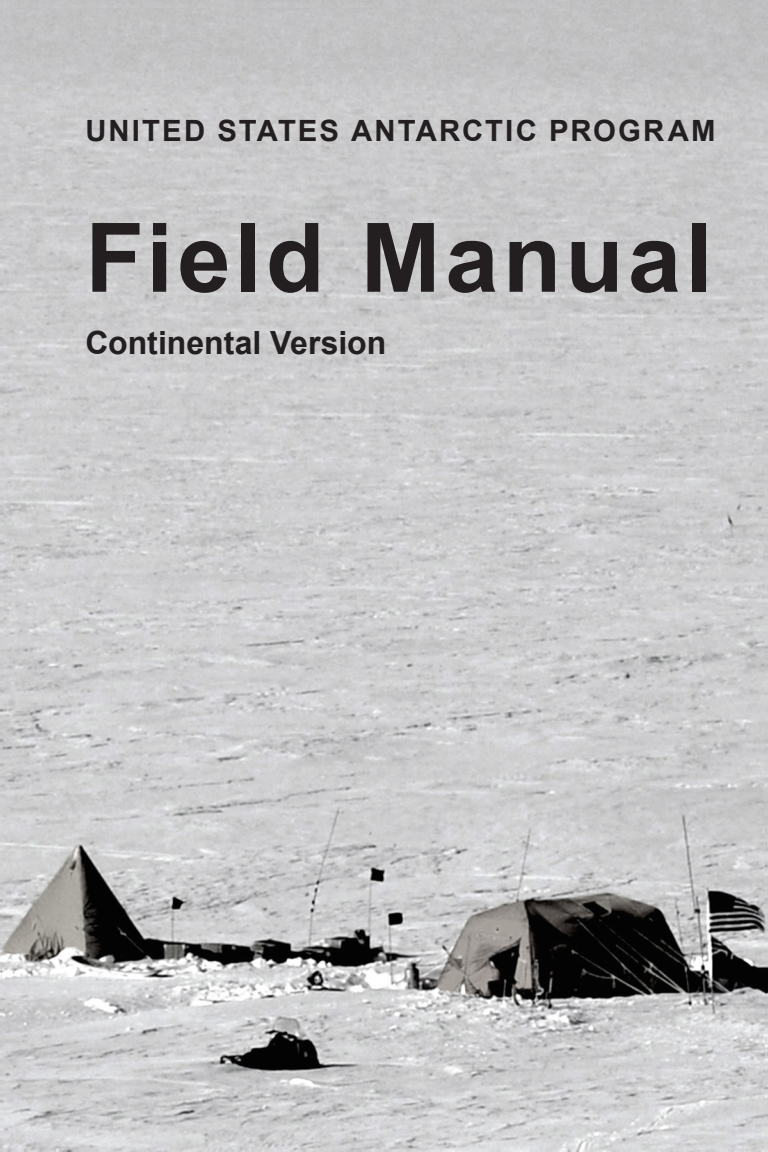
UNITED STATES ANTARCTIC PROGRAM

Field Manual

Continental Version



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Program Information

National Science Foundation Introduction

The purpose of the *United States Antarctic Program (USAP) Field Manual* is to provide an overview of USAP field logistics, operations, and safety. It contains information relevant to field deployments and living and working in an Antarctic field camp and is intended to enhance your success in the field. It is your responsibility to be familiar with the skills and techniques covered in this manual.

This is intended to be a reference manual and it should be taken into the field with you. Valuable knowledge is provided. Safety, environmental stewardship, and your health are of paramount importance. Continued vigilance and action in these areas are essential to maintain a safe and productive environment for work in Antarctica.

The harsh conditions encountered in the field setting, coupled with relatively short deployments and important scientific objectives, require effective leadership and constant risk management from all team members. Reducing the risk of injury and illness depends on a combination of systematic risk assessment, hazard elimination or control, appropriate use of personal protective equipment, and safe work practices.

This manual is designed to be used in conjunction with the *USAP Field Practices Manual* located on www.usap.gov. The *Field Practices Manual* provides pre-deployment, planning information that is useful during the Support Information Packet (SIP) process. Use of these manuals and adherence to the guidelines set forth will enhance both your safety and productivity while working in Antarctica.

We wish you a very safe and productive field season.

Kelly Falkner – *Director, Division of Polar Programs*
Scott Borg – *Section Head, Antarctic Infrastructure and Logistics*
Eric Saltzman – *Section Head, Antarctic Sciences*

First Aid Emergency Response Checklist

- **Survey the scene.**
  Is it safe? What happened? How many are injured? Who can help?
- **Do a primary assessment of the victim.**
  Breathing? Heart beating? Major bleeding?
- **Radio or call for help, if needed.**
  Alert other field team members or people in the vicinity.
- **Do a secondary assessment of the victim.**
  Interview the victim, check vitals, conduct head-to-toe exam.
- **Call MacOps.**
  Inform MacOps of the incident and victim's condition, of other camp members' condition, and of any plan. Request assistance or evacuation, as needed. Ask for a communications transfer to medical personnel, if necessary.
- **Stabilize the patient until help arrives.**
  Keep patient warm and dry, move him or her to shelter if possible, be reassuring, provide food and warm liquids if appropriate, and improvise toilet equipment, if necessary.
- **Follow up.**
  Notify appropriate manager and other involved parties about the incident. Complete and submit the required incident report as soon as possible.

USAP Operational Risk Management

Probability	Consequences				
	none (0)	Trivial (1)	Minor (2)	Major (4)	Death (8)
Certain (16)	0	16	32	64	128
Probable (8)	0	8	16	32	64
Even Chance (4)	0	4	8	16	32
Possible (2)	0	2	4	8	16
Unlikely (1)	0	1	2	4	8
No Chance 0%	0	0	0	0	0

None	No degree of possible harm
Trivial	Incident may take place but injury or illness is not likely or it will be extremely minor
Minor	Mild cuts and scrapes, mild contusion, minor burns, minor sprain/strain, etc.
Major	Amputation, shock, broken bones, torn ligaments/tendons, severe burns, head trauma, etc.
Death	Injuries result in death or could result in death if not treated in a reasonable time.

USAP 6-Step Risk Assessment

USAP 6-Step Risk Assessment	
1) Goals	Define work activities and outcomes.
2) Hazards	Identify subjective and objective hazards.
3) Safety Measures	Mitigate RISK exposure. Can the probability and consequences be decreased enough to proceed?
4) Plan	Develop a plan, establish roles, and use clear communication, be prepared with a backup plan.
5) Execute	Reassess throughout activity.
6) Debrief	What could be improved for the next time?

Field Planning Checklist: All Field Teams

Day 1: Arrive at McMurdo Station

- o Arrival brief; receive room keys and station information.
- o Meet point of contact (POC).
- o Find dorm room and settle in.
- o Retrieve bags from Building 140.
- o Check in with Crary Lab staff between 10 am and 5 pm for building keys and lab or office space (if not provided by POC).
- o Check in with other team members.

Day 2

- o Attend science in-brief; get lock combination to cage holding field gear and details regarding flight times and allowable cabin loads (ACLs).
- o Contact the Berg Field Center (BFC) to schedule the food pull and ensure allocated fuel quantities are correct.
- o Locate cage containing field gear in Building 73; confirm the BFC gear is complete and as requested.
- o Retrieve radios and other equipment from the Field Party Communications office.
- o Check with the Mechanical Equipment Center (MEC) for mechanical equipment, such as snowmobiles and generators, if requested.
- o Check with Science Cargo to see where project cargo shipped from U.S. has been staged.

Days 3 to 5

- o Confirm that resupply items are clearly labeled and stored in cage.
- o Meet with MacOps personnel to discuss field communication plan and establish a daily call-in time.
- o Give resupply plan to the BFC supervisor and the Fixed-Wing Operations Office. Retain a copy.
- o Check and test all equipment destined for the field. Call MacOps to test communication equipment.
- o Bring all material and equipment collected from the BFC, MEC, and other departments to Science Cargo for processing.
- o Check that team members have been scheduled for required training, such as Antarctic Field Safety, Crary Lab, radio and communication, fire extinguisher, environmental, Dry Valleys Code of Conduct, cargo,

snowmobile, small engine, weather, light vehicle, tracked vehicle, food safety, and outdoor safety. Schedule any additional training, as needed.

- Pick up any required office supplies, safety gear, or science equipment from Central Supply (Building 140, upstairs). Check hours of operation before going.
- Consult with the environmental coordinator regarding proper procedures for handling hazardous material and human waste at the camp site. Procure the necessary materials, such as human waste containment and spill kits. Gather the correct forms for reporting spills and waste discharge.

Field Planning Checklist: Fixed-Wing Supported

Three business days before the flight

- This is the last day to deliver hazardous cargo to Science Cargo (Building 73).
- Meet with Field Support and Training to go over risk assessment.

Two business days before the flight

- This is the last day to deliver all remaining non-hazardous cargo to Science Cargo (Building 73) and assist cargo staff with packaging cargo and assigning shipment numbers.
- Schedule a meeting to go over final cargo weights, cargo priorities, and passenger names to the Fixed-Wing Office.

The day before the flight

- Contact MacOps and provide put-in plan, including camp name, camp leader, and the number of people in the camp. Set a time for the daily check-in.
- If going to an "unsupported" field camp, make an appointment with McMurdo Medical to pick-up a field medical box.
- Fixed-Wing Office staff will confirm that all cargo is ready for flight.
- The fixed-wing flight schedule will be published by 1800 hours; check the intranet or televisions for departure times.
- If dorm rooms are not being held for field team members, be sure to clear the rooms and properly store items not going into the field. Housing personnel will perform a room inspection.
- Be sure batteries are fully charged for satellite phones, radios, Kestrel®

weather meters, cameras, and other electronic devices.
- Set up the "away from email" auto reply function on USAP and personal accounts.

The day of the flight

- Check the flight schedule early in the morning.
- Stay near the phone identified as the team's contact number, and monitor the pager if the team has one.
- If releasing a dorm room, pack the bedding and leave it in its blue bag outside the door.
- Be at Building 140 or Derelict Junction, dressed in extreme-cold-weather (ECW) gear, at the time stated on the flight schedule.
- At the airfield, team members may be asked to assist with loading the plane.
- Visually confirm that sleep kits and all critical life safety items have been loaded on the plane. Do not allow the plane to take off until crucial safety gear has been confirmed on board the aircraft.

If the flight is delayed or canceled

- For same-day departures, remain in the passenger area and wait for updates.
- If the flight is canceled, take the shuttle back to McMurdo.
- Check with Housing staff to confirm room assignments.
- Check with the Fixed-Wing Office regarding an updated flight schedule.

Field Planning Checklist: Helicopter Supported

Three business days before the flight

- Confirm the flight request with the helicopter coordinator. The request must include estimated cargo weights, the number of passengers, and a list of hazardous cargo.
- This is the last day to request changes to the flight schedule.
- Meet with Field Support and Training (FS&T) to go over risk assessment.

Two business days before the flight

- This is the last day to deliver hazardous material to Science Cargo.

The day before the flight

- Be sure all non-hazardous cargo has been delivered to the helicopter pad.
- Contact MacOps and provide put-in plan, including camp name, camp leader, and the number of people in the camp. Set a time for the daily check-in.
- If going to an "unsupported" field camp, make an appointment with McMurdo Medical to pick-up a field medical box.
- If dorm rooms are not being held for field team members, be sure to clear the rooms and properly store items not going into the field. Housing personnel will perform a room inspection.
- Be sure batteries are fully charged for satellite phones, radios, Kestrel® weather meters, cameras, and other electronic devices.
- Set up the "away from email" auto reply function on USAP and personal accounts.

The day of the flight

- Check the flight schedule early.
- Monitor the pager, if the team has one.
- Stay near the phone identified as the team's contact number.
- Be at the helicopter pad, dressed in ECW gear, 45 minutes before the flight.

If the flight is delayed or canceled

- Check with Helicopter Operations staff regarding an updated flight schedule.
- For same-day departures, remain in the passenger area and wait for updates.
- If the flight is canceled, check with Housing staff to confirm room assignments.

Field Camp Put-In Procedures

Before departing McMurdo Station

- Review the Field Planning Checklist to be sure all items are complete.
- Turn in room keys to housing staff and lab keys to Crary Lab personnel (unless authorized to keep them).
- Be sure all electronics are warm and batteries fully charged.
- Visually confirm that all sleep kits, communication equipment, and

required safety gear are loaded on the aircraft. Do not allow the aircraft to depart until this is confirmed.

Upon arrival at the camp site, while aircraft is still on the ground

- Assist the flight crew with unloading the aircraft, as directed.
- Establish communication with MacOps using a satellite phone or radio; verify the camp name, the name of the camp leader, and the number of people in the camp. Confirm the time of daily check-in.
- Establish a shelter; set up a tent away from the landing area.
- Establish a flame; light a camp stove.
- Inform the pilot when these tasks are complete.
- Obtain the following information from the pilot:
  - An altimeter reading for the site (to program the Kestrel® weather meter).
  - The direction of Grid North (to establish directional flags for weather observations).
- Keep clear of the aircraft and any prop wash as it departs.
- In fixed-wing camps, test the VHF air-to-ground radio (if you have one) with the pilot once the aircraft has become airborne.

Immediately after the aircraft has departed

- Identify the best location for the camp; look for a spot that offers easy access to research sites, avoids hazards, and provides protected areas for shelters. Consider storm wind direction (study the topography for clues) and helo pad and/or skiway location to create optimal camp orientation.
- Set up all tents with equal and appropriate spacing, taking whiteout scenarios and drifting into consideration.
- Set up the HF radio, solar panel, and antenna. Test the radio by contacting MacOps.
- Set up a camp toilet area. This may be a shelter tent for a human waste container or a hole in the snow in areas where accumulation is permitted.

As soon as practical

- Place all fuel containers and equipment, such as generators, in containment.

- Establish a site for trash. Be sure all trash is correctly packaged and labeled for return to McMurdo Station.
- Erect flag lines between tents and/or cargo lines in case of whiteout situations.
- Set-up a camp survival cache with spare fuel, food, and a personal locating beacon. The toilet tent is often a good candidate if it's a Scott Tent.
- Establish GPS coordinates for cargo lines, tents, and the survival cache. Store this GPS in an easily accessible location for a whiteout situation.

Field Camp Daily Tasking Checklist

Communications

- Complete daily check in call before the appointed time. Inform MacOps of the number of people at the camp and whether or not all is well.
- Make weather observations and call them into MacWeather at the pre-arranged times.
- Call the fixed-wing or helicopter supervisor to confirm any upcoming flights.
- Make calls to work centers, as necessary, to request or confirm material for any impending resupply.

Record Keeping

- Record any pollutant spills using the "Field Spill Reporting Sheet."
- Record any information each day that will be required in the camp report.

Housekeeping, Health and Safety

- Sort waste and recyclables and keep them in proper containers.
- Check for and clean up any pollutant spills.
- Check and tighten all guy lines and anchor points.
- Monitor surroundings and weather patterns for indications of coming storms.

