charge the batteries until the sun is too far below the horizon and a 512 MB SanDisk Compact Flash (CF) card for storage of the GPS data. With special firmware provided by JNS, extraneous information from the raw data file was eliminated while retaining essential data required for translation into the RINEX format. Thus, we can log to the 512 Mb CF card up to about 350 days of raw observation data collected at 30-second sampling rate.

Besides the concern whether or not the batteries will maintain voltage above 11.0 volts throughout the period of winter darkness (11.0 is cutoff voltage for powering down the receiver), the other concern is how well the CF cards will function through the winter. The “industrial” or ultra version of the CF cards are specified to operate at temperatures down to about - 40º. Unfortunately, due to factory delays, it was not possible to obtain the industrial version for the CF cards. Instead, the “commercial” version for the CF cards installed may fail since the specifications for minimum operating temperature is about 0ºC. However, since the “industrial” version of the card is selected by rigorous testing of the commercial version, it is possible that some, if not all the CF cards, will function normally.

Six of the 12 batteries are stored with the receiver in a specially designed and insulated box. The second set of 6 batteries are stored in insulated plywood box that was fabricated in McMurdo. To help keep the minimum temperature for the CF card as high as possible, we enclosed the receiver inside a blueboard box. We believe we have a chance for success, particularly at Cape Roberts, to operate continuously through the period of darkness where maximum power used is about 2.2 watts.

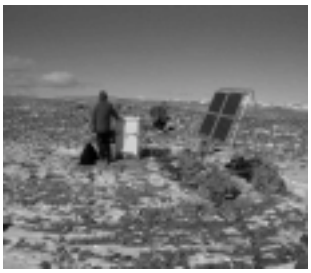
In the figure to the left is a view inside the custom ordered specially designed vacuum-sealed insulated fiberglass box manufactured by Energy Storage Technologies, Vacu-Panel Division, Xenia, Ohio. The figure shows a dark rectangular shaped box (shown without special small insulated box) which contains the EURO-80 GD receiver card and 512 MB CF card. Also shown are the voltage disconnect device, the solar panel voltage regulator, and two temperature sensor/logging instruments. The temperature is continuously logged at hourly intervals for use in evaluating the operation of the receiver and power system as the system is subjected to external temperatures that may be reach as low as –50ºC.

Before close of the field season, data collected at ARGO station ROB1 with the new JNS EURO-80 GD receiver were retrieved for processing and analysis for the period: 18 December 2001 through 17 January 2002.

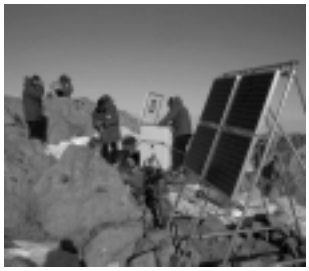
GPS data collected at ROB1 will be used in conjunction with processing and analysis of data collected during the West Antarctic GPS Network (WAGN) GPS observing campaign carried out in January and February 2002.

1.3.2 ARGO stations established at Mount Fleming (FLM1) and Fishtail Point (FTP1)

Similar to remote autonomous GPS observatory system installed at Cape Roberts, systems were installed at two other sites of the TAMDEF network. The low power JNS EURO-80 GD receiver with an Ashtech Dorne Margolin choke ring antenna covered with a SCIGN antenna radome, were deployed at Mt. Fleming (station FLM2) and at Fishtail Point (station FTP1). Observations at FLM2 started on 9 January 2002 and at FTP1 on 27 December 2001. The setup of system at FLM2 and FTP1 is the same as for ROB1 except that the four 40-watt solar panels were mounted on a aluminum tubular A-frame. Scenes of the setup for FLM2 and FTP1 are shown in the figures below.



FLM2 – Mount Fleming



FTP1 – Fishtail Point

FTP1 – Fishtail Point

Before close of the field season, data collected on ARGO stations FLM2 and FTP1 with the new JNS EURO-80 GD receiver were retrieved for processing and analysis for the period: FLM2 - 9 through 22 January 2002, and FTP1 - 27 December 2001 through 14 January 2002.

GPS data collected at FLM2 and FTP1 will be used in conjunction with processing and analysis of data collected during the West Antarctic GPS Network (WAGN) GPS observing campaign carried out in January and February 2002.

1.3.3 TAMDEF and cooperative VLNDEF and WAGN projects

During field seasons 2000-1 and 2001-2, in cooperation with the Italian Antarctica Geodetic Science Program and coordinated with the Italian geodetic team, GPS observations were acquired at selected stations of TAMDEF simultaneously with data collected at selected stations of the North Victoria Lands of the Transantarctic Mountains Deformation Monitoring Network (VLNDEF) in support of the Italian GPS observing campaigns. The USGS/LINZ geodetic team performed repeat measurements on stations of the "footprint" reference arrays at most of the TAMDEF sites. Repeat measurements were made on the six station array of the Beacon Valley Fault Monitoring Network.

As noted in sections 1.3.1 and 1.3.2, GPS data collected at TAMDEF and ARGO stations FLM2 , FTP1, and ROB1 will be used in conjunction with processing and analysis of data collected during the West Antarctic GPS Network (WAGN) GPS observing campaign carried out in January and February 2002.

1.3.4 Cape Roberts tide gage

The USGS/LINZ Geodetic Team conducted annual maintenance, data retrieval, and calibration of the tide gauge system. In coordination with Dr. Alex Pyne, Wellington University, tide data logged during 2000 and 2001 were retrieved and calibration surveys were performed. The high accuracy (mm-level) calibration surveys were carried out in November and December 2000 (two independent surveys) and in January 2002. Tide gauge data and a report on the annual Cape Roberts tide gauge maintenance and calibration surveys are available from LINZ, Wellington, NZ.

1.3.5 Scott Base tide gauge

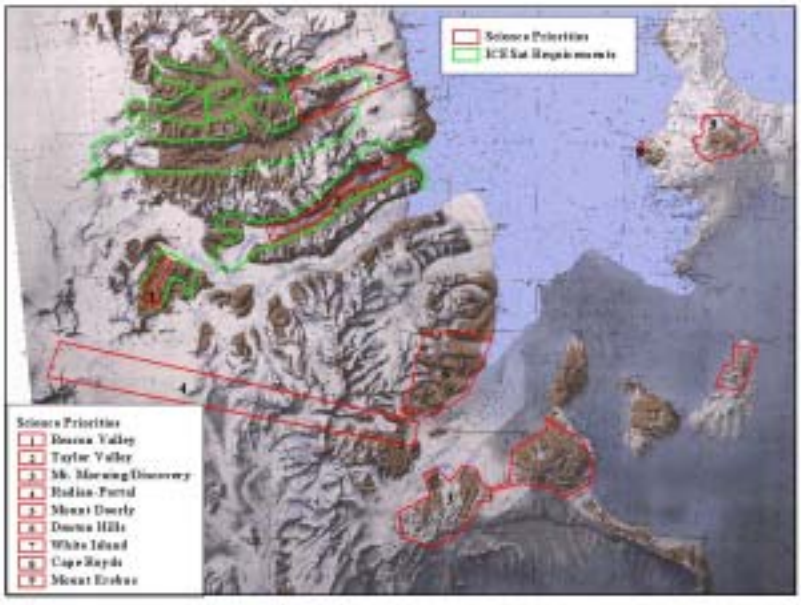
The first in a series of annual tide gauge instrumentation calibration surveys was conducted. The Scott Base tide gauge was deployed in January 2001. The calibration survey was conducted during 15 to 18 December 2001. During December 24, 2001, and in cooperation with the McMurdo Station engineering surveyors, differential leveling surveys were performed to obtain height connections between control marks around Scott Base, including Scott Base Astro, and the tide gauge. Tide gauge data and a report on the annual Cape Roberts tide gauge maintenance and calibration surveys are available from LINZ, Wellington, NZ.

1.3.6 Gravity Station, McMurdo

During the 2000-2001 field season, a new primary gravity station in McMurdo was established and enclosed in building 146. The new location replaces the site for the old primary station located in building 57 which will be destroyed when a new building is constructed in 2003. Markers are set in a large massive concrete pillar that will accommodate the FG5 absolute gravity meter. Numerous differential gravity surveys have been performed and documented to ensure a high accuracy tie between the old and new primary station.

Special signs (see figure) to identify the gravity station have been installed. The new station is named THIEL Gravity Base Station. The station was named after Edward C. Thiel (1928-61) who was chief seismologist at Ellsworth Station and member/leader of traverse team conducting geophysical observations near the Pensacola Mountains.

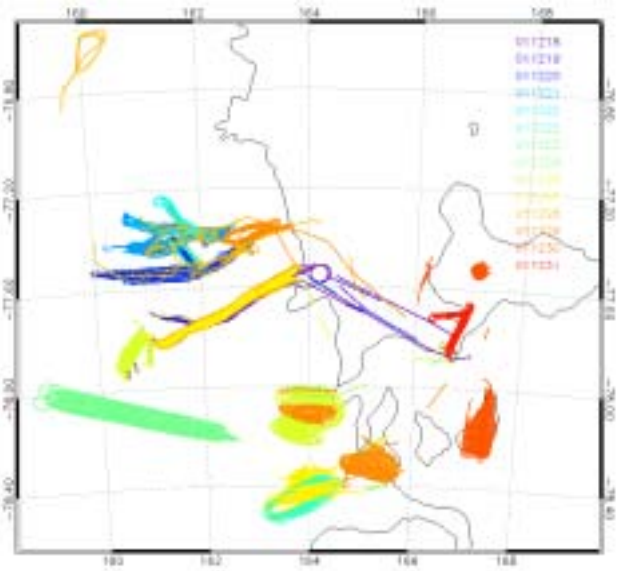
1.3.7 2001 LIDAR Data Collection Project



For the last 2-3 years, we have been undertaking a LIDAR data collection experiment for the Antarctic in the McMurdo Station and Dry Valleys vicinity. The project finally came together in time for the 2001-2002 field season. The field team consisted of the USGS LIDAR team and NASA ATM team from Wallops Island, Virginia. Funding came from NSF, USGS and NASA through the NSF/USGS science project GO-052-L and the NASA ICESat calibration project. On November 15, 2001, Cheryl Hallam (USGS) deployed to McMurdo Station and began the setup of the facilities for the NASA team that arrived at the end of the month. After the initial setup at Williams field and in the Crary lab, field training, installation of the equipment on the Twin Otter aircraft and nearly a week of waiting for the weather to clear, data collection began December 18 and continued through Dec 31, 2001. They collected elevation data with 1-5 meter horizontal sampling and 10-50 cm vertical resolution for the selected areas from priority 1 through 9 as shown below. Vertical resolution varied based on area requirements.

1.3.7.1 On site review of data

Based on the plots of the data provided by NASA, they determined that all requested areas were covered with one exception – Radian Glacier to The Portal (priority 4). The lower section of this site was too steep and rough for the aircraft to fly at the required altitude and maintain lock with the ground.



Several areas that were not in the initial request were added to compensate for the problem.

- Full coverage of White Island was collected instead of the partial coverage that was requested.
- McMurdo Station was flown on several occasions while traveling to and from requested sites.
- Odell Glacier was covered with two flight lines at the request of the logistics support group.
- Hut Point Peninsula and the Erebus Glacier Tongue were flown on the last day.

The map below displays each of the areas covered in colors linked to the dates of the flights.

USGS review of the data began once they were received from NASA after their processing was completed at their home site. The data processing and review is described in the geographic information activities section.

1.3.7.2 Geodetic support

GPS base reference stations were established at two sites in support of the December 2001 airborne LIDAR project: TAMDEF station ARR1 at Arrival Heights and a special temporary station (WAL4) established at Marble Point Camp. The distance between station WAL4 and ARR1 is about 80 km. ARR1 is located about 8 km from where the Twin Otter, airborne platform for the LIDAR and GPS/INS systems, was parked at Willy Field. Data were successfully acquired at both stations for all Twin Otter airborne LIDAR missions at the specified sampling rate of 2 Hz (0.5 seconds).