Resupply

- Check levels of commonly used items, such as propane, food, paper towels, toilet paper, and hand sanitizer. Make a list and call for resupply once a week, remembering that many items have a long lead time.

Field Camp Pull-out Procedures

In the days leading up to pull-out:

- Package equipment and cargo not being used. Record the weight, cube, and type of retrograde cargo for each box. This information will be passed to the fixed-wing or helicopter supervisor for pull-out flight planning.
- Package hazardous cargo in its original packaging and label it. Locate original hazardous cargo documentation, as the pilot may request it.
- Identify a staging area next to the landing strip and place cargo there when it is packaged and ready to go.
- Communicate with the fixed-wing or helicopter supervisor to confirm pull-out flights and relay cargo details.
- Notify MacOps of planned pull-out date.
- Plan the take-out in stages. Cargo and passengers slated for the last flight should include essential gear and survival food for one week, as well as someone to provide weather observations, in case the takeout needs to be aborted for any reason.
- Communicate with Housing personnel at least two days before arriving in McMurdo to arrange and confirm room assignments.
- Take GPS coordinates of all release sites for the end-of-season Environmental report.

Day of pull-out:

- In fixed-wing supported camps, begin hourly weather observations six hours before an LC-130 aircraft leaves McMurdo and three hours before a KBA aircraft (Twin Otter or Basler) leaves McMurdo.
- Take down tent(s).
- Place all remaining camp items in the staging area and conduct a visual sweep of the campsite ensure all items are removed.
- Disassemble the radio(s) and antenna(s).
- Before takeoff, take one last look to make sure everything and everyone is on the plane!

After return to McMurdo Station:

- Take the time necessary to clean and return all equipment to its proper storage area or department. See the “Camp Gear Return Procedure” for details.

Field Camp Hut Etiquette

Please complete the following before leaving the hut:

Trash

- Sort and pack all trash and recycled materials and take them back to McMurdo Station for proper disposal.
- No trash or recyclable items should be left in hut containers.

Floors, surfaces, and furniture

- Sweep the floor.
- Wipe all tabletops and chairs clean.
- Arrange chairs and tables neatly.

Personal items

- Conduct a thorough sweep of the hut in order to locate and remove all personal and project-specific items.

Food and dishes

- Wash and put away any dishes, utensils, and cookware.
- Non-perishable food should be neatly packaged, labeled, and stored in its proper area.
- Take perishable food back to McMurdo Station.

Thank you for leaving the hut in a clean and tidy condition for the next field team.

Camp Gear Return Procedures

Allow sufficient time *for returning equipment to the BFC. Field teams are responsible for cleaning the gear, sorting it, and ensuring it is checked in by BFC personnel. Gear return can take from an hour to two days, depending on the type of gear and its condition.*

- Call the BFC in advance at x2348 to make an appointment for gear return.
- At the appointed time, bring all camp gear to the BFC and make piles of like items (e.g., sleeping bags, Thermarests®) on the floor downstairs.
- Remove all flight tags, cargo stickers, and duct tape from the gear.
- Report any damage to a BFC staff member, or tag it as such.

- A BFC staff person will inspect the gear, inventory it, check it in, and print out an "Outstanding Returns" sheet for any missing items. Locate and return these missing items or make a note on the sheet explaining what happened to them.

BFC items needing extra attention:

- Tents – All communal cook tents must be set up, swept out, and scrubbed. Make an appointment with the BFC personnel so they can assign a location and provide the proper cleaning tools.
- Dishes, thermoses, food coolers, stoves, water coolers, and five-gallon buckets – Wash and dry these items, using the sinks at the BFC. Please repack the kitchen box and inform a BFC staff member of any missing content.
- Climbing ropes and equipment – Inform BFC staff of any issues with the equipment or any falls on the rope. Also, please check ropes before returning them. BFC staff will check all equipment during the winter, but field-team knowledge and assistance is valued and appreciated.
- Pee bottles and toilet seats – Clean and bleach these items. A system with directions is in place downstairs at the sink next to the washing machine. Please do not leave them for other people to clean.
- Trash – Separate, clean, and dispose of all trash in the bins outside the BFC. Each category needs to be bagged. Extra bags are in the BFC bay.
- Human waste – Please take it to the Waste Barn and place in the appropriate container.
- Cage – Please clean cage out completely! Throw out garbage, sweep floors, and wipe off shelves. DO NOT LEAVE ANYTHING IN THE CAGE! It will be inspected by a BFC staff member when this task is completed.
- Jerry cans – Consolidate like fuel and empty all unknown or unmarked jerry cans in the waste barrel near the flammables van. Please tag and label any full or partially full cans with the contents. Place them under the appropriate sign outside the flammables van.
- Food – Dry food that is in good condition and unopened can be returned to the BFC. Frozen food cannot be returned, as it may have thawed during transport.

Environmental Guidelines

Environmental stewardship and protection in the Antarctic is essential. The United States (U.S.) is a signatory to the Antarctic Treaty (1959) and the Protocol on Environmental Protection to the Antarctic Treaty (Protocol, 1991). These agreements are implemented in the U.S. under the Antarctic Conservation Act of 1978, Public Law 95541, as amended by the Antarctic Science, Tourism, and Conservation Act of 1996, Public Law 104-227.

The Antarctic Treaty sets Antarctica aside for peaceful purposes, primarily scientific research, cooperation, and the exchange of information. The Protocol commits to comprehensive protection of the Antarctic environment, including a ban on commercial mineral exploration, and through its six Annexes requires environmental impact assessment of all proposed actions and conservation of native fauna and flora (including management activities to limit introduction of non-native species). The Protocol also establishes protocols for waste disposal and waste management, prevents marine pollution, and establishes a process for area protection and management. Implementation of Protocol obligations by USAP participants relies on education programs for each of these areas.

United States Federal regulations implementing the ACA can be found in the Code of Federal Regulations (CFR) Title 45, sections 640, 641, and 670 through 674. For questions or to obtain additional information regarding the information presented below, contact ASC Environmental (Environmental@usap.gov).

Antarctic Specially Managed Areas (ASMAs)

ASMAs are areas in which careful planning and coordination are required to avoid activity conflicts, improve coordination among field parties, and reduce the risk of cumulative environmental impacts. The two ASMAs covered by this manual are the McMurdo Dry Valleys (ASMA 2) and Amundsen-Scott South Pole Station (ASMA 5).

Please note: Personnel entering the McMurdo Dry Valley ASMA are required to attend specific Dry Valley ASMA training prior to entry. The management plans for each ASMA contain information regarding Restricted Areas and/or Managed Areas with which the entrant should be familiarized.

Antarctic Specially Protected Areas (ASPAs)

ASPAs are areas designated to protect outstanding environmen-

tal, scientific, historic, aesthetic, or wilderness values. This includes protecting ongoing scientific research from inadvertent disruption or contamination. ASPAs require an ACA permit to enter. ASPAs located directly within the McMurdo Station area include Arrival Heights, ASPA 122, and Discovery Hut at Hut Point, ASPA 158.

There are several ASPAs located within the McMurdo Dry Valleys, ASMA 2. These include: Lower Taylor Glacier and Blood Falls, ASPA 172; Canada Glacier, Lake Fryxell, Taylor Valley, ASPA 131; Barwick and Balham Valleys, ASPA 123; Linnaeus Terrace, ASPA 138; and Botany Bay, Cape Geology, ASPA 154. Additional ASPA sites located on, or in the vicinity of, Ross Island include: Cape Royds, ASPA 121; Backdoor Bay, Cape Royds, ASPA 157; Cape Evans, ASPA 155; New College Valley, ASPA 116; High Altitude Geothermal Sites of the Ross Sea Region, ASPA 175; Cape Crozier, ASPA 124; Beaufort Island, ASPA 105; Lewis Bay, ASPA 156; and Northwest White Island, ASPA 137.

Additionally, there are 26 Historic Sites and Monuments (HSM) in the Ross Sea Region. Some HSMs are incorporated within ASPAs, such as the historic huts from early Antarctic Expeditions (e.g. HSM 15, Shackleton's Nimrod Hut in ASPA 157; HSM16, Scott's Terra Nova Hut in ASPA 155; HSM 18, Scott's Discovery Hut in ASPA 158;), and some are individual HSMs.

USAP participants who find something of historical significance (pre-1958) are asked to note the location, describe the artifact, and notify ASC or NSF Environmental of its presence.

For additional information regarding ASMAs, ASPAs, or HSMs, refer to http://www.ats.aq or query ASC Environmental via email at environmental@usap.gov.

ACA Permits

An ACA permit is required to: 1) enter and work in an ASPA; 2) take native mammals or birds, or remove or damage such quantities of native terrestrial or freshwater plants that their local distribution or abundance would be significantly affected; 3) engage in harmful interference of native mammals, birds, non-marine invertebrates and non-marine plants; 4) introduce non-native species into Antarctica; or 5) export native mammals or birds or parts thereof. The term "take" also applies to dead mammals or birds, bird eggs, mummified seal teeth, feathers, etc. Research with marine invertebrates, plants, and fish do not require an ACA permit.

An ACA permit is not needed for entry into an ASMA; however, personnel entering or working in an ASMA are required to know and follow the code of conduct specified in the applicable ASMA Management Plan. For any questions regarding ACA permits contact the NSF ACA permit officer at acapermits@nsf.gov.

Spill Prevention, Clean-up, and Reporting

- All spills of designated pollutants (e.g., fuel, glycol, transmission fluid) need to be reported immediately upon their discovery, regardless of spilled volume.
- To reduce the occurrence of spills, appropriate secondary containment and spill kits must be available for any fueling operation.
- For camps with a camp manager, spills should be reported directly to the camp manager.
- For McMurdo-based camps without a camp manager, spills should be reported to the Firehouse (via MacOps).
- For Peninsula-based field camps without a camp manager, spills of any designated pollutants should be reported to the location of the daily check-in.
- All spilled, designated pollutants need to be cleaned up to the greatest extent practicable and disposed of through the hazardous waste system.

Waste Management

- Releases of human waste or gray water are only permitted in accumulation zones, i.e., areas where snow and ice are thickening relative to the surrounding area. Releases onto blue ice, into crevasses, or on ice-free land are not permitted. No releases to the environment are permitted in the McMurdo Dry Valley ASMA or within ASPAs.
- All hazardous waste (e.g., fuel-contaminated material, lab waste, chemical containers, aerosols, radioactive material) requires special handling and labeling. Questions regarding hazardous waste management should be directed to the local Waste Department (present at each station) or to the marine lab technician on the vessels.
- The ACA has strict guidelines on managing hazardous waste. Be sure to remove all hazardous waste from the field at the end of each field season.

Human Waste

- Human waste must not be discharged onto ice-free land, sea ice, or in blue-ice areas. Discharge can only occur in snow accumulation areas and only if there is specific permission to do so.
- Surface discharge of urine is not allowed anywhere on the continent. If urine discharge is specifically approved, it may only be discharged to the subsurface (into a pit or hole).
- Personnel must carry a pee-bottle when bathrooms or outhouses are not available. Used pee-bottles must be cleaned and emptied by personnel before they leave the station (McMurdo has dedicated pee-bottle cleaning stations at the Science Support Center (SSC) and the BFC).
- Human waste and gray water should be planned for retrograde back to McMurdo Station. For planning purposes, the table below summarizes the estimated volumes requiring removal.

Usage Rates for Buckets and Containers

Human Waste Type	Container Type	Persons/Days
Human Solid Waste	5-gallon bucket (1)	5 people for 5 days (minimum)
Urine	5-gallon bucket (1)	1 person for 5 days
Gray Water	5-gallon bucket (1)	1 person for 5 days

Interactions with Animals

- Personnel should not interfere with wildlife unless they have an ACA permit and are specifically trained for the activity being conducted.
- In general, maintaining a distance of 15 to 20 feet from animals should be sufficient, but if an animal's behavior is altered or disturbed, the individual should increase that distance.

Non-Native Species

- No non-native species of animal or plant may be introduced onto land, ice shelves, or into water in the Antarctic Treaty area, except in accordance with an ACA permit.
- To avoid introducing non-native species into Antarctica, personnel must clean all science gear and personal equipment before arriving on the continent.

- To avoid cross contamination, personnel must also clean gear and personal equipment before transiting between Antarctic field sites.
- If a suspected non-native species is observed in Antarctica, it should be reported immediately to the environmental representative.

End-of-Season Report

- At the conclusion of field activities, all Peninsula-based and McMurdo-based science groups must submit an Environmental End of Season Report (EOS) to Environmental@usap.gov. The forms are available on the station intranet, or science personnel can email the above address to obtain a template.
- To make the process simpler and more accurate, the Environmental EOS should be populated with information throughout the season.
- A general summary of information required when filling out the Environmental EOS is included in the next section.

Environmental End-of-Season (EOS) Report Form: General Information Required

The following information must be tracked and quantified in the EOS (as a Microsoft Excel spreadsheet). Please refer directly to the EOS report form for specifics.

Section A – Field Camp Summary

Part 1: Camp or site information

Part 2: Fuel use

Part 3: Hazardous materials Use (non-fuel)

Part 4: Waste disposition

4a: Containerized waste

4b: Discharged sanitary waste

Part 5: Items remaining at camp closeout (fuel, hazardous materials, waste)

Part 6: Fuel, waste handling, spill prevention and response suggestions

Section B – Summary of Field Activities

Part 1: Equipment deployed

Part 2: Materials released

Part 3: Environmental disturbances in the Dry Valleys

Part 4: Spills

End-of-Season (EOS) Report Form Instructions

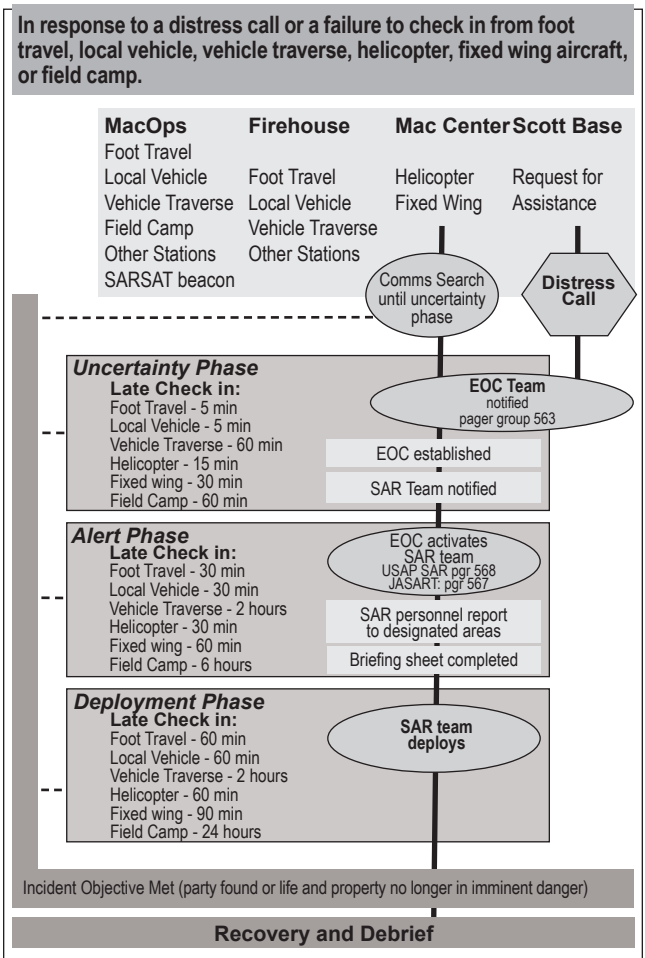
- Please complete the EOS form thoroughly and send it electronically as a Microsoft Excel file to the Environmental Department. (Environmental@usap.gov).
- Completion of the form is a requirement for each science group and ASC work center. All end-of-season reports are submitted to the NSF, and data in the reports are compiled in the USAP Master Permit.
- All principal investigators (PIs) or their designated environmental POC must complete the form. Field camp managers must complete a form separately.
- Please use the drop-down menus in the Microsoft Excel spreadsheet form for consistent reporting.