Besides serving as a backup base reference station, a research objective for acquiring GPS base reference station data at station WAL4 was to test capability of computing the trajectory for the aircraft by application of "integer on the fly" processing methods. If it could be demonstrated that the trajectory, particularly the height component, could be computed relative to station WAL4 and results found comparable to within 5 centimeters of the trajectory computed relative to ARR1, this would be useful information in planning for future LIDAR missions at locations substantially beyond the areas surveyed during the December 2001 LIDAR project. Initial processing yielded results for the height component of the trajectory that agrees within 5 cm and within the specified accuracy limits for the height component for the aircraft trajectory.

In support of providing ground truthing or test points for evaluating the accuracy for the results from the airborne LIDAR project, a series of ground points in relatively flat areas with minimal slope were selected and occupied. A total of 17 test points were selected and geopositioned by GPS geodetic survey methods. This project was managed by Bob Glover in coordination with Cheryl Hallam, Co-PI for the airborne LIDAR project. Special data processing using the IGS precise ephemerides was performed to obtain heights accurate to the level of a few cm.

1.3.8 IGS GPS/GLONASS observatory, station CRAR (IERS DOMES Number 66001M004)

Operations continue for GPS/GLONASS receiver & antenna system on station CRAR at Crary Lab, McMurdo. The daily transmitted data files contributes to the International GLONASS Service Pilot Project (IGLOS-PP) of the International GPS Service (IGS). The data are used to produce high accuracy orbital coordinate data for Russia's GLONASS satellites referenced to the International Terrestrial Reference Frame (ITRF). Station CRAR is currently one of three GPS/GLONASS observatories operating in Antarctica. There are approximately 60 stations in the global network. The semi-automated station operation is monitored by the McMurdo Science Technician.

1.3.9 IGS GPS observatory, station MCM4 (IERS DOMES Number 66001M003)

Operations continue for IGS station MCM4. JPL/NASA in Pasadena provides technical support for the system deployed. Operation is remotely controlled from Pasadena with data automatically transmitted hourly to Pasadena. McMurdo Science Technician is responsible for the on-site monitoring of the system.

The system setup includes three L1/L2 receivers: (1) Allen Osborne Associates (AOA) model ACT-II (primary), (2) a AOA model Benchmark (backup), and (3) an Ashtech model Z12 (backup). All receivers are connected via an antenna splitter to the Dorne Margolin choke antenna located on station MCM4 (see figure to the left). Additionally, via a special splitter device, all receivers are using an external Efratom Rubidium reference frequency.

1.3.10 Amundsen-Scott Station, South Pole, IGS Station AMUN (IERS DOMES Number 66040M001)

Operations continued for the GPS observatory at South Pole. Annual site visits and work activities include: (1) provide training and orientation for Science Technician, who is responsible for monitoring daily operations during the winter seasons; (2) perform upgrades and maintenance on the system for station AMUN; (3) establish a temporary marker where the mean axis for South Pole is located on January 1; and (4) in coordination with Raytheon survey engineers, perform special high accuracy surveys on stations of the South Pole Geodetic Network (SP-GEONET).

The daily transmitted data files contributes to the data obtained from the global network of permanent stations of the International Association of Geodesy (IAG), International GPS Service (IGS). The data are transmitted daily and archived at the NASA Crustal Dynamics Database Information Service (CDDIS) in Greenbelt, MD. The data are used to compute high accuracy orbital coordinates for the GPS satellites; by NIMA to evaluate the accuracy for the predicted orbit in the southern hemisphere that is transmitted in the broadcast message; by researchers to evaluate atmospheric refraction effects on the GPS observations; by USGS and Ohio State University (OSU) to monitor the horizontal and vertical motion of the ice plateau at the South Pole; and, as a reference base station for other geopositioning projects. Coordinates for station AMUN are referenced to the geodetic reference system adopted by SCAR (i.e. the International Terrestrial Reference Frame (ITRF)). The system includes an two Ashtech Z12 L1/L2 receivers using a Rubidium external reference frequency, with operation for observations and data logging handled with Ashtech's GBSS software version 3.2.00.

Coordinated with the Raytheon surveying engineers for the 2001-2002 construction season at South Pole, a high accuracy geodetic survey was performed. Two existing and two new stations of the SP-GEONET were occupied. Station AMUN was the reference station for the resultant coordinates. One of the two new stations was located on the roof of the new elevated structure (ELST) and the second station was located on the roof of building for the MARISAT RF equipment (RFBD).

The purpose of the survey was to establish a base reference network that the survey engineers could occupy and perform measurements using optical survey equipment (i.e. total stations) for monitoring the stability of the structures at South Pole. Repeat measurements would be used to detect possible structural deformation. The estimated accuracy for the coordinates determined at the 4 stations was about 1.5 cm in the horizontal and about 2 cm in the vertical reference to ITRF2000.

To ensure the base reference network of stations for SP-GEONET are tightly controlled, repeat measurements are planned during the future field seasons. The SP-GEONET will be expanded from 4 to about 8 stations. The surveys will include differential leveling connections to the special vertical reference marker established in early 1990s and located under the dome. The differential leveling survey is a repeat of survey performed in December 1999.

1.3.11 Palmer Station, IGS Station PALM (IERS DOMES Number 66005M002)

Operations continued for GPS data collection at station PALM, collocated with a continuous operating tide gauge, one of the permanent stations of the global network of the International Association of Geodesy (IAG), International GPS Service (IGS). The data are transmitted daily and archived at the NASA Crustal Dynamics Data Base in Greenbelt, MD. The data are used: to compute high accuracy orbital coordinates for the GPS satellites; by international researchers to evaluate atmospheric refraction effects on the GPS observations and to evaluate improved models for tropospheric refraction effects; by investigators to measure vertical and horizontal deformation in the region of the Antarctic Peninsula and for determining changes in mass of the adjacent Antarctic ice sheet; and, by biologists and other scientists collecting field data in vicinity of Palmer requiring in real-time high accuracy positioning for the spatial data. The coordinates for the station are referenced to the system adopted by SCAR or the International Terrestrial Reference Frame (ITRF 2000).