- For all field parties, please submit GPS coordinates of any science equipment installations, sampling or coring locations, temporary camps, releases (planned and unplanned), any equipment left in the field over the winter, and/or disturbances of any kind (past or present). GPS data should be reported in decimal degrees to five decimal places.
- Specific to field parties operating in an ASMA or ASPA, please submit GPS coordinates for each of the following environmental disturbances (refer to the ASMA or ASPA management plan http://www.ats.aq/documents/ATCM38/WW/atcm38_ww005_e.pdf for additional details):
  - Sample sites
  - Soil pits
  - Non-established helicopter landing sites
  - Tent sites outside facilities zones (remote camps) – please GPS the perimeter of the camp location
  - Fuel storage locations outside facilities zones
  - Waste handling and storage location outside facilities zones
  - Any releases of fuel (intentional or unintentional), equip ment, etc.
- Contact ASC Environmental (at the above email address) with any questions or comments you may have regarding the EOS form or any other environmental issue.
- Please save and send the form with the file name: Group number_PI_YearEOS.xls (e.g., B-001_Smith_2017_EOS.xls)

Emergency Management

The Emergency Operations Center (EOC) is on call 24/7. The staff will collect the caller's name, phone number, and location; classify the situation as an injury or illness, spill, aircraft mishap, vehicle accident, loss of shelter, etc.; and gather the information necessary to assess needs and risks and determine appropriate actions. If a search-and-rescue is launched, it may contain personnel from the USAP SAR team and/or the Joint Search-and-Rescue Team (JSART), which is comprised of both USAP and Antarctica New Zealand (ANZ) personnel.

Emergency Response Flow Chart



Survival Bags Explained

Local Survival Bags - Red

Needed - When traveling off of established roadways outside of McM town limits (Examples: Cape Evans, Cape Royds, Windless Bight).

Not Needed - On established roadways such as Pegasus Road, Ice Runway Road, Williams Field Road or within town limits.

from the BFC

Helo Survival Bags - Orange

Needed - When traveling by helicopter. Bag will be left with personnel if deboarding anywhere but an established camp.

Not Needed - Once personnel disembark at an established camp, a location with a survival cache, or at a tent camp with all components of a survival bag.

from Helo Ops

Red and orange bags contain everything – including fuel. Bags should be opened only in an emergency.

Deep Field Survival Bags - Blue

Needed - When traveling away from any camp in the deep field.

Not Needed - If traveling via LC130, Twin Otter, or Basler to an established camp. The aircraft carry survival bags for all passengers.

Deep-field survival bags have no fuel! Fuel bottles must be obtained from a BFC staff member and then hazardous certified separately by Science Cargo.

from the BFC

The fuel should be kept near or in the survival bag so the kit remains complete.

Local Field Survival Bag Contents

Red, shiny, dry bags - Supports 2 persons for 3 days

- 2 ea sleeping bags
- 2 ea bivy bag
- 2 ea ensolite™ pad, 24"x48"
- 1 ea mtn tent w/instructions & repair kit
- 1 ea collapsible snow shovel
- 1 ea snow saw
- 1 ea first aid kit
- 2 bt white gas, 22 or 33 oz bt in ziplock™ bag and PVC

Tent stake bag:

- 10 ea assorted stakes
- 2 ea ice screws
- 1 ea snow flukes (ok if missing)
- 1 ea hammer

Cook & Stove Set Bag:

- 1 set cookset, 1-2 pots w/lid
- 1 ea signal mirror
- 1 ea MSF Whisperlite™ Stove w/ instructions, repair kit, & 4 bx. Matches, 35/bx wrapped in foil

Toilet Paper:

- 1 roll toilet paper

Food Bag:

- 6 ea dehy meals
- 3 ea large chocolate bars or 6 ea small
- 12 ea tea bags, assorted
- 12 ea hot chocolate
- 2 pk Mainstay™ food bars, 9 bars/pk (2 per person per day) or 10 Bumper™ Bars

Utensil set contains:

- 1 ea pot handle
- 2 ea mug, hard plastic
- 2 ea spoon
- 1 tu or bt burning paste wrapped in foil
- 1 ea pocket knife

Clothing Bag:

- 1 bag misc. clothing (hat, mittens, gaiter, etc.)

Ziplock™ Bag:

- may contain a book or game, not essential
- survival manual
- 50 ft parachute cord
- 1 ea contents list

Deep Field Survival Bag Contents

Blue, shiny,dry bags - Supports 2 persons for 3 days

Full fuel bottles cannot be flown on LC-130 aircraft. They must be hazardous certified separately. This survival bag is intended for people traversing away from a fixed camp on a daily basis. Fuel should be added to this bag from camp stock.

- 2 ea sleeping bags
- 2 ea bivy bag
- 2 ea ensolite™ pad, 24"x48"
- 1 ea mtn tent w/instructions & repair kit
- 1 ea collapsible snow shovel
- 1 ea snow saw
- 1 ea first aid kit

Tent stake bag:

- 10 ea assorted stakes
- 2 ea ice screws
- 1 ea snow flukes (ok if missing)
- 1 ea hammer

Cook & Stove Set Bag:

- 1 set cookset, 1-2 pots w/lid
- 1 ea signal mirror
- 1 ea MSF Whisperlite™ Stove w/ instructions, repair kit, & 4 bx. matches, 35/bx wrapped in foil

Toilet Paper:

- 1 roll toilet paper

Food Bag:

- 6 ea dehy meals
- 3 ea large chocolate bars or 6 ea small
- 12 ea tea bags, assorted
- 12 ea hot chocolate
- 2 pk Mainstay™ food bars, 9 bars/pk (2 per person per day) or 10 Bumper™ Bars

Utensil set contains:

- 1 ea pot handle
- 2 ea mug, hard plastic
- 2 ea spoon
- 1 tu or bt burning paste wrapped in foil
- 1 ea pocket knife

Clothing Bag:

- 1 bag misc. clothing (hat, mittens, gaiter, etc.)

Ziplock™ Bag:

- survival manual
- 50 ft parachute cord
- 1 ea contents list

Survival Cache Contents

Staged at fixed camps

Exact quantities and supplies may vary, depending on average population and specific camp criteria.

Supplies:

- o sleeping bags
- o ensolite™ pads, 24"x48"
- o collapsible snow shovel
- o snow saw, Ice ax, sledge hammer
- o assorted tent stakes
- o ice screws
- o snow flukes
- o mountain tents (large camps do not have tents since there are several Jamesways or Rac-tents.)
- o parachute cord (100 ft)
- o signal mirror
- o pocket knife
- o pee bottles
- o human waste buckets
- o toilet paper rolls
- o sledge hammer

First Aid:

- o first aid kit, group
- o books - *Medicine for Mountaineering, Cold Injuries*

Cooking:

- o Coleman fuel
- o Coleman two burner stove
- o MSR Whisperlite™ stove
- o pot, 10 qt
- o pot, 5 qt
- o pot, 3 qt
- o plates
- o utensils (fork, knife, steak knife, spoon)
- o mug, hard plastic
- o pot grips
- o fry pan
- o matches
- o cleaning pads, scrubbies

Food:

- o dehydrated meals
- o oatmeal
- o meals-ready-to-eat (MREs)
- o hot chocolate
- o bars (granola, chocolate)

Communications

Regional Travel Communication Requirements

Travel off established roadways is tracked by MacOps.

Established roadways include: ice road to Ice Runway, snow roads to the Long Duration Balloon (LDB) site and Pegasus Runway, and dirt roads between McMurdo, Scott Base, T-Site, and Arrival Heights.

Requirements:

- Check-out by radio (to ensure it's working)
- Check-in before estimated time of return (ETR) (failure to do so initiates emergency response)

Solo Travel Requires NSF authorization and additional requirements. Defined as: a) single person traveling alone or b) any number of people traveling on a single snowmobile.

Weather Condition 3 - Standard travel procedures in place
Condition 2 - No snowmobile travel / No solo travel
Condition 1 - No travel of any kind allowed

Check-out Procedure Use VHF radio. "MacOps, MacOps, this is (vehicle number or call-sign) calling on (channel name)"

Provide the following when prompted:

- Vehicle number(s)
- Event number (or department)
- Destination
- Number of people on board
- Driver name (one name per group)
- Point of contact (in McMurdo) and phone/pager
- ETR to McMurdo or estimated time of arrival (ETA) at destination

Call to extend return time! There is NO grace period!

Overnight Stays

- Before departing McMurdo, provide the names of all members
- Provide one-way check-out to site, morning check-in at site, and one-way checkout for return.

If you are late

After five minutes the Emergency Operations Center (EOC) is activated. This includes the NSF station manager, ASC station manager, emergency communications manager, field science manager, information technology manager, and the fire chief.

Field Camp Communication Requirements

Before Departing McMurdo

- Comms equipment pickup: contact communications Coordinator at (Bldg 159, ext 2378)
- Test the gear - call MacOps for comms check

Arrival at Field Site Put-in call required *before* aircraft departs:

- Location name
- Camp leader name
- Number of people (by event number)
- Confirm daily check-in time

Daily Check-In Call Check-in *before* your scheduled time

- Location name
- Number of people (by event number)
- "All is well"

Return from the Field (Pull-out)

- Notify MacOps when leaving camp vacant

Aircraft Daytrips

- No communications with MacOps required - the (flight is tracked by MacCenter and Aviation Ops)
- Establish communications with helicopter pilot before the helo departs
- MacOps is available for comms checks, message relays, or to record a location

EMERGENCIES

- Notify MacOps directly
- Medical - call MacOps transfer line and indicate if URGENT or not

If you are late

After one hour the Emergency Operations Center (EOC) is activated. This includes the NSF station manager, ASC station manager, emergency communications manager, field science manager, information technology manager, and the fire chief.

McMurdo Vicinity Communication Systems

Telephone Dial 2586 for MacOps (rolls over to four available lines)

HF Radio Speak clearly, loudly, and slowly. Point the antenna at Black Island for comms check with MacOps *before* departing McMurdo.

4.770 MHz	MacOps
7.995 MHz	MacOps
11.553 MHz	MacOps
9.032 MHz	Air Traffic Control - only field party emergencies

Iridium Satellite Phone Multiple units? The lowest phone number is assigned as ALPHA (primary) phone followed BRAVO, CHARLIE, etc.

MR 1	MacOps Iridium 00-8816-763-12464	Calls cannot be transferred from MacOps
MR 2	MacOps Transfer 00-697-720-568-1042	Calls can be transferred to McMurdo business lines
MR 3	MacWeather 00-8816-763-20030	McMurdo Weather Department
MR 4	Helo Ops 00-8816-763-29073	Helo Hangar
MR 5	Medical 00-8816-763-15142	***Do not use unless directed*** Call MacOps for emergencies
MR 6	Search & Rescue 00-8816-763-15141	***Do not use unless directed*** Call MacOps for emergencies

Iridium Text Messages

Receiving Messages – Power up phone, place a call to ensure message download, and call MacOps to confirm you received message.

Sending Messages – Messages can be sent from computer to Iridium but cannot be sent directly from Iridium handset.

Option 1: Send message using website:
http://inah.pac.disa.mil/sms.shtml

Option 2: Send message via email using format:
8816xxxxxxxx@inah.pac.disa.mil

- Must be PLAIN text
- Limit 120 characters
- Indicate who message is from in the text body
- Do not include subject, signature, or other 'extras'

Additional phone numbers and dialing sequences available from MacOps

Radios

VHF Radio

VHF Radio is the primary form of wireless communication in and around McMurdo Station. This is a shared resource monitored by multiple users. Proper radio etiquette should be maintained when transmitting on this or any radio network. Always refer to the frequencies by the channel name and not the channel number. Radio communications should be brief and on-topic. This is especially true when using the VHF field-party repeaters, which operate on renewable energy sources and can be disabled in periods of poor weather and heavy communications traffic.

McMurdo deploys three different VHF systems:

1) **Simplex.** In this system, each unit communicates directly with other units. All units use the same frequency to transmit and receive, so communications are one-way and one-at-a-time.

   These functional areas use a simplex system: Science, Tower/airfield, Utility, Aerospace Ground Equipment/Air National Guard (AGE/ANG), Marine 16, and all air band channels.

2) **Simplex with Base Station.** Where buildings and hills block radio signals, a base station is used. An antenna is placed at the highest point, such as a hill, a tall building, or a radio tower. The radio at the tower, called a "base station," is connected to a remote dispatcher's console. All units, including the base station, transmit and receive on the same frequency. If two units can't communicate directly, the dispatcher relays messages.

   These functional areas use the McMurdo base station: I-Net, Fire, Fuels, and Helo Ops.

3) **Semi-Duplex.** For areas farther from McMurdo, such as for camps in the Dry Valleys, semi-duplex repeaters are used. A repeater is a radio receiver/transmitter combination. The repeater is installed on a hill, a tall building, or a radio tower, and it automatically retransmits the signal it receives on one frequency (F1) on another frequency (F2). The control point at the dispatcher's desk transmits and receives just like a mobile radio.

   These functional areas use the McMurdo semi-duplex system: MacOps, all field party repeaters, all flight-following repeaters, and the Movement Control Center (MCC).

VHF Radio Operations

- Listen before transmitting (to ensure channel is not in use).
- Hail MacOps and wait for reply before giving checkout information.
- Key-pause-talk to ensure entire transmission gets through.
- Keep batteries warm (and always carry a spare).
- Do not over-use repeaters (power conservation).