Daily operations are monitored by the Science technician assigned to Palmer by the NSF contractor. Upgrades to the base station support computer and software were carried out successfully. In addition to upgrading the base reference station software to GBSS v3.2.00, the data processing software was upgraded to Ashtech SOLUTIONS v2.0. The receivers deployed at station PALM are Ashtech Z12 models.

2. MAPPING ACTIVITIES

2.1 Topographic Mapping

The United States Geological Survey and Land Information New Zealand completed the topographic mapping of Ross Island at 1:50,000-scale.

2.2 Thematic Mapping - Landsat TM Satellite Image Mapping

Six satellite image maps were published:

- Two quadrangles at the 1:250,000 scale in the DARWIN MOUNTAINS,
- One quadrangle at 1:100,000 scale - TURNSTILE RIDGE, and

- Four quadrangles at 1:25,000 scale on Ross Island with merged Landsat multispectral and Spot panchromatic data, - MOUNT EREBUS, HUT POINT PENINSULA, MOUNT BIRD, and CAPE CROZIER.

3. GEOGRAPHIC INFORMATION ACTIVITIES

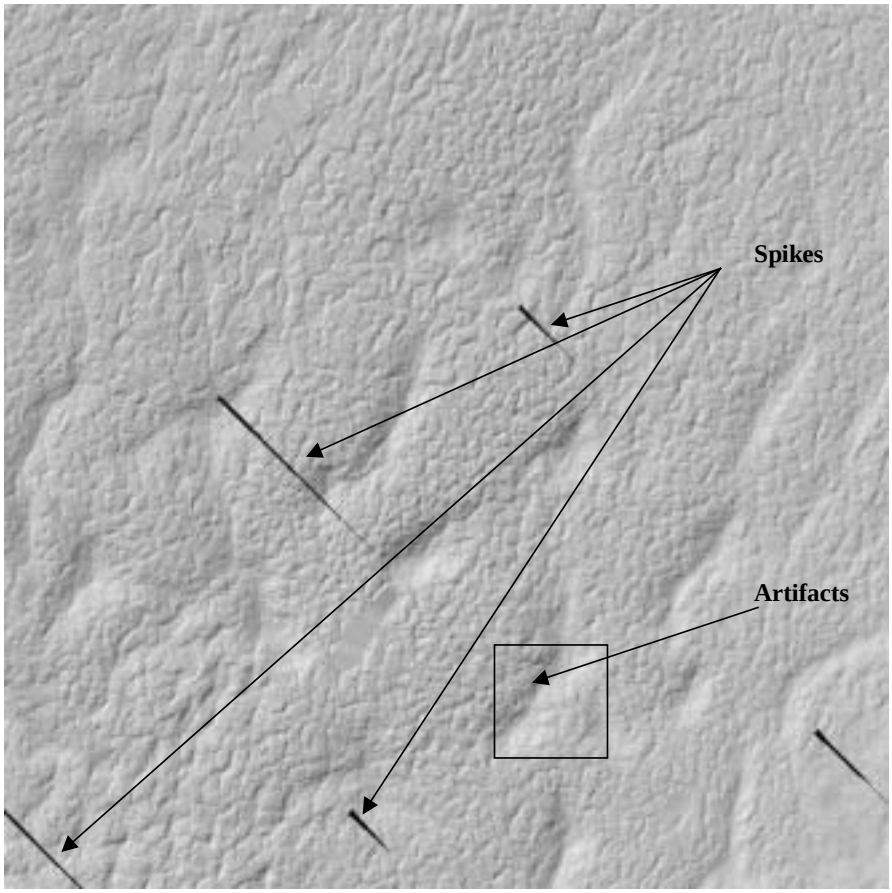
3.1 2001 LIDAR Project

3.1.1 Data status

December 18, 2001	Data collection began
December 31, 2001	Data Collection completed
April, 2002	Delivery of the first data
July, 2002	Expected delivery of the remaining LIDAR data

3.1.2 USGS preliminary review of the data

During the month of May, the Beacon Valley LIDAR data were examined. The individual flight lines were imported into ArcView as shape files converted to ArcINFO coverages and projected to fit the declassified image of the McMurdo Dry Valleys area. The point coverages were merged for the December 26 Beacon Valley data and a 1-meter DEM generated for the Beacon Valley floor. That image displayed one of the major errors in the data-spikes. They were the result of errors in the point data at a limited number of locations throughout the valley. The data show surface detail at 1-meter resolution. We are now in the process of developing a partnership with OSU to process the data.



3.1.3 Final notes

- Ground control data for the project, collected for each of the requested regions, have been processed by USGS personnel and will be used for initial tests of the accuracy of the data.
- The data is projected to be available October 2002.
- Data requests and inquiries have been received concerning Beacon and Taylor Valleys as well as the north slopes of Discovery and Mt Morning and the Erebus crater.
- Inquiries regarding data status and access should be addressed to Dr. Cheryl Hallam at the U.S. Geological Survey: challam@usgs.gov.

3.2 Terrestrial GPS and GIS-Based Data Collection and Image Mapping in the Antarctic Peninsula

Remote sensing combined with the rapidly evolving global positioning system (GPS) and geographic information system (GIS) technology offer a quick and effective way to gather information in Antarctica. Terrestrial GPS- and GIS-based data collection systems were used in this USGS Polar Program project for gathering baseline data to examine changes in the Adélie penguin habitats resulting in part from regional climate warming. The research application in this National Science Foundation cooperative study is yielding important information on climate varability and in documenting Adélie penguin population in the Antarctic Peninsula.

Adélie penguins population census

3.3 United States Antarctic Resource Center (USARC)

In the Antarctic Resource Center (ARC) we continue to employ cost effective technology changes in industry and adopt what is needed to disseminate ARC data. Toward this objective, we have accomplished the following since October 2001:

- We digitized 419 flight indexes maps at 1:250,000-scale for Antarctica. The index maps were high resolution to allow for full-scale high-resolution storage and reprinting of the maps. These maps were also re-purposed in HTML format and optimized for full-scale progressive web downloading and printing.