Call Signs

Whenever isolated letters or groups of letters have to be pronounced separately, e.g. to identify unusual words, call-signs, or in conditions of difficult communication, the following phonetic alphabet should be used:

A Alpha	**H Hotel**	**O Oscar**	**V Victor**
B Bravo	**I India**	**P Papa**	**W Whiskey**
C Charlie	**J Juliet**	**Q Quebec**	**X X-Ray**
D Delta	**K Kilo**	**R Romeo**	**Y Yankee**
E Echo	**L Lima**	**S Sierra**	**Z Zulu**
F Foxtrot	**M Mike**	**T Tango**	
G Golf	**N November**	**U Uniform**	

VHF Frequency Assignments at McMurdo Station

Frequency (MHz)	Name/Description
118.2	APPR (Approach) – Air Traffic Control - frequency for controlled airfields.
118.5	HELOFF (Helicopter Flight Following) – Air Traffic Control - used to coordinate helicopter movements.
121.5	GUARD/VHF (Guard) – aircraft emergency and distress.
123.45	ANG (Air National Guard) – common air-to-air frequency.
126.2	TOWER (Military Common – Air Traffic Control) - frequency for controlled airfields.
129.7	TIBA (Traffic Information Broadcast by Aircraft) – primary Antarctic operational frequency.
134.1	GRND (Ground – Air Traffic Control) - frequency for controlled airfields.

VHF Channel Use

	Name	General Use	
Simplex (Line of sight)	I-Net	Shuttle operations; antenna at T-site (not monitored by MacOps)	
	Science Net	Comms between field parties (not monitored by MacOps)	
	Helo Ops	Comms between helo hangar, helicopters, helo field parties (not monitored by MacOps)	
Duplex (Repeaters increase range)	**Name**	**Repeater Location**	**Areas of Coverage**
	MacOps	Crater Hill (above McM)	McMurdo area, sea ice areas south of Erebus tongue
	Mount Aurora	Black Island	McMurdo area, sea ice area south of Erebus tongue, ice shelf
	Wright Valley	Mount Newall	Wright Valley, New Harbor, sea ice areas
	Taylor Valley	Mount Coates	Taylor Valley (Lake Hoare, Lake Fryxell, Lake Bonney, F6)
	Mount Terror	Mount Terror	Cape Crozier, Windless Bight, areas south of Ross Isand
	Mount Brooke	Varies	Repeater location and use varies each season
	Mount Erebus	Mount Erebus	Line of sight to west side of Mount Erebus

Field Party Plan

1 I-Net
2 Fire
3 MacOps (rpt)
4 Science
5 MCC/Fleet Ops (rpt)
6 Helo FF (no rpt)
7 Helo Ops
8 Taylor Valley (rpt)
9 Mount Brooke (rpt)
10 Mount Terror (rpt)
11 Mount Aurora (rpt
12 Wright Valley (rpt)

*Channels monitored by MacOps are in **BOLD**.*
Channels 13-16 not available on all radios.

McMurdo Plan

1 I-Net
2 Fire
3 MacOps (rpt)
4 Science
5 MCC/Fleet Ops (rpt)
6 Airfield Tower
7 Helo Ops
8 Utility
9 Fuels
10 Mount Terror
11 Mount Aurora (rpt)
12 Wright Valley (rpt)
13 Taylor Valley (rpt)
14 Mount Brooke (rpt)
15 **Mount Erebus (rpt)**
16 Marine 16

Deep Field to McMurdo

HF Radio

All deep-field camps are issued an HF radio. Users should follow the setup instructions to verify that radio settings are correct. The antenna should be elevated at least four feet off the ground. Ensure all shorting bars are connected, except for the desired frequency. Speak LOUDLY into the microphone. The loss of saved frequency programming in the nine available channels indicates an internal battery failure and does not render the radio inoperable. Manually tune the radio to the desired frequency and operate normally.

Iridium Phone

Deep-field camps are also issued Iridium (satellite) phones. Iridium satellite coverage is not guaranteed in and around McMurdo Sound, and users should keep this in mind when attempting to access the satellite phone network. When possible, move to an area free from obstructions to obtain the best reception possible.

Note: The Iridium phones issued by the USAP are administered by the Department of Defense. Dialing sequences to and from other commercial Iridium phones may vary.

Note: In the USAP, the Iridium with the lowest phone number is designated as the Alpha line. The next ones are Bravo, Charlie, Delta, and so on.

Iridium Phone Instructions

Iridium Dialing

From Iridium to Iridium: Dial 00-8816-763-XXXXX

1. POWER UP the Iridium phone.
2. Wait for the telephone to register with the network and show a signal level in display.
3. Dial 00 to access the satellite network.
4. Dial 8, the country code for Iridium phones.
5. Dial the area code and eight-digit Iridium number.

Example: 00 8 (816) 763-12464 for MacOps

To a commercial (non-USAP) Iridium phone: Dial 00 698 (8816 or 8817) XXX-XXXXX.

From Iridium to a regular phone
(whether in U.S. or McMurdo via Denver)

1. POWER UP the Iridium phone.
2. Wait for the telephone to register and display a signal level.
3. Dial 00 for an international call.
4. Dial 697 to connect to FTS (Federal Telephone System).
5. Dial area code (DO NOT dial "1" before dialing the area code).
6. Dial seven-digit telephone number.
   Example: 00 697 (720) 568-1042 for the MacOps Transfer Line

From Iridium to any McMurdo or Scott Base extension
(via NZ Telecom)

1. POWER UP the Iridium phone.
2. Wait for telephone to register and display a signal level.
3. Dial 00.
4. Dial 698 (this code also works for all international calls).
5. Dial NZ country code 64.
6. Dial 2409.
7. Dial McMurdo four-digit phone extension.
   Example: 00 698 64 2409 2586 for MacOps

From Iridium to a U.S. Toll Free number
Dial 00 699 1 (800/888/877) XXX-XXXX.

From Iridium to an international number
Dial 00 698 + country code + city code + local number.

To a USAP Iridium from any phone

Any USAP Iridium phone may be dialed via a U.S. domestic phone by using a Hawaii area code. Replace the Xs below with the last four digits of the Iridium number.

If SIM card's last five digits start with a 1: Dial 808-659-XXXX

If SIM card's last five digits start with a 2: Dial 808-434-XXXX

If SIM card's last five digits start with a 3: Dial 808-684-XXXX

If SIM card's last five digits start with a 4: Dial 808-851-XXXX

If SIM card's last five digits start with a 5: Dial 808-852-XXXX

For example, if the Iridium number is 8816 763 2XXXX, dial 808-434-XXXX.

Iridium Text Messages

Friends and family can send short text messages to an Iridium phone. However, unless there is an email data kit installed, an Iridium phone cannot send outgoing texts. People sending a text message should enter the initials of the intended recipient at the start of the message and their own initials at the end. Otherwise, the camp members won't know to whom to pass the message.

Note: Generally, friends and family should only be provided the secondary Iridium number (Bravo Phone), keeping the primary Iridium (Alpha Phone) for business purposes, and they should be informed that the Iridium phones are a shared resource.

Iridium Email

It is possible to send an email to an Iridium phone. The Iridium email address is 8816763XXXXX@inah.pac.disa.mil, where the last five digits of the Iridium are inserted for the X's.

- Select the Plain Text option (it is easy to do this in Outlook, in the "format" tab).
- Leave the subject line blank.
- Type in the body of the email. There is a 120-character limit.
- Abbreviate where possible.
- The message should start with camp recipient's initials, so camp personnel know to whom to pass the message.
- Do not include a signature line or any other extras.

People can also send messages through the Iridium website, which is http://inah.pac.disa.mil/sms.shtml. Fill out the form on the homepage by entering the Iridium phone number (Ex.8816763XXXXX) and a message that is no more than 160 characters. To check for Iridium text messages in the field, power up the Iridium and place a call. This begins the message download. The Alpha line may be used.

Iridium Troubleshooting

Disconnect and reconnect all accessories (battery, antenna, adapters, etc.) to ensure there are solid contacts. If possible, move to an area clear of obstructions.

Frequently Used Iridium Numbers

DEPARTMENT	ROUTING	NUMBER
MacOps Iridium	Iridium	00 8816 763 12464
MacOps Transfer	via Denver	00 697 720 568 1042
MacWeather	Iridium	00 8816 763 20030
AVIATION		
Aviation Operations supervisor	via Denver NZ Telecom	**00 697 720 568 1043** 00 698 64 24 09 2529
Fixed-Wing Operations supervisor	NZ Telecom	00 698 64 24 09 2697
Helo Operations supervisor	Iridium via Denver NZ Telecom	**00 8816 763 29073** 00 697 720 568 1002 00 698 64 24 09 2277
SCIENCE SUPPORT		
Berg Field Center (BFC)	via Denver NZ Telecom	**00 697 720 568 1021** 00 698 64 24 09 2348
BFC food room	NZ Telecom	00 698 64 24 09 2461
Crary Lab supervisor	via Denver NZ Telecom	**00 697 720 568 1045** 00 698 64 24 09 4169
Field Safety Training	NZ Telecom	00 698 64 24 09 2345
Field Support supervisor	NZ Telecom	00 698 64 24 09 2067
Field Support manager	via Denver NZ Telecom	**00 697 720 568 1003** 00 698 64 24 09 2545
Science & Tech Projects manager	NZ Telecom	00 698 64 24 09 3189
Mechanical Equipment Center (MEC)	NZ Telecom	00 698 64 24 09 2352
Science Construction	via Denver NZ Telecom	**00 697 720 568 1016** 00 698 64 24 09 2221
INFO TECHNOLOGY		
Comms Techs	via Denver NZ Telecom	**00 697 720 568 1061** 00 698 64 24 09 2796
Crary IT Support	NZ Telecom	00 698 64 24 09 4242
CHALET		
Chalet Administrator – Grantee Travel	NZ Telecom	00 698 64 24 09 2734
MEDICAL		
Clinic front desk	via Denver NZ Telecom Iridium	**00 697 720 568 1048** 00 698 64 24 09 2551 00 8816 763 15142
Bold indicates a preferred number.		

Field Gear

Shelters

Field teams should become experienced in erecting the tents they are issued before they deploy to the field. The tents should be set up in McMurdo and their condition double-checked.

Tents should have a solid anchor for every guy line, and these should be checked daily to ensure they are tensioned. Loose guy lines make the tent more prone to wind damage, and they make catastrophic failures in a storm more likely. “Hard” knots should be avoided. Instead, use taut-line hitches or trucker’s hitches for guy lines, as they are easy to undo. Field team members should practice and become familiar with these knots before deploying.

Erecting Tents at Deep-Field Snow Camps

Establishing Wind Direction

The most important factor in the set-up process is securely anchoring the tent so it can withstand high winds. Field teams should first determine the prevailing wind direction, which can be done by observing patterns in the snow. Long rows of drifts (sastrugi) in, for example, a north-south orientation will indicate that the prevailing wind is either from the north or south. Look for etching at the ends. If the prevailing wind is from the south, the snow at the southern end of the sastrugi will be etched. Orient the tent with the main door opening downwind but at a 45-degree angle to the prevailing wind. This will help prevent drifting that blocks the door.

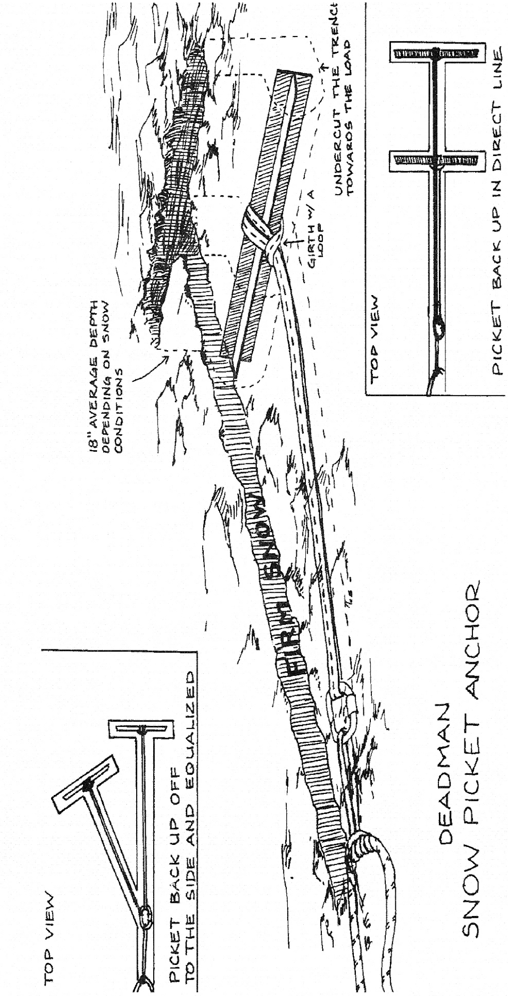
Anchoring the Tent

The best method for anchoring a tent is determined by snow conditions. If the snow surface is hard-packed, hammer in long stakes or sections of bamboo, angled slightly away from the tent, and attach guy lines to these. If the snow is soft, bury a long stake or piece of bamboo (“dead man”) in a slot perpendicular to the angle of pull, with a guy line attached at the mid-point. The guy line runs in a straight line from the dead man to the tent, via a slot cut in the snow. The dead man should not be buried too close to the tent or it will be pulled upward when the line is tensioned. In very soft snow, the dead-man anchor should be buried two feet deep or more.

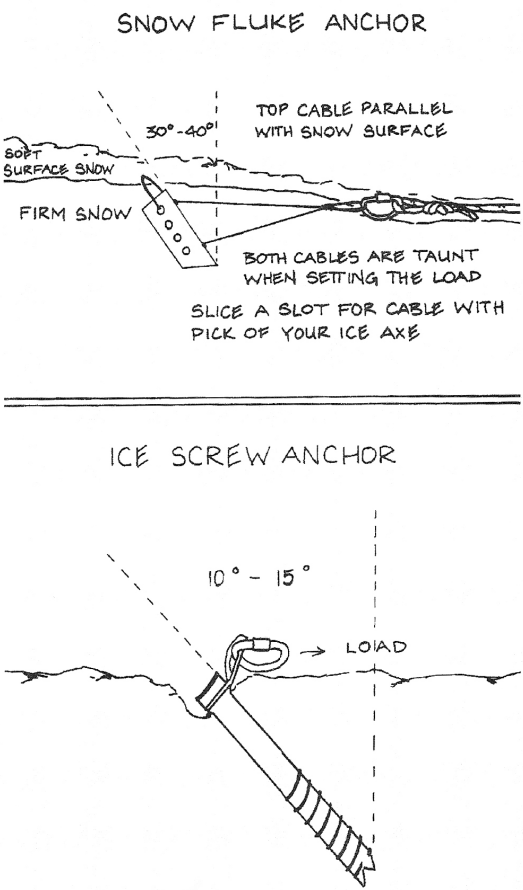
Snow Walls

Snow walls, which are constructed with blocks cut from the snow, shelter tents from wind. If it is a windy day or if the camp is at a windy

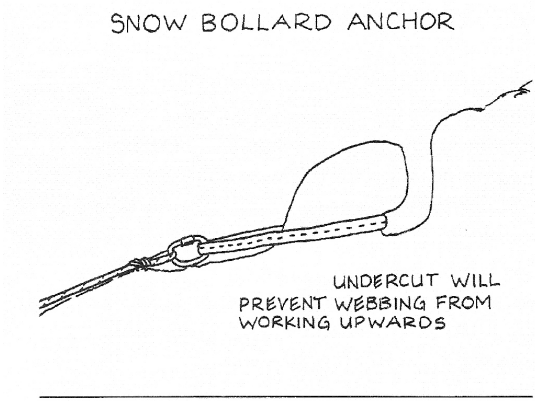
Deadman snow picket anchor

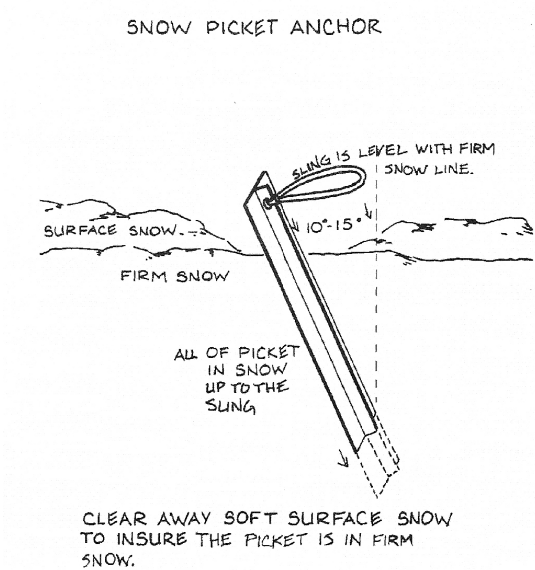


Snow fluke and ice screw anchors



Snow bollard and snow picket anchors





location, field teams may need to construct walls before attempting to set up a tent. Ideally, blocks are cut with a saw in hard-packed snow, but a shovel or ice ax may work. Since snow conditions can change over a small area, probe the snow to see if there is an area harder than others. If only soft snow conditions exist, the snow can be packed down with boots to see if it hardens (sinters) after an hour or more.

Erecting Tents on Sea Ice and Blue Ice Glaciers

If the snow on the ice is deep enough, anchor the tent as described above. Otherwise, clear off any snow and anchor the tent to the ice with ice screws. Team members may also drill V-threads (two holes that intersect to form a V-shaped channel), then use an ice screw or ice drill to feed a guy line through the channel, and attach the line to the tent.

Erecting Tents in the McMurdo Dry Valleys

It is important that field teams adhere to environmental regulations for site selection and camp set-up in the Dry Valleys. Team members should consult with the environmental department before departing for the field. Most commonly visited Dry Valley areas have pre-determined camping locations.

Large boulders can provide a wind break, and large rocks or stacks of rocks can be tied off as anchors. If the field team is using metal stakes for anchors, it may take several minutes to sledge hammer each one into the frozen soil. If the team intends to move camp, members should take extra anchors, as it may be difficult to remove some from the frozen soil.

Emergency Shelters

If a tent is lost, the first and most important order of business is to arrange for protection from the wind, as this will increase the odds of survival.

The quickest emergency shelter to construct in snow is a trench. Dig a three-foot-deep, shoulder-width trench in the snow, making it long enough for a person to lie down, with extra room for gear. Cover the trench with a tarp, and anchor the tarp with snow blocks, bamboo stakes, shovels, sleds, or other equipment. Snow blocks or slabs may also be used to cover the trench opening. A trench can accommodate two people if the bottom is excavated to form a bell shape. However, the surface opening should remain shoulder wide.

Other emergency snow shelters are snow mounds (Qunizhee huts), snow caves, and igloos. Keep in mind that ventilation is critical if a stove is to be operated in any snow shelter.

On sea ice or on a blue-ice glacier, a wind break can be created by re-positioning snowmobiles and sleds.

Stoves and Heaters

The Berg Field Center (BFC) issues propane and white-gas cooking stoves to field parties. The construction department maintains the heaters in semi-permanent field camps and sea-ice huts. This guide provides information on stove and heater safety, basic operation, and troubleshooting. Contact construction or BFC personnel for assistance or further guidance.

Stove Safety

Liquid-fuel stoves are potentially hazardous due to the flammability of the fuels and the toxicity of the carbon monoxide they produce. Therefore, it is important for field personnel using a stove to follow these safety measures:

- Test all stoves before field deployment.
- Do not use stoves without adequate ventilation.
- Do not release fuel-tank pressure near an open flame.
- Use extreme caution when refueling. Skin contact with super-cooled fuel can cause instant frostbite.
- Check for leaks before every use.
- Release pressure in the fuel tank before packing and storing.
- Pack stoves and fuel away from food.
- Do not cook in mountain tents, except in emergencies.
- Preheat the stove outside the tent.
- Insulate the base of the stove so it won't melt through the tent floor.

Residues of evaporated gasoline are combustible. Designate a pair of gloves for fueling operations and don't use them near stoves. Should a person's clothing become ignited, stop, drop, and roll to extinguish flames.

Carbon Monoxide Risks

Carbon monoxide (CO) is a colorless, odorless, tasteless, and toxic gas produced by the incomplete combustion of carbon compounds,

including the fossil fuels used in heaters and stoves. Dangerous amounts of CO can accumulate when fuel does not burn properly and/or when an area is poorly ventilated. Both of these situations can occur when someone is cooking in or heating a tent.

CO displaces oxygen in the bloodstream, starving the heart, brain, and other vital organs. People are even more susceptible to CO poisoning at altitude.

Carbon Monoxide is Dangerous

There have been several cases of CO poisoning in Antarctic field camps from improper stove use. This is completely avoidable. The best way to prevent CO poisoning is by ensuring any structure in which cooking is taking place is well ventilated. Because CO has no color, taste, or smell, it is better to be safe than sorry. In short:

- ALWAYS ventilate the tent.
- NEVER cook in or heat a tent without leaving a door or window cracked.
- Be especially vigilant if sleeping in a heated structure.
- VENTILATE, VENTILATE, VENTILATE!

Also, field teams must use a CO detector (issued from the BFC) when cooking, but the detector should not be attached directly to the stove. The detectors are not fool-proof, so all team members should remain vigilant of CO risks and symptoms. For information on the signs, symptoms, and treatment of CO poisoning, consult the First Aid section of this manual, or contact the medical department.

MSR® WhisperLite™ Stove

Assembling the Stove

- Fill the MSR® fuel bottle to within two inches of cap.
- Screw the pump snugly into the fuel bottle.
- Pump the plunger 15 to 20 times for a full bottle. Additional strokes will be necessary if the bottle is not full.
- Insert the fuel line through the hole in the heat reflector.
- Rotate the stove legs into the slots in the flame reflector.
- Insert the end of the fuel line into the fuel-tube bushing on the pump. Lubricate the end of the fuel line with lip balm, and be extremely gentle when inserting.
- Snap the catch arm securely into the slot on the pump body.

Operating the Stove

Priming:

- To preheat the stove, the priming flame must contact the generator tube.
- Open the control valve until fuel flows through the jet and fills the priming cup ½ full.
- Close the control valve.
- Light the priming cup or wick.
- Place a windscreen around the stove.

Lighting:

- As the priming flame diminishes, slowly open the control valve.
- If the stove goes out, wait for the stove to cool and re-prime it.
- If the stove burns with a yellow, erratic flame but the priming cup is still burning, turn the control valve off and prime longer.

Cooking:

- The stove should burn with a steady blue flame.
- To simmer, operate the stove with low pressure in the fuel bottle.
- Note that there is a delay between control valve turns and changes in flame intensity.

Shutting Off the Stove:

- Turn the control valve off.
- Wait for the stove to cool before disassembling.
- To depressurize the fuel bottle, move away from heat, sparks, or flame. Turn the stove assembly upside down and open the control valve. Pressure will be eliminated through the jet.

Safety Tips

- Do not use these stoves in mountain tents.
- Ensure the stove assembly has no fuel leaks.
- Securely lock the catch and ensure the stove is properly assembled.
- Clear the area of flammables and spilled fuel.
- Do not open the control valve more than three full turns.

MSR® WhisperLite™ Stove Troubleshooting		
Problem	**Possible Cause**	**Remedy**
Fuel leaks at control valve	Control valve O-ring torn or damaged	Replace O-ring*.
	Control valve threads are damaged or stripped from over-tightening	Replace with new pump.
Fuel leaks at pump/fuel bottle connection	Incorrect fuel bottle in use	Use only MSR® fuel bottle.
	Bottle threads are damaged or bottle is dented	Replace bottle.
	Fuel bottle O-ring is torn or damaged	Replace O-ring*.
Fuel leaks at fuel line/pump connection	Fuel tube O-ring is torn or damaged	Replace O-ring*.
	Fuel tube bushing is damaged or missing	Replace bushing*.
Fuel leaks at fuel line	Fuel line is damaged	Replace fuel line or entire stove.
Fuel leaks at shaker jet	Shaker jet is loose	Tighten with jet and cable tool*.
	Shaker jet is damaged	Replace shaker jet*.
Fuel leaks through the shaker jet when control valve is off	The pump is damaged from over tightening the control valve	Replace pump.
Erratic yellow flame	Insufficient priming	Shut off the stove, let it cool down, and re-prime it.
	Fuel bottle is over-pressurized	Reduce bottle pressure.
	Improper fuel used	Replace fuel.
	Old or poor quality fuel	Replace fuel.
	Improper jet installed	Replace jet.
	Incorrect flame ring installation under burner cap	Re-install flame rings. Correct order is wavy, flat, wavy, flat, wavy, flat, wavy.
	Weather conditions are cooling the generator tube	Use windscreen and heat reflector.
	Lack of oxygen at high altitudes	Reduce fuel bottle pressure and open windscreen.
Burner cap turns bright red and a dull roar is audible	The flame is burning under the burner cap instead of through the flame rings	Clean the jet, ensure the correct jet is installed, and ensure flame rings are clean and installed correctly.

Reduced performance; diminishing flame, slow boil	Insufficient pressure in fuel bottle	Pump plunger as required to increase pressure.
	Obstructions in jet and/or fuel line	Remove obstructions.
	Incorrect jet installed for fuel type	Install correct jet.
Pump not pressurizing	Dry leather pump cup	Lubricate or replace pump cup.
	Dirt in check-valve assembly	Clean check-valve assembly.
* Stove and pump replacement parts available in the repair kit.		

Coleman® Gas Stove

Operating the Stove

Filling the Tank:

- Close the valve and unscrew the tank cap. Do this carefully if the tank has pressure inside.
- Use a fuel funnel (with filter) to fill the tank. Use white gas only.
- Wipe off any spilled fuel and replace the cap.

Caution: Never open the tank around an open flame! Never remove the cap while the stove is running!

Pressurizing the Tank:

- Close the cap and ensure the generator valve is closed.
- Turn the pump plunger handle to the left to open.
- Place a thumb over the small hole in the handle and pump 35 to 50 times.
- Turn the plunger handle to the right to tighten.
- Put the stove handle into the opening on the side, insert the generator into the mixing chamber, and place the tank in hanger brackets.

Lighting the Stove:

- Close the auxiliary burner valve.
- Turn the fuel-valve lever to the up position.
- Hold a match above the main burner and open the fuel-flow valve wide.
- Let the stove burn for one minute with fuel-valve lever up.
- When the flame is blue, turn the valve lever down.

Note: Add more pressure if needed, but hold the tank firmly. If the flame does not burn fully, open and close the valve to clean the tip. After the main burner is lit, the auxiliary burner can be lit by opening

the valve on the left side of the stove. If there are problems, refer to the "Troubleshooting Guide" included with the stove.

Shutting Off the Stove:

- Put the fuel-valve lever in the up position and let the stove burn for one minute to reduce carbon deposits.
- Turn off the valve. The flame will burn for a few minutes until the gas in the generator is gone. When the flame is out, let the stove cool before packing it away.

Coleman® Gas Stove Tips

Most problems associated with Coleman® stoves occur in extremely cold temperatures. This stove was not designed for use in sub-zero temperatures, and measures must be taken to enhance its performance:

- Use white gas only. Always use clean, filtered gas.
- Do not overfill the tank, as this impedes performance.
- The pump mechanism becomes impaired as temperatures drop. Keep the pump plunger oiled. Also, the rubber or leather pump cup sometimes dries out. It is essential to keep it oiled and pliable.
- In temperatures below -6°C, the stove generator must be preheated to ensure the fuel vaporizes. Apply priming paste along the generator and above the burner. Light it with a match. Allow at least three minutes of burning to ensure the stove is sufficiently preheated. When the flame burns down, make sure the lever is up and open the valve. The burner should light from the paste.
- Keep the stove and tank clean. Grease deposits can flame up. Line the inside of the stove with foil for easy cleaning.

Note: Place the stove where it can be thrown out of the tent in an emergency. Keep a small fire extinguisher nearby.

Coleman® Gas Stove Troubleshooting

If fuel vaporization does not occur, liquid gas collects in the manifold assembly and a strong, blue flame cannot be achieved. The stove will sputter and spark, and the flame will be orange and sooty. If this occurs, shut the stove down and allow it to cool off completely. Remove the tank assembly and clean fuel from the manifold and burners with absorbent pads provided in the spill kit (the small, black nylon bag). Replace the tank assembly and repeat the lighting process.

To access the control valve assembly (behind the knobs and under the burners) for troubleshooting:

- Unscrew the burners
- Turn the stove over and unscrew the nuts on the bottom. It should be possible to push the burner assembly up and release the retaining ring that holds the burner to the metal tray. Alternatively, spread the retaining rings to release the burner assembly.
- Remove the metal tray for access to the burner and control valve assemblies.

Coleman® Gas Stove Troubleshooting		
Problem	**Possible Cause**	**Remedy**
No pressure	Cracks, dryness, creases, or tears in pump	Remove and inspect pump; replace if necessary and oil.
	Leaking tank lid gasket	Check gasket; replace if necessary.
	A flooded pump cylinder indicates a faulty pump valve	Replace pump valve.
	Broken seal at valve assembly and tank junction	Tighten by one rotation, if possible; replace seal if necessary.
	Loose generator	Tighten.
Loses pressure too fast	The tank will lose pressure the longer it sits without periodic pumping	If pressure is lost soon after pumping, check all joints and gaskets.
	Leaky cap and gasket	Replace if necessary.
Yellow flame	Bad or dirty generator	Clean or replace.
	Manifold assembly is flooded	Turn stove off, cool, remove tank assembly, and wipe out excess fuel.
	Bad fuel	Drain and replace with new fuel.
Orange flame (on older stove with flame rings)	Corrosion on flame rings	Remove flame rings as on a white gas stove. Lightly use steel wool or a nylon brush to remove corrosion from each ring and improve flame quality.
Flame at generator/manifold assembly	Tip of generator is loose	Tighten.
Poor gas flow to burner	Clogged generator	Clean or replace generator.
	Cleaning needle is nonfunctional or bent	Check the needle and replace if necessary.

Weak flame	Generator too cold	Preheat generator.
	Bad or dirty generator	Clean or replace generator.
	Pressure too low	Increase pressure.
	Manifold assembly is flooded	Turn stove off, cool, remove tank assembly, and wipe out excess fuel.
	Contaminated fuel	Replace fuel.
	Control valve nut too loose	Remove the metal tray (see above). There is a small nut where the copper tube meets the control valve assembly. Try tightening (or first loosening then re-tightening) this nut. This often works on new stoves that burn poorly.
Flaring	Loose gas tip	Tighten gas tip (at end of generator).
	Flooded burner	Shut down stove and dry it out
	Excessive pressure in tank	Reduce pressure.
	Insufficient priming	Shut down stove and re-prime.
	Premature switch to “on” position of fuel flow switch	Refrain from opening fuel flow switch too early.
	Contaminated fuel	Replace fuel.
	Grease in stove	Clean grease out of stove. Line the bottom of the stove with foil and change when dirty.