- We digitized the 179 USGS published maps of Antarctica at a high resolution to allow for full-scale high-resolution storage and reprinting of the map. These maps were then formatted at a lower resolution for integrated ARC visual database viewing. In addition, the files were re-purposed for progressive Web-download, and to be copied onto high capacity storage media.

- We identified Landsat film images stored in the ARC by Path and Row. The scene coordinates on the image was typed into the appropriate dialog boxes in the GLIS software, which in turn displayed the metadata information that contained the Path and Row. The numeric data (Path and Row) can now be found on the Landsat scene envelopes stored in the ARC. This information allows for quick on-line access using GLIS.

- We digitized NSF videotapes for DVD, Intranet, and library workstation viewing. The files have been digitized in the following formats:
  - For Video library visual database functions, the format is AVI
  - For the Web, the resolution is 320x240 and the formats are. Mpeg and AVI.

- We installed and tested New Sony Universal Multipurpose Multimedia and Inter-connectivity Computer Technology. The New Digital Asset Storage, Development and Streaming Workstations of the future are in the ARC today.

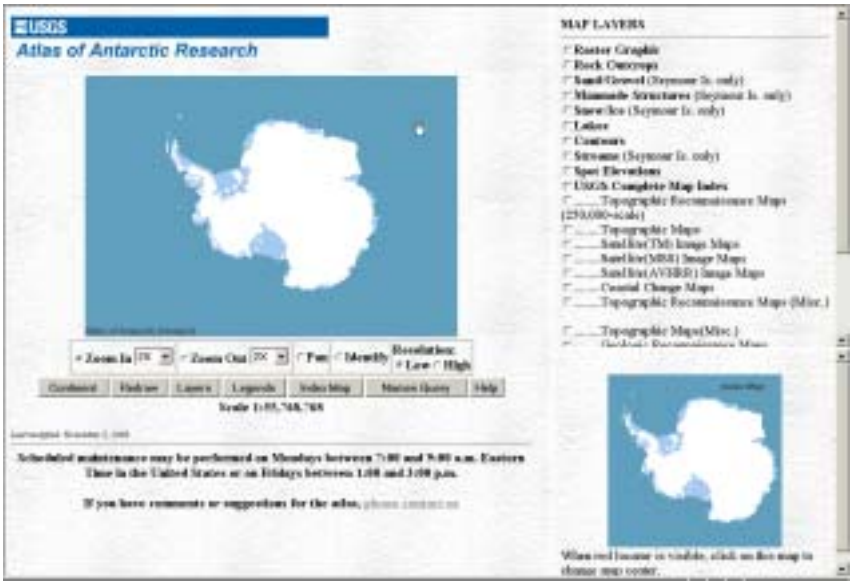
- We re-configured old workstations with new technology and software to facilitate high-end graphics multitasking and storage. This was done by installing new high capacity CD, DVD, and firewire drives for fast backup and long-term storage of digital assets.

3.4 The Atlas of Antarctic Research

The Atlas of Antarctic research was developed to provide a single platform for the display and distribution of a variety of data ranging from base cartographic data to data contributed by the science community. That focus was

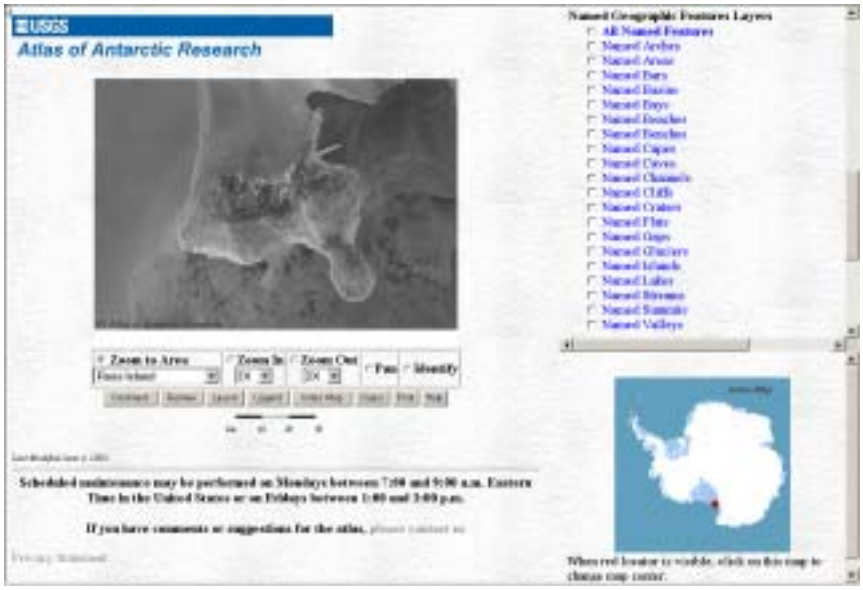
adopted to encourage the science community to utilize soundly geo-referenced base maps for the collection and compilation of their field data and science findings, thereby producing information that could be easily shared and stored for future research applications.

3.4.1 Status



Version 1 of the Atlas remains on the main server as accessed via the USGS website (www.usgs.gov), and serves the Antarctic community. With only one minor exception, it has been available round the clock since its release in 1999.

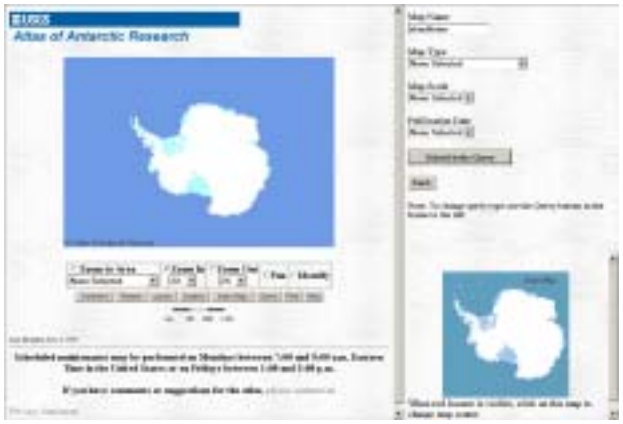
The **Version 2 Atlas** (http://rnp2039.er.usgs.gov/antarctic_atlas/atlasstart.cfm) remains on the test server in Reston.

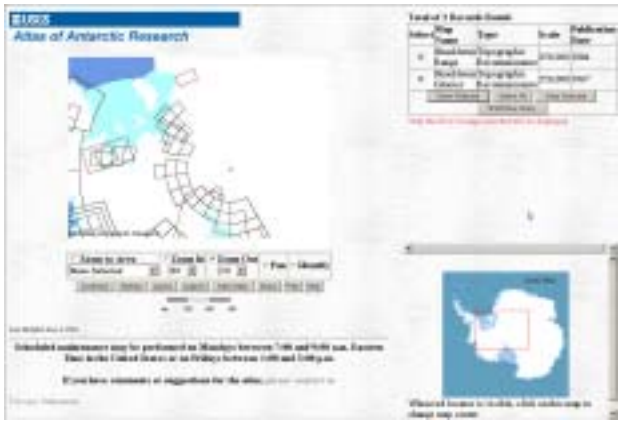


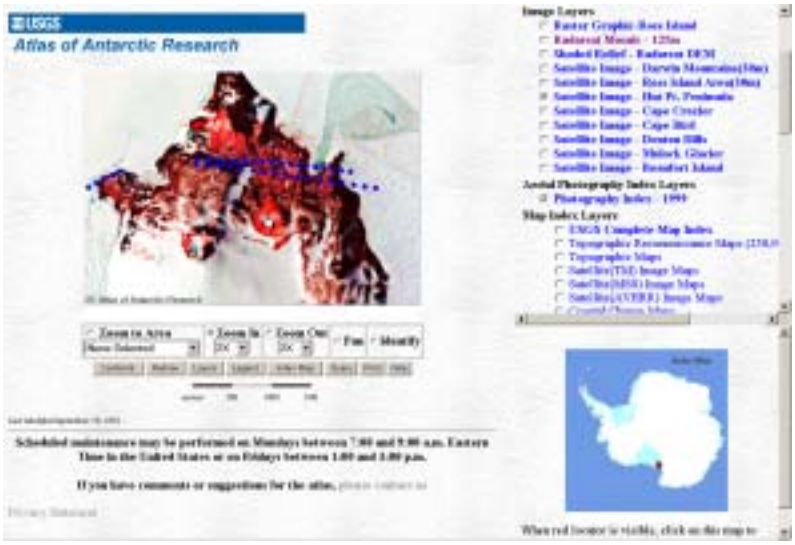
It has ten categories of base data containing 61 individual layers.

They range from standard topographic map layers to geographic names and map index layers to aerial photography indexing and logistics information for helicopter, twin otter and LC-130 flights.

It provides limited descriptions of the layers displayed that can be accessed by clicking on the layer names. Other enhancements include a zoom to area function for selected portions of the continent, a bar scale displayed in metric units, a capability to search by variant names as well as US names of Antarctic features, a map index search and display capability, and more layers than Version 1.

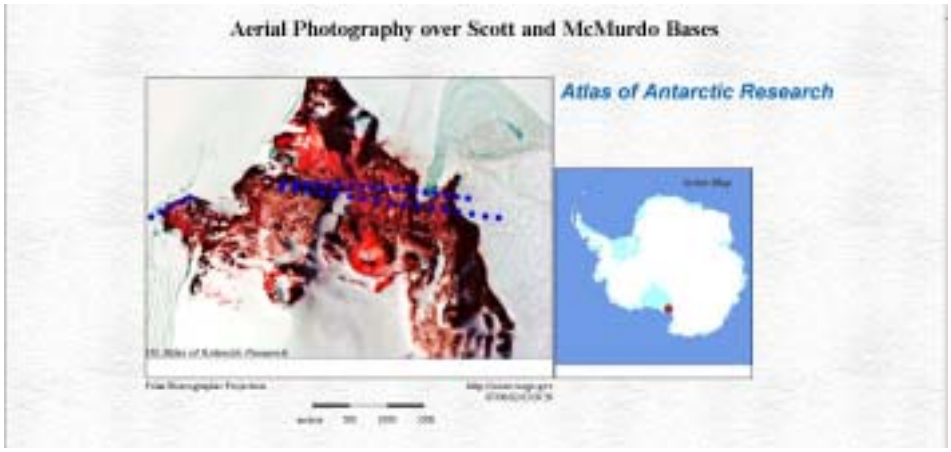






The addition of satellite image data from the USGS Antarctic satellite-image mapping project provides good base information for display of other layers.

In addition, it provides the capability to generate a printed map of the area of interest with title, scale and index map.



The location layer for ASPAs is under construction (planned release: September 30, 2002).

3.4.2 New Developments

Version 3 of the Atlas using ArcIMS software is on a server in Battle Ground Washington. (http://209.95.34.42:9221/antarctic_atlas/newatlas/frames.cfm) When completed, it will provide the same capabilities as the previous version, but the display of images will be simpler and the symbolization of area boundaries will be better. It provides a much larger map display window, an index map that is toggled on and off when it is needed so that space on the screen is not dedicated to it, and the zoom in and out functions support dragging a box to select the extent of the next map in the map display window. This development atlas will be transferred to the Reston test server once the appropriate software is purchased and installed to support it. It is under construction right now, so not all layers work, their colors are not optimal, and they do not all automatically turn off and on with changing scale of display. But the display window is so much better than the previous version that it is worth a quick look even now.