Coleman® Propane Stove

Note: Propane cylinders should only be stored outside of a tent. Use a long propane hose though an opening in the tent door or window to connect the cylinder to the stove.

Setting up the Stove

- Press on latch to open the lid.
- Position the wind baffles.
- Insert wire clips into slots.
- Close both burner valves firmly.
- Remove the regulator from storage under the grate.
- Attach the regulator, hand tight, to hose or propane bottle.
- Inspect the gasket on the stove connection before attaching the regulator.
- Screw the regulator hand-tight onto the stove.

Operating the Stove

Lighting Electronic Ignition Stoves

- Open the burner valve and rotate the igniter knob several times until the burner lights.
- Use a match to light the burner if the igniter fails.

Lighting Standard Ignition Stoves

- Hold a lighted match near the burner and open the valve.
- Adjust the flame with burner valves.

Shutting the Stove Off

- Close the burner valves firmly.

Storing the Stove

- Remove the propane cylinder or hose.
- Unscrew the regulator from the stove and store it under the cooking grate.

Preway® Diesel (AN-8) Heater

These heaters are installed in the McMurdo Dry Valleys.

Lighting the Heater

- Make sure the Preway® is level. This is very important! If it is not level, it will not burn correctly.
- Make sure the outside fuel valve at the tank is open and the breather tube is open to prevent “air lock.” If there is no breather tube, loosen the upper bung cap.
- Open the valve behind the Preway®.
- Take a small piece of toilet paper, wrap it around the end of a wire, and place a small amount of burn paste on it.
- Push the safety lever down on the carburetor.
- Open the valve knob on the carburetor to “3” (the halfway position).
- Allow a small amount of fuel (about two tablespoons) to puddle in the bottom of the burn chamber.
- Shut off the valve knob on the carburetor.
- Light the fuel in the burn chamber with the tissue on a wire, removing it once the fuel is lit.
- Allow the fuel to burn until the flame is nearly out. This preheats the chamber.
- Open the valve knob on the carburetor to “3” again and push down the safety lever.

- Adjust heat as desired. Typically these heaters burn poorly and will soot excessively on either “1” (too low) or “6” (too high), reducing performance and requiring frequent cleaning. Stick with settings “2” through “5.” For reference, a properly burning heater doesn’t require cleaning more than once every couple of months.

Shutting Off the Heater

Close all valves and lift the safety lever on the carburetor.

Things Not To Do with a Preway®:

- Do not leave burned tissue in the chamber, and do not throw any other combustibles in the burn chamber. Yes, they will burn (partially), but the heater will soon stop working and be full of partially burnt ashes. The Preway® is not an incinerator.
- At start-up, do not turn the stove up to a high number immediately. Let the heater warm up first on “3” or it will make frightening “woofing” sounds.
- Don’t leave the burn chamber door open longer than necessary when the heater is burning. It interferes with proper drafting by letting too much air in.
- NEVER wire down the safety lever on the carburetor. If it needs to be “held down” for operation, there is an internal problem that needs to be addressed. Wiring down the lever poses two risks: 1) flooding the heater with too much fuel (creating a mess), or 2) flooding the structure with the full contents of the fuel barrel (even bigger mess).

Empire® Vented Propane Heater

These heaters are installed in sea ice huts.

Starting the Heater

- Turn on propane at the tank by turning the knob all the way to the left.
- Open the combustion air vents on the wall.
- Open the valve behind the stove (the handle in line with the tube to the stove).
- Set the heat dial (numbered 1-7) to “1.”
- Remove the front panel of the stove by lifting the bottom out and then up.
- Remove the pilot-light sight glass.

- Push and hold down the control knob; turn from “off” past “ign” to “pilot.”
- Light the pilot with a match; don’t bother with the piezo igniter.
- Hold the control knob down in “pilot” position for one minute after lighting.
- Let the control knob pop up and move it to the “on” position.
- Replace the sight glass and front panel of stove.
- Adjust heat dial as desired.

Shutting Off the Heater

- Set heat dial to “1” and control knob to “pilot.”
- Close combustion air vents.

Note: The pilot light should be left on at all times unless the tank is being changed or the hut is being moved. Be sure and turn off the propane at the tank if moving the hut.

Sleds

The Berg Field Center (BFC) issues several types of sleds that can be towed behind a snowmobile or pulled with a rope by someone skiing or walking. Each field team should consult with BFC staff to determine which sled type matches the team’s requirements.

Loading and Securing Cargo

Following are illustrations showing how to distribute the cargo load on a Nansen sled. The same principles apply to the other sleds.

Load the sled with heaviest items on the bottom. Place small items in sled bags. The survival bag should be placed at the top of the load, along with anything the team members might need during the day. Rock boxes (18” L x 12” H x 12” D wooden boxes) make convenient containers for fieldwork and can be loaded with both samples and gear. Rock-box platforms are available if the team anticipates hauling a large number of boxes.

It is best to transport fuel drums on drum cradles for stability.

- Nansen sleds can haul two drums side to side.
- Siglin® ultra high molecular weight (UHMW) sleds can also accommodate two drums side to side.
- Komatik sleds can carry up to five drums side by side.

Secure the finished load tightly with cord, cargo straps, or bungee

cords. Banana sleds have fabric cargo covers attached along the sides. The fabric folds over the cargo and is tied down. Siglin UHMW sleds have side ropes for lashing down gear.

Avoid using hard knots when rigging loads for travel. Use taut-line hitches or trucker's hitches instead, as they are easy to undo if it becomes necessary to re-tension a cord. Be sure to check all lashings periodically and every time the team stops for any reason. At the same time, inspect the snowmobile, tow plate, ropes, and sled for any developing structural issues. Re-tighten the lashings if they have become loose. It is prudent to bring extra lashing supplies into the field.

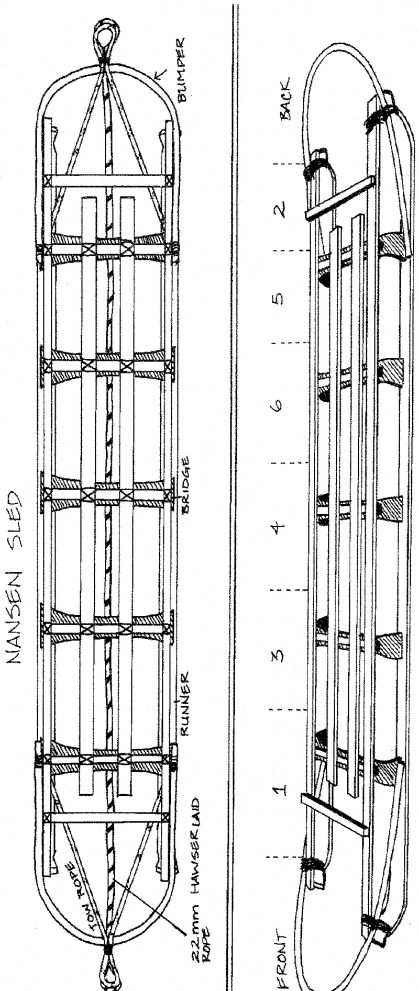
Pulling Sleds with a Snowmobile

With ideal surface conditions, a tail wind, and light loads, a snowmobile may achieve seven miles per gallon (mpg). Soft snow conditions, heavy loads, and strong head winds significantly reduce fuel efficiency. Mileage can drop to as low as two to three mpg. In good conditions, a snowmobile may be able to pull up to 2,000 pounds. Soft snow and a head wind will reduce that substantially. It is important for field teams to keep these things in mind when planning loads and fuel consumption.

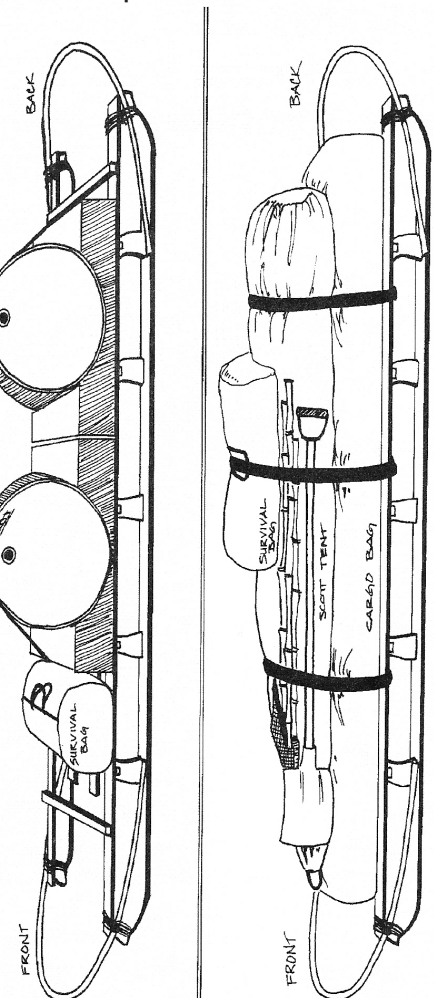
Snowmobile operators pulling a sled should adhere to the following rules:

- Attach sleds equipped with rigid tongues directly to snowmobiles. Other sleds attach with a tow rope.
- Before driving, rock sleds back and forth to break the runners and bottom free of the ice.
- Drive slowly. Driving fast over uneven terrain may cause a sled to tip over, which can damage not only the sled and cargo, but the snowmobile as well.
- Drive even more slowly if pulling passengers. Everyone must wear a snowmobile helmet, including those riding on the sled.
- Maintain situational awareness and regularly look back to ensure everything is riding securely, especially passengers.
- Stop gradually so the sled doesn't run into the back of the snowmobile.

Nansen sled weight distribution example



Nansen sled load example



Snowmobiles, Generators, and Renewable Energy Power Systems

The Mechanical Equipment Center (MEC) provides training in the operation and maintenance of equipment to science team members before they deploy to the field. General operation and troubleshooting guidance is provided here as a reference. Contact the MEC for assistance or further guidance, if required.

Snowmobile Operation

Operational Guidelines

- All riders and passengers must wear a helmet! This includes people pulled on a sled behind a snowmobile.
- Each operator is responsible for checking a machine before each use.
- Ensure the correct fuel is used. Snowmobiles have two-stroke engines that require gasoline (mogas) pre-mixed with lubricating oil. The mixture ratio is 50:1 (12 ounces of oil per five gallons of mogas).
- To avoid over-working the electric starter, the pull starter should be used when the engine is cold.
- A snowmobile's center of gravity is just in front and toward the bottom of the fuel tank. Operators must shift body weight for turning and as needed for the load, the terrain, and the snow and ice conditions.
- Be mindful of track tension. In general, if the track is slapping against the frame tunnel while the snowmobile is in motion, it is too loose. Adjustments to both tension and alignment are made via long bolts at the end of the suspension.
- Watch for loose trailing straps and ropes, as these can get tangled in the tracks and around axles.
- Never shift the transmission unless the snowmobile is stopped. Shift gently. If gears will not engage, turn off the engine, shift gears, and restart. Abusive shifting can cause drive-train problems that are not repairable in the field.
- Park snowmobiles so they face into the prevailing wind, and always cover them. This reduces the likelihood of snow fouling the points and accumulating under the cowling.

Preventative Maintenance

Daily

- Check operation of the snowmobile.
- Check the suspension, particularly when operating on ice. Look for broken suspension components.

Weekly

- Check for loose mounting bolts on bogie wheels, skis (particularly the two bolts through the springs), rear suspension, and steering. A small suspension problem can rapidly become serious (e.g., slashed tracks, broken bogie mounts).

Loading, Towing, and Driving

Loading

- Maintain a low center of gravity.
- Place survival packs on the front to help maintain ski contact on hills.
- Keep straps tied down; ensure there are no loose ends.
- Place frequently used items where they are easy to access.

Towing a Sled

- Sleds may be towed with rigid tongues or ropes, depending on the circumstances. Rigid tongues are preferable.
- Check the hitch mechanisms on both snowmobile and sled for proper operation.
- Cover the load to protect it from track spray, if necessary.
- Check load tie-downs for tightness and security shortly into each trip.
- Check both the sled and the load frequently for problems.

Driving

- Whenever possible, drive on a proven trail or a hard surface.
- If driving in powdery snow and the snowmobile begins to bog down, head in the straightest line possible for firmer or packed snow; sharp turns will compound the problem; maintain the throttle.
- If the machine slows and reaching firmer snow appears impossible: STOP! DO NOT CONTINUE SPINNING THE TRACK!
  - Tip the snowmobile on its side (in both directions, if necessary), clear snow from the track, and pack the snow under the track.

– Dig a ramp out of the hole and attempt to ease the machine out of the hole, with other people pushing. Or use a tow rope and have another snowmobile pull the stuck one out.

Caution: If a stuck machine does not come out quickly when towing it, stop towing and dig more. Continual towing wears drive belts prematurely and can cause them to break. It can also damage engine parts.

Driver Communication

Hand signs for group travel on snowmobiles

Hand Sign	Meaning
No sign	"Not ready to depart"
Hand on head	"OK, ready to depart"
Arm waving above head	"Problem - Assistance required"
Left arm in air, elbow at right angle with fist	"Stop" or "Stopping"
Arm outstretched, palm down, patting down	"Slow down" or "Slowing down"
Arm outstretched, palm up, pushing up	"Speed up" or "Speeding up"

Troubleshooting

Fuel Flow Problems

Symptoms: The engine cranks but it won't run; no fuel is present in the line from the pump to the carburetor; the engine may run briefly after priming.

Diagnosis and Cure:

1. Check the fuel level in the tank.
2. Pry the fuel line off the carburetor, pressurize the fuel tank (i.e., seal and blow into the vent line) to see if fuel flows out the end of fuel line. Crank the engine to see if fuel pulses out the end of fuel line.
3. If fuel flows adequately and pumps adequately, the problem may have been small ice crystals in the fuel pump valves. Pressurizing the tank dislodged them, solving the problem. Replace the line and continue operation.
4. If fuel flows when the tank is pressurized but does not pump, the problem is in the fuel pump. First, disconnect the vacuum pulsation line from the center of the fuel pump to the engine crankcase. Blow through the line. If it is blocked, clean ice out of the line with wire. Check the nipples on the pump and crankcase for obstructions. If

the vacuum line is operational but fuel still does not pump, replace the pump or remove it and thaw it.

5. If fuel will neither flow nor pump, then either the line or the fuel filter is clogged. Clean the line or replace the filter.
6. If the tank is under vacuum pressure when the cap is open, check the vent line for obstructions or pinches. Occasionally the vent hose will rub on the exhaust and melt. Make sure the tank is venting properly.
7. If all of the above is tried and still no fuel flows, check the line for cracks or holes. Look for any obvious fuel deposits (i.e., discolored snow) in the engine compartment. Repair or replace the line.