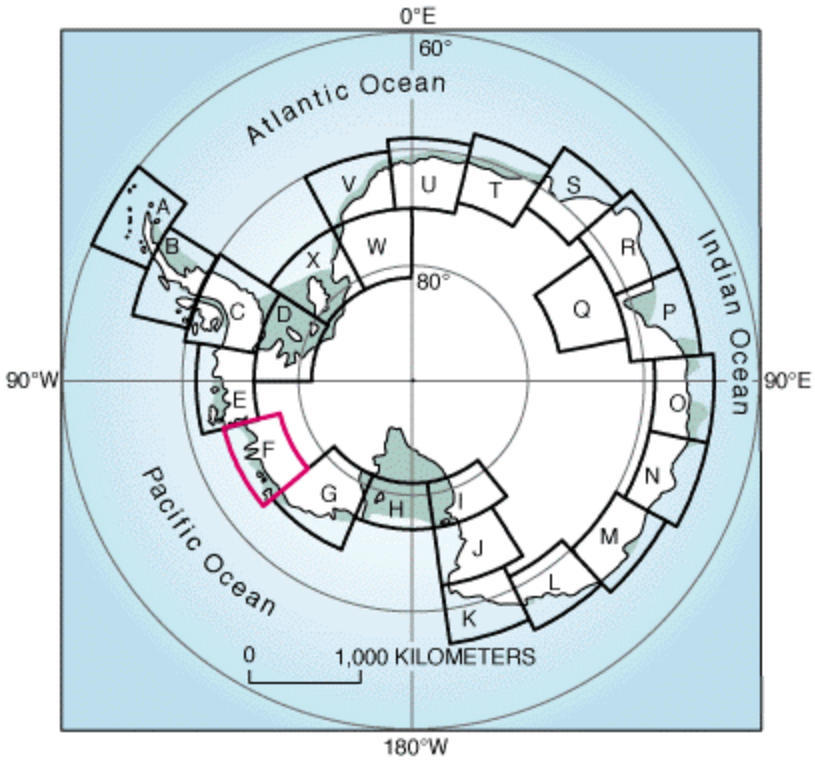
The ArcIMS application is being assessed on two levels:

- Utility of the new format – does it provide enough benefit over the original to make the transfer worthwhile? At this time, I believe it is a good idea, but will be looking for input from the science community for the final decision.
- Ability of the ArcIMS software to support complex Identify requests. It has been the experience of the U.S. National Atlas development team that complex identify operations (those performed with several layers turned on) take an inordinate amount of time. It is much slower than the current software.

Discussions with the National Atlas team have led us to look at a third option that would use a new version of the Map Objects software (versions 1 and 2) but it will be served by ArcIMS server software. Once the National Atlas team finishes its studies, we will decide on the direction to be taken by the Antarctic Atlas (estimated release date for the test version: March 1, 2003).

3.5 Coastal Change and Glaciological Maps of Antarctica

The coastal-change and glaciological mapping task, an element of the Glacier Studies Project (GSP) of the U.S. Geological Survey (USGS), has had five objectives from its start:



- To determine coastline changes in Antarctica.
- To establish an accurate baseline series of 1:1,000,000-scale maps the glaciological characteristics of the coastline of Antarctica and the location of floating ice fronts during the time periods represented by the imagery.
- To determine velocities of outlet glaciers, ice streams, and ice shelves from comparison of images of the same areas taken over time.
- To compile a comprehensive inventory of named and unnamed outlet glaciers and ice streams in Antarctica that are mappable from the images.
- To publish the results of the analyses in 24 maps as I-2600-A-X of the USGS Geologic Investigations Series (I-Maps).

Each 1:1,000,000-scale map extends to the southernmost nunatak within each map area or to the southernmost extent of Landsat images (about 81.5°S. lat.).

The map series is now being georeferenced to the 125-meter resolution digital mosaic of RADARSAT images of Antarctica created by the Byrd Polar Research Center of Ohio State University. This change in the procedures for the map series has led to the recompilation of the Bakutis Coast map (I-2600-F) that was first published in 1977. Both the Bakutis Coast and Saunders Coast (I-2600-E) maps are now nearing completion.

In 2000, GSP and the Mapping and Geographic Information Centre (MAGIC) of the British Antarctic Survey (BAS) began a formal cooperative 3-year endeavor to prepare three maps of the Antarctic Peninsula region. The maps will be based on a large variety of cartographic, aerial photograph, satellite image, and ancillary historical datasets archived at each institution. The maps will document dynamic changes on the peninsula during the past 50 years for three of the maps in the planned 24-map series; the maps are of the Trinity Peninsula area (I-2600-A), the Larsen Ice Shelf area (I-2600-B), and the Palmer Land area (I-2600-C). The 1:1,000,000-scale maps will encompass an area 1,800 kilometers (km) long and with an average width of 400 km (range of 200 to 600 km wide); the area is between latitudes 60° and 76° S. and longitudes 52° and 80° W. For much of the Antarctic Peninsula, BAS has used a georeferenced digital image mosaic from Landsat Thematic Mapper images prepared by Germany as an image-map base (backdrop). Thus, I-2600-A-C will have a different base than the other maps of the series.

All digital cartographic data for the coastal change maps will be available in the web-accessible USGS Atlas of Antarctic Research, and new coastline information will be incorporated into the SCAR Antarctic Digital Database (ADD). See USGS Fact Sheets FS-050-98 at http://pubs.usgs.gov/factsheet/fs50-98/ and FS-017-02 at http://pubs.usgs.gov/factsheet/fs17-02/ for more details on the project.

3.6 Geospatial Data Partnerships

During the field season, meetings were held to discuss the addition of a layer to the Atlas of Antarctic Research to describe the Antarctic Specially Protected Areas. The data is set for release by the end of September 2002.

In meetings with the Gateway Antarctica group in Christchurch, in late January, joint work to further describe the ASPA's was discussed and a partnership to do that work will be developed. A meeting was also organized to discuss GIS activities of mutual interest in the Antarctic with the New Zealand program Environment group and Raytheon Polar Services GIS support. It was attended by representatives of Land Information New Zealand, Antarctica New Zealand's Environment section, Gateway Antarctica, Landcare New Zealand, Raytheon Polar Services, and USGS. It allowed the exchange of information about each of the groups' activities related to Antarctica. It was agreed to maintain the contacts to eliminate duplication and look for activities by the US and New Zealand programs that can be leveraged to increase what can be done both in Antarctica and at the home offices during the rest of the year.

In separate meetings with Landcare, New Zealand in Palmerston North and the AAD GIS officer in Hobart, discussions were initiated to combine forces in the development of the Atlas capabilities. The partnership will provide more development support for the software currently used for all of the atlases and some consistency in their interfaces.