Starter/Cranking Problems

Symptoms: Engine cranks slowly or not at all when key is turned.

Diagnosis and Cure:

1. Usually this problem indicates a dead battery. If that is the case, the engine must be pull-started. Once the engine is running, the battery should begin to recharge, unless it is shorted or the rectifier is faulty. The battery can also be charged with an AC charger, if one is available.
2. If the battery is fine, check the in-line fuse (30 amp) in the red wire near the starter or see if the red-green wire has slipped off the terminal on the starter solenoid. Finally, the starter itself may be faulty.

Spark Problems

Symptoms: The engine cranks but it won't start. Fuel is present in the line between the fuel tank and carburetor.

Diagnosis and Cure:

1. Remove both spark plugs. Push the spare plugs into the wire caps, ground the metal plug bodies to the metal engine housing, and crank the engine. If a spark can be seen at the electrodes of the spare plugs, the problem may be that the installed plugs were fouled with excessive fuel, ice, or a piece of carbon. Install the new plugs or clean and re-install the old ones. **Note:** When the engine is cold, it may be hard to see the spark in direct sunlight.
2. If a spark is not present, the problem is in the electrical system. First, check the kill switches and all electrical connectors. If they are in the correct position and operational, the solution to the problem depends on the engine type.
   a. 503/550: These models have an electronic ignition, so

the problem is probably the igniter box. Replace the igniter box.

b. Other engines: The problem may be a bad coil or a shorted wire.

Power Problems

Symptoms: The snowmobile runs but it lacks power.

Diagnosis and Cure:

1. If engine seems to be running fine, but the snowmobile has trouble with uphill starts, the problem may be with the clutch-driven pulley. Remove the cowling and see where the belt is riding on the pulley. It should be along the outer edge of the driven pulley when the snowmobile is at rest. If the belt is instead slotted down between the driven-pulley halves, check for ice in the drive and driven pulley. Shift the transmission into neutral and rev the engine slowly until the belt works its way to the outer edge.
2. If the engine has very low power or dies when revved, remove the carburetor and check for ice. If ice is present, thaw out the carburetor and reinstall it. If the engine is weak and runs rough, but the carburetor is ice free, the problem may be a bad spark in one cylinder. Follow the procedures outlined in Spark Problems.
3. The problem may be altitude. If hill-climbing performance is weak and the problem isn't the belt or an iced-up carburetor, check the spark plug color. Chocolate brown is correct; gray or white too lean; and black signifies a mixture that is too rich. For altitudes up to 4,000 feet, decrease jet size by one increment from the standard setting (i.e., 290 to 280). From 4,000 feet to 8,000 feet, decrease it by two increments. From 8,000 feet to 11,000 feet, decrease it by four. Remember to enrich the mix when returning to lower altitudes.

Honda Generator Operation

Generator Safety

- Place the generator on a firm, level surface. If the generator is tilted or turned over, fuel may spill or the generator may become contaminated with soil or water.
- To prevent a fire hazard and provide adequate ventilation, keep the generator at least three feet away from tents or other equipment during operation. Do not place flammable objects close to the generator.

- Know how to stop the generator quickly. Know how to operate all the controls.
- Do not let the generator get wet, and do not operate it with wet hands. The generator is a potential source of electrical shock if misused.
- Gasoline is extremely flammable and is explosive under certain conditions. Do not smoke or allow flames or sparks where gasoline is stored or where the generator is refueled. Refuel it in a well-ventilated area, with the engine stopped.
- The engine muffler becomes very hot during operation and remains hot for a while after stopping the engine. Be careful not to touch the muffler or engine until the generator has cooled down. Let the engine cool before storing the generator indoors.

Pre-Operation Check

1. Check and add fuel (mogas), if necessary.
2. Check and add engine oil (0W30), if necessary. Check the oil level every time fuel is added.
3. Check the air cleaner element to ensure it is clean and free of ice and snow. It should feel oily.

Starting the Engine

1. Make sure the AC circuit breaker is in the “off” position. It may be hard to start the generator if a load is connected.
2. Turn the fuel valve to the “on” position.
3. Pull the choke rod, or lever, to the closed position. **Note:** Do not use the choke if the engine is warm.
4. If the generator is so equipped, make sure the auto-throttle switch is off.
5. Move the engine switch to the “on” position.
6. Pull the starter grip slowly until resistance is felt, then pull briskly. **Note:** Do not allow the starter grip to snap back. Return it slowly by hand.
7. Once the generator has started, push the choke rod, or twist the choke lever, to the open position as the engine warms up.
8. Allow the engine to warm up for three to five minutes; do not apply a load during this time.
9. Once the generator is warm, turn on a breaker or plug in a load.

Stopping the Engine

1. Turn off the breaker or unplug the load.
2. Allow the generator to run unloaded for two minutes to cool down.
3. Turn off the engine switch.
4. Turn off the fuel supply.

Troubleshooting

Symptom: The engine will not start.

Diagnosis and Cure:

1. Check that the engine switch is on.
2. Check to see if the oil-alert lamp flashes when the starter is pulled. If it does, add oil.
3. Ensure all loads are disconnected from the AC receptacles.
4. Check to see if there is a spark at the spark plug. Ground the side of the electrode to the engine and pull the recoil starter to see if a spark jumps the gap. If there is no spark, replace the spark plug.
5. Check to see if gasoline is reaching the carburetor. Place a suitable container under the carburetor and loosen the drain screw. Fuel should flow freely. If it does not, check the fuel valve on the tank.

Symptom: The engine starts but stops immediately.

Diagnosis and Cure:

1. Check the oil level. If it is low, fill the oil reservoir to the top of the dipstick.
2. Restart the engine.

Symptom: There is no electricity at the receptacles.

Diagnosis and Cure:

1. Check to see if the AC circuit breaker is on.
2. Check the appliance or equipment plugged into the generator for defects.

Mini-Portable Field Power Systems

The Mini-Portable Field Power System (MFPS) is a portable, self-contained solar power supply that can be disconnected and disassembled quickly for transportation. The unit is composed of three components: a weatherproof box, a solar panel stand, and an output cable. The input and output cables connect to the battery box

via sturdy, screw-on, weatherproof connectors. The system is fully grounded, and all wiring and electrical components are rated to -40° C. Maximum output is 300 watts AC or 80 watts DC.

Directions:

1. Open the box and inspect the unit for damage or loose wires. Correct as necessary.
2. Decide on the configuration of the solar panels. They can be mounted on top of the box with four 1/4 X 20 bolts, they can stand independently and be tied down, or they can be spread out to face the sun for maximum input. However they are configured, ensure the panels are secure in case of wind gusts.
3. Connect the three-pin solar plug to the three-pin receptacle.
4. Connect the five-pin extension cord to the five-pin receptacle.
5. Turn the 40-amp breaker to “on” and turn the switch on the far side of the inverter to “on.” AC power will now be available.

When battery power is low, the AC and DC outputs will disconnect. The power will not return until battery voltage reaches 12.2 volts DC. Disconnect loads and let the system recharge. Recharge time from 80% discharge is approximately three days in the sun. Keep in mind there is rarely full sun in Antarctica for three days in a row.

Weather Observations and Ice Assessment

Antarctic Weather

Weather in Antarctica is characterized by extremes: extreme temperatures, extreme winds, and extremely variable local conditions. All of this makes Antarctica a challenging place to work and live. The temperatures can vary from below -40°F (-40°C) to above freezing during the course of an austral summer. Moderate to strong winds are common. It's an unusual day when there is not at least a breeze blowing. The wind takes its toll on people, making camp chores, such as setting up tents, difficult. More importantly, wind chill increases the risk of hypothermia and frostbite. The wind chill chart in the reference section shows the effect of wind on perceived termperature.

McMurdo Area Weather

Storms arrive quickly and are sometimes fierce enough to halt all outside activity. Storms can also be very localized. Weather at McMurdo Station can produce near-zero visibility with blowing snow (halting flight operations), while the McMurdo Dry Valleys, which are 50 miles away from McMurdo, might be calm and sunny. Approaching storms are usually preceded by high, thin bands of cirrus clouds (mare's tails), followed by thicker layers of cirrus, which may cause a halo-like effect around the sun. The clouds grow progressively thicker and lower over the next six to 12 hours until the arrival of low cumulus clouds and the main front. Blizzards can happen any time of year and may last from several hours to several days.

Storms usually approach McMurdo Station from the south, through the gap between Black Island and White Island. They eventually obscure Minna Bluff with blowing snow or low clouds, at which point there is usually less than an hour before bad weather hits. Travel is difficult and dangerous during storms and should be avoided. Blowing snow can hide crevasses or sea-ice cracks. Even moderate winds can produce a layer of dense, blowing snow that may be as thin as a few feet or as thick as 1,000 feet. Whiteouts are equally dangerous phenomena. In a whiteout, thick, low clouds reduce surface definition, and the horizon is obscured. It's difficult or impossible to know if one is on a flat or sloping surface. It is also difficult to judge distances or the size of objects. Travel should only be attempted during a whiteout if there is an emergency. People caught unexpectedly in a whiteout should stop and wait for visibility to improve enough to reveal a recognizable landmark.

Antarctic Weather in Remote Locations

Weather conditions vary widely throughout the Antarctic continent, depending on a location's elevation, topography, and relative distance from the ocean. The polar plateau is very cold because of its higher altitudes and greater distance from the moderating effect of the sea. Areas near the coast can be subject to wet, heavy precipitation and warm days with intense sunlight. Winds at remote Antarctic sites range from calm and light to sustained hurricane force. Past reports and weather data can help parties plan for weather conditions at a given site. Still, it is best to expect the unexpected when it comes to weather.

Antarctic Weather Forecasting

Weather forecasting for U.S. Antarctic stations is done under the auspices of the National Science Foundation and is coordinated through the SPAWAR (Space and Naval Warfare) Systems Center in Charleston, South Carolina. SPAWAR also has a presence at McMurdo Station. Compared to most places in the world, Antarctic weather forecasters have fewer data collection sites upon which to base their forecasting models. Forecasters rely heavily on weather observations called in from remote field sites. They also use satellite imagery, data from automated weather stations, and a weather modeling system, the Antarctic Mesoscale Prediction System (AMPS), which produces twice daily forecasts for the Antarctic continent.

Terminal Aerodrome Forecasts (TAFs)

Weather forecasts for remote sites are called Terminal Aerodrome Forecasts (TAFs), and they are generated each day for sites scheduled to receive aircraft. A TAF is automatically generated for a given site based on the aircraft schedule; field personnel do not need to request one in advance. TAFs are usually issued every eight hours for a 24-hour period and are effective for 24 hours from the time they are issued.

Occasionally, an amended or corrected TAF will be issued between the standard issue times. Amended TAFs are issued when the current TAF no longer adequately describes the ongoing weather or the forecaster feels the TAF is not representative of the current or expected weather. Corrected TAFs are issued when there is misinformation on the original TAF.

USAP Field Party Weather Observing

Field parties must identify the person or persons responsible for making weather observations each day and reporting these observations to the McMurdo Weather Center (MacWeather). Weather observations made at remote field locations facilitate safe and timely aircraft operations to those locations. The data also support the continent-wide weather forecasting system.

When to Make Observations Each Day:

1. If no aircraft activity is planned:
   a. Make three daily weather observations and report them to MacWeather at 1800 Zulu (Z), 0000Z, and 0600Z.
   b. On holidays, only two observations need to be reported: morning (1800Z) and evening (0600Z).
   c. All observations should be recorded and called in to MacWeather within 15 minutes of the scheduled time.
   d. Begin the observation about 15 minutes before the top of the hour. (Weather observations should take 10 to 15 minutes to complete.)
   e. Call in the observation within five minutes of the top of the hour.
2. If an aircraft is scheduled to arrive:
   a. Hourly observations begin six hours before an LC-130 and three hours before a Basler or Twin Otter aircraft is scheduled to depart from its original location en route to a remote camp.
   b. Hourly observations continue while the aircraft is on the ground at camp.
   c. Observations return to the normal daily schedule when the aircraft departs.

Setting Up a Weather Observation Site

Altitude and Grid North

Key information for setting up a weather observation station is available from the pilot of the aircraft. Upon arrival, the designated weather observer should ask the pilot for an exact altitude reading. This number is required to take accurate pressure readings with the handheld weather meter (Kestrel®). Also, the pilot should be able to identify grid north. This will assist in setting up the flagged weather-observation site.

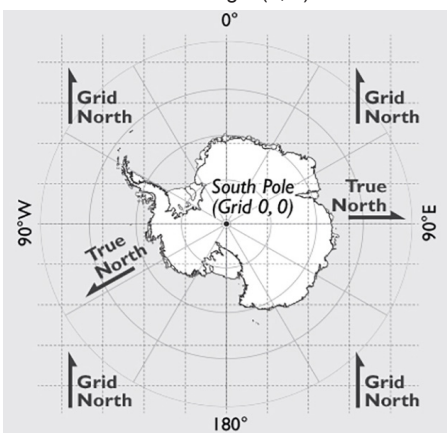
Grid North Versus True North

In order to avoid confusion, especially when traveling where lines of longitude converge near the South Pole, aircraft pilots in Antarctica navigate using directions based on an artificial grid pattern overlaying the continent, rather than on true compass directions. The designated weather observer should use these grid directions when observing and reporting the weather. (**Note:** Do not report weather using true or magnetic direction readings. Always use grid direction.)

North has been conventionalized in two ways:

True North is defined as the direction of a line of longitude that ends at the North Pole.

Grid North is defined on the Antarctic Polar Stereographic Grid, with 0 degrees longitude acting as the reference (central) meridian and the South Pole as the origin (0, 0).



Determining Grid Directions

For locations in an easterly longitude, grid direction equals true direction minus the longitude of the camp.

For locations in a westerly longitude, grid direction equals true direction plus the longitude of the camp.

Examples: For a camp located at 167 degrees east longitude, subtract 167 (the longitude of the camp) from 360 (true north). Place the flag for grid north at 193 degrees true.

For a camp located at 60 degrees west, add 60 (the longitude of the camp) to 0 (true north). Place the flag representing grid north at 60 degrees true.

Note: The declination between magnetic north and true north varies widely throughout the continent. Observers using a magnetic compass to determine direction must be sure to use an accurate declination for their location.

Grid Direction Flags

Upon arriving at a camp, team members should create a weather-observing site. Use four flags placed a few meters apart at the points representing grid north, grid south, grid east, and grid west. Label each flag with its grid direction. The observer should stand in the middle of this flag configuration when making weather observations. This will help determine the direction of the wind and provide a consistent point from which to observe sky and ground conditions.

Visibility Markers

To help determine visibility levels, team members should place a second layer of flags spaced 400 meters (1/4 mile) away, in line with each directional flag. If possible, additional flags should be placed at major intervals, such as 800 meters (1/2 mile), 1,600 meters (one mile), and/or 3,200 meters (two miles). The team members should measure and record distances to landmarks that can be seen from camp for additional help in determining visibility.