A partnership is being formed with Ohio Sate University to review and edit the LIDAR data collected in December 2001 from McMurdo. We will assess the quality of the data, correct errors and generate the most useful products for distribution of the data to the science community.

We are forming a partnership with the Naval Facilities Engineering Command, Charleston, South Carolina, to generate a digital elevation map of McMurdo Station based on the LIDAR data and the Digital Globe Image of the Station. Work will commence as soon as the LIDAR data for the base are received and corrected.

4. SCIENTIFIC PAPERS PUBLISHED / PRESENTED

Hallam, C.A., (2002). Surface Modeling using LIDAR Data in Antarctica, *Proceedings of the ASPRS Conference*, April (abstract).

Hothem, L.D. and Willis, M.J. (2002). "Low Power Remote GPS Observatories in Southern Victoria land, Antarctica," (abstract) proposed for presentation at Weikko A. Heiskanen Symposium in Geodesy, Ohio State University, Columbus, Ohio, 1-5 October. http://geodesy.ceegs.ohio-state.edu/50_years/

Hothem, L.D. (2002). "Absolute Gravity Epoch Measurements in Victoria Land, Transantarctic Mountains-Initial Results," (abstract) proposed for presentation at Weikko A. Heiskanen Symposium in Geodesy, Ohio State University, Columbus, Ohio, 1-5 October. http://geodesy.ceegs.ohio-state.edu/50_years/

Wilson, M.J., Wilson, T.J. and Hothem, L.D. (2002). "Deglaciation in the Western Ross Sea Region, Antarctica: Comparison of GPS-derived Vertical Crustal Motions and Geological Records," American Geophysical Union, Spring Meeting 2002, abstract #U42A-09. http://adsabs.harvard.edu/ads_abstracts.html

Hothem, L.D. and Willis, M.J. (2001). "Construction of a Low Power Continuous Operating Remote GPS/GLONASS Station in Southern Victoria Land," Antarctic Neotectonics Workshop, Siena, Italy, 11-15 July (Poster) http://www.scar-ggi.org.au/geodesy/antec/siena/docs.htm

Willis, M.J., Wilson, T.J., Whillans, I.M., and Hothem, L.D. (2001). "Analysis of Crustal Motion in Southern Victoria Land, Antarctica," Antarctic Neotectonics Workshop, Siena, Italy, 11-15 July (Poster) http://www.scar-ggi.org.au/geodesy/antec/siena/docs.htm

Hothem, L.D., Whillans, I.M., Willis, M.J., and Wilson, T.J. (2000). "TAMDEF GPS Campaign," (abstract) poster presentation in session on Neotectonic deformation of the Antarctic plate, XXV General Assembly, European Geophysical Society, Nice, France 25-29 April.

5. PLACE NAMES

The Advisory Committee on Antarctic Names, U.S. Board on Geographic Names, continued to be active in the past two years. Toponyms were provided for unnamed features on USGS maps of the Cook Mountains, Darwin Mountains, Britannia Range, and various parts of Victoria Land. Information on place names, including geographic coordinates and historical notes on the names. USGS satellite image map name, scale, and year published are as follows:

Turnstile Ridge	1:100,000	2001
Darwin Glacier	1:100,000	2001
Darwin Mountains	1:250,000	2002
Cape Crozier	1:25,000	2002
Hut Point Peninsula	1:25,000	2002
Mount Bird	1:25,000	2002
Mount Erebus	1:25,000	2002

6. GROUND CONTROL POINT LIBRARY

USARC Antarctic Ground Control Library: This joint USGS/NASA project is to produce a digital ground control point library for Antarctica. Data has been converted from analog form on the shelves of the United States Antarctic Resource Center locate at the to a set of web pages accessible on the ARC web site (http://usarc.usgs.gov/antarcticgroundcontrol). These data are organized by USGS IMW quadrangle sheet with a separate page for each control point. Each point is described in terms of its coordinates and physical description. It also includes views of the point with aerial photography and satellite imagery.

7. PLANNED ACTIVITIES FOR THE NEXT TWO YEARS

7.1 Geodetic Projects

Geodetic projects are planned that continue a program of contributing to building and maintaining a continent wide geodetic infrastructure (GIANT) in support of wide-ranging international scientific research objectives, including monitoring horizontal and vertical deformation on Ross Island and in the region of Victoria Land, Transantarctic Mountains, by: (1) establishment and maintenance of a framework of permanent and continuous operating, attended and unattended geodetic observatories, including the Antarctica Remote GNSS Observatories (ARGO), with geopositioning measurements linked to the International Terrestrial Reference Frame (ITRF), (2) performing new or repeat measurements on existing and newly monumented deformation monitoring stations of the TAMDEF, (3) cooperative maintenance and special calibration surveys of tide gauge instruments, (4) conducting absolute gravity measurements, (5) providing GPS base reference station support in application of high accuracy remote sensing measurement technologies such as airborne laser altimetry or LIDAR and airborne digital photography, (6) maintaining continuous operating GPS/GLONASS observatories at McMurdo, South Pole, and Palmer stations and transmitting daily, high quality data to the International GPS Service (IGS), (7) establishing ground control at identifiable points for satellite image digital mapping projects, and (9) expanding and maintaining the Antarctica Resource Center's on-line geodetic data base with historical and new data.

All field geodetic projects and work are supported through a cooperative arrangement with Land Information New Zealand (LINZ). Annually, starting in 1998, LINZ has assigned a geodesist to the USGS geodetic team.

7.2 Remote Sensing

We will continue to work with the British Antarctic Survey to complete Trinity Peninsula, Larsen Ice Shelf and Palmer Land and include the data in the Atlas of Antarctic Research. We will print the 5 maps.

7.3 Topographic Mapping

We plan to continue our cooperative program with Land Information New Zealand for topographic mapping which may include satellite image mapping and bathymetric mapping.

7.4 Geographic Information Activities

We will continue to pursue international cooperation in atlas development as well as joint data collection and development activities.

8. ACKNOWLEDGEMENTS

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