Setting Up the Handheld Weather Meter (Kestrel®)

Weather observers in remote locations often use a handheld weather meter to measure wind speed, temperature, dew point, and pressure. The handheld weather meter discussed in this manual is the Kestrel® 4000. Observers using a different meter should refer to the user instructions for that meter.

The Kestrel® 4000 is available through the Berg Field Center (BFC). The field team should call the BFC in advance and arrange a pick-up time. The team member making the pick-up should ensure the Kestrel® is set to measure temperature in Celsius, wind speed in knots, and altitude in feet. Extra batteries should also be procured at that time, in case the batteries in the Kestrel® lose power in the field. The Kestrel® must be returned to the BFC promptly at the end of the season.

The Kestrel® should be stored in an inside coat pocket or a warm

area when not in use. The liquid crystal screen will function only at temperatures above -10°C (-14°F). At colder temperatures, the screen will be sluggish and eventually fade, although the device will still record data. The Kestrel® should be returned to a warm, inside coat pocket as soon as possible after use.

Setting a Reference Altitude and Barometric Pressure on the Kestrel®

Obtain the remote site's altitude in feet from the aircraft pilot. (Be sure to notify the pilot in advance so he or she knows to provide this information before departing.)

Navigate to the barometric pressure (BARO) screen and press the center COMMAND button to enter. On the screen, go to the reference altitude (Ref Alt) line. Use the left and right buttons to increase or decrease its value to equal the altitude (in feet) provided by the pilot. Be sure the Kestrel® is set with feet as its default altitude measurement. Notice that the barometric pressure reading changes in response to changes in the altitude number. Press the COMMAND button to save and exit the adjustment mode.

Next, go to the altitude screen and navigate to the reference pressure line. Enter the barometric pressure number now shown in the BARO screen. Since the Kestrel® is used to monitor barometric pressure for weather reporting, it should be kept in the same location (i.e., at the same altitude), because the pressure will change with changes in altitude. Read the pressure from the BARO screen.

Weather Reporting Sheet

Use the Surface Weather Observations form (METAR/SPECI) to record your weather observations. MacWeather provides this form, which is too detailed to print here. Review how to fill it out at your weather briefing with MacWeather personnel before deploying to the field. Note: It is not necessary to maintain a written record of each observation. MacWeather will record and track the observations called in.

Camp Name/Location

List the latitude and longitude of the camp. If the camp has a name, provide that too. Example: Whillans Ice Plain Camp - Latitude: 83.65 S, Longitude: 167.4 W

Time in Zulu (GMT)

Weather observations should be reported using Zulu (GMT) Time. For example, if a weather observation is called in at 0700 New Zealand Daylight Time, it should be referred to as the "Eighteen Z Observation" since 0700 NZ time is 1800 Zulu (GMT).

Direction of Winds

The observer should stand in the middle of the flagged weather-observing site and use the feel of wind on the face and/or any visual cues, such as blowing flags and blowing snow, to determine the grid direction of the wind. Wind direction readings should be taken for at least two minutes. The average direction over that time should be reported. Wind direction is identified according to the following:

calm	no direction, report "winds calm"
northeast	023 to 067 degrees
east	068 to 112 degrees
southeast	113 to 157 degrees
south	158 to 202 degrees
southwest	203 to 247 degrees
west	248 to 292 degrees
northwest	293 to 337 degrees
north	338 to 022 degrees
variable	wind must be 6 knots or less

Speed of Winds

Confirm the Kestrel® is set to record wind in knots. Power it up and navigate to the wind speed screen. Expose the impeller (the small, revolving wheel at the top of the Kestrel®) by rotating open the plastic cover. While viewing the Min/Max/Avg screen, hold the unit into the wind (the screen facing the observer). When the screen displays "--average" press the button to begin collecting data. Press it again when the screen displays "--stop" to stop collecting data and hold the values on the display. Press the button when the screen displays "--clear" to clear the data. Collect enough data to calculate a two-minute average for all measurements.

Visibility at Surface

Visibility is the measure of how far an observer is able to see objects like flags or rock outcrops that are not obscured by weather, as viewed from ground level. Visibility should be recorded in meters

and as an average of all quadrants.

Visibility distances are broken down to “Reportable Visibility Values.” Miles and feet are included in the Reportable Visibility Value chart for reference, but observers should call in observations using meters. For example, visibility estimated at 700 meters must be reported as either 600 or 800 meters since 700 is not a Reportable Value. The term “Unrestricted Visibility” refers to visibility that is 9,999 meters or greater. All visible distances 9,999 meters or greater are reported as “Unrestricted.”

Present Weather

This entry is a description of the weather effects that may or may not be restricting visibility, as seen at ground level. Examples include precipitation, such as snowfall or fog, and obstructions to visibility from blowing or drifting snow. It is possible to have two or three present-weather effects and obstructions to visibility in a given entry. For example: snow and drifting snow; or snow showers, fog and blowing snow.

Weather categories (with visibility obstruction):

No Weather	Visibility not obstructed by any weather condition
Snow	Visibility less than 9000m and precipitation steady
Snow Grains	Visibility is less than 9000m; steady precipitation of small, round, flat snow pieces
Ice Crystals	Can occur at any visibility, including unrestricted visibility
Fog	Only reported when visibility is less than 1200m
Mist	Looks like fog; reported when visibility is between 1200 and 9000m
Snow Showers	Visibility less than 9000m; precipitation intermittent
Ice Pellets	Visibility less than 9000m in steady precipitation of tiny hailstones <5mm (rare event)
Blowing Snow	Visibility less than 9000m
Drifting Snow	Visibility greater than 9000m

Reportable Visibility Values		
Meters	**Statue Miles**	**Feet**
0	0	0
100	1/16	328
200	1/8	656
300	3/16	984
400	1/4	1312
500	5/16	1640
600	3/8	1969
800	1/2	2625
1000	5/8	3281
1200	3/4	3937
1400	7/8	4593
1600	1	5249
1800	1 1/8	5906
2000	1 1/4	6562
2200	1 3/8	7218
2400	1 1/2	7874
2600	1 5/8	8530
2800	1 3/4	8858
3000	1 7/8	9843
3200	2	10500
3600	2 1/4	11810
4000	2 1/2	13120
4400	2 3/4	14440
4800	3	15750
6000	4	19690
8000	5	26250
9000	6	29530
Unrestriced 9999 or more	7 or more	

Amplification of Weather

This is a more detailed description of weather severity, such as "Light," "Heavy," or "Moderate." Examples (including accompanying obstructions to visibility):

None	
Light Ice Pellets	Visibility not restricted
Moderate Ice Pellets	Visibility reduced to between 3 and 7 miles (4800 to 9000m)
Heavy Ice Pellets	Visibility reduced by ice pellets to less than 3 miles (4800 m)
Light Snow	Visibility greater than ½ mile (800m)
Moderate Snow	Visibility between ¼ and ½ mile (400-800m)
Heavy Snow	Visibility less than ¼ mile (400m)

Cloud Layers

Each cloud layer is usually reported using two entries: the first represents the amount of sky covered by a layer and the second represents the cloud layer height. At least one layer is reported (even if it's "sky clear"), and often two or three cloud layers are reported. The heights of cloud layers are reported in feet (not meters). If there is more than one layer, begin with the lowest layer. Examples:

Entry #6 – Cloud Layer 1, Few at 1,000
Entry #6a – Cloud Layer 2 (if needed), Scattered at 5,000
Entry #6b – Cloud Layer 3 (if needed), Broken at 10,000

To report cloud layers, always round to the nearest 100 feet for layers that are 5,000 feet or less. For layers between 5,000 feet and 10,000 feet, round to the nearest 500 feet. For layers 10,000 feet and above, round to the nearest 1,000 feet. Example: A cloud layer at 1,150 feet is rounded to 1,100. A cloud layer at 5,300 feet is rounded to 5,500 feet.

Summation Principle

A higher cloud layer cannot be reported as having less total area coverage than the area below it. The higher layer is considered to include the amount of sky coverage from all of the clouds below it. For example, if the lowest cloud layer is reported as "broken," the next higher layer must be reported as either "broken" or "overcast," even if there are only a few clouds in the higher layer.

Using Cloud Types to Estimate Layer Heights

A cloud's appearance or type will give clues as to how high it is. Following are some typical Antarctic cloud heights:

Cloud Type	Description	Typical Height
Stratus	Low, grey, shapeless sheet stretching wide	1,500 feet or less
Stratocumulus	Low, lumpy, rounded, with some blue sky visible	1,000 - 5,000 feet
Cumulus	Low, puffy, popcorn-like, vertical development	1,000 - 5,000 feet
Altostratus	Mid-level, uniform sheet of grey cloud	4,000 - 9,000 feet
Altocumulus*	Mid-level puffy clouds, sometimes in patterns. One part of the cloud is usually darker, "castles	4,000 - 9,000 feet
Cirrus	High, whispy, feathery, see-through clouds	10,000 - up to 19,000 feet
Cirrostratus	A high, very thin sheet of see-through clouds	10,000 - up to 19,000 feet
Cirrocumulus	High, thin, wavy or rippled clouds in part of the sky	10,000 - up to 19,000 feet

** Altocumulus includes lenticular clouds. These are dangerous for air operations and must be reported in the Remarks section.*

Additional Ways to Determine Cloud Layer Height

Ceiling Balloons Also called "weather balloons," ceiling balloons are helium-filled balloons released from ground level. Their ascent is timed and the balloons observed until clouds hide them from view. Cloud height is then determined based on a chart that shows how fast a given balloon will rise. Not all remote camps will have ceiling balloons, as they require the transport of compressed gas. Additional training is required for those using ceiling balloons to determine cloud height.

Pilot Report Observers may confirm the heights of cloud layers with pilots who fly into camp. The aircraft's instrumentation allows pilots to determine exact heights of cloud layers as they fly through them. A pilot report is called "PIREP" (pronounced "pie rep") and should be used only periodically, not for every single flight.

Total Sky Cover

This includes all of the layers of clouds taken as a whole. Sky cover is measured in "oktas" or eighths. If half of the sky is cloudy, that is described as 4/8 or four oktas. The oktas are grouped into the following categories:

Value	Amount of sky covered by cloud
Sky Clear	0/8 coverage Sky must be totally clear; do not encode a layer height.
Few	1/8 - 2/8 coverage Anything from one tiny cloud up to 25% of the sky covered.
Scattered	3/8 - 4/8 coverage
Broken	5/8 -7/8 coverage
Overcast	8/8 coverage If the cloud is "see-through," it is still considered overcast.
Vertical Visibility	Sky view is obscured. Sky is entirely covered by fog and/or blowing snow; cloud layers cannot be discerned.

Temperature and Dew Point

Both of these readings should be recorded directly from the Kestrel®. Navigate to the correct screen by using the up and down arrows. Navigate to lines within a screen using the side to side arrows.

These data are reported in the nearest whole degree Celsius.

Negative temperatures and dew points are recorded with an "M" before the number (example: M06).

The dew point will never be higher than the temperature.

Sometimes the dew point will not register on the Kestrel® in extreme cold conditions. If this occurs, omit the dew point report from the weather observation.

Barometric Pressure

For this item, report the station pressure and not the altimeter. Station pressure is the atmospheric pressure at the station elevation. It should be read directly from the Kestrel® and reported in inches of mercury to the nearest five-thousandth of an inch.

Always round down. For example, 29.249 inches would be reported as 29.245 inches.

Remarks & Surface/Horizon Data

These descriptions help pilots anticipate visual conditions for landing. The surface definition is relayed first, horizon definition second.

Surface Definition This entry describes how the contours of the ground and/or snow surface appear. Surface definition is judged by the relative distinctness of features like sastrugi or vehicle tracks in snow. Observers should notice how surfaces appear in good weather to use as comparison in changing weather.

Surface Definition Levels

Good	Snow surface features such as sastrugi, drifts, and tracks are easily identified by a shadow. The sun is usually not obscured.
Fair	Snow surface features can be identified by contrast. No definite shadows exist. The sun is usually only dimly visible.
Poor	Snow surface features cannot be readily identified except from close up. The sun is usually totally obscured.
Nil	Snow surface features cannot be identified. No shadows or contrast exist. Dark colored objects appear to float in the air. The sun is totally obscured, though the overcast may exhibit considerable glare. The glare appears to be equally bright from surface reflection and from all directions.

Horizon Definition This is an observer's judgment as to the ease with which the sky can be distinguished from the land or snow surface.

Horizon Definition Levels

Good	The horizon is sharply defined by shadow or contrast. There is an obvious difference between land and sky (i.e., white surface and blue sky) and the horizon is distinct.
Fair	The horizon may be identified, though the contrast between sky and snow surface is not sharply defined. The sky distinguishable from land, and the horizon is visible. "Fair" horizon conditions are often observed when clouds are approaching or during light precipitation.
Poor	The horizon is barely discernible. Though it is difficult to distinguish the sky from the snow surface, there still seems to be a (hard to see) separation between the two. "Poor" is observed in conditions similar to those that cause "nil," only less severe.

Nil Total loss of horizon. The snow surface merges with the whiteness of the sky. No horizon is visible, which is common when there is a low stratus layer and blowing snow.

Examples:

Snow surface and horizon are both easily seen
= good and good

Surface contrast is seen in dim sun and the horizon is hard to discern
= fair and poor

Surface has no shadows or features and the horizon is not discernable
= nil and nil

If a poor or nil horizon is visible in one grid direction only and the rest of the horizon is more easily seen, report this condition in the remarks as, for example, "poor horizon grid south through west" or "nil horizon grid east."

Remarks

The remarks section should also be used to describe any significant weather-related phenomena that are not reflected elsewhere in the report. This could include weather seen in the distance, weather in a small quadrant (such as different surface or horizon definitions), or weather seen in the vicinity (such as fog, mist, or lenticular clouds at 2,000 feet grid northwest). Use plain language for remarks; no code is needed.

Calling in a Weather Observation

By Iridium (satellite) phone – dial MacWeather at 8816-763-20030.

By HF Radio – use the frequency that works best to contact MacOps. Provide MacOps with the observation and request it be passed to MacWeather.

Example weather observation call:

"Hello, this is Chris from Whillans Ice Plain Camp with the Six Z Observation." [Wait for affirmation between relaying bits of information.] "We are at 83.65 south latitude and 167.4 west longitude. Winds: Grid Northwest at 12 knots. Visibility: 1,600m. Present weather: snow and mist. Amplification of weather: light snow. Clouds: Broken at 1,000, Overcast at 5,000. Total sky cover: eight oktas. Temperature: negative ten. Dew point: negative fifteen. Barometric pressure: 28.245. Surface Definition poor, Horizon Definition poor. Remarks: all winds grid, mist in the vicinity at grid north. Thanks. Goodbye."

Calling for a TAF

To receive a TAF for a specific site, call MacWeather at 8816-763-20030. This call may be placed at any time on a day that an aircraft is scheduled for the site. Only the most recently generated TAF will be provided, regardless of the time of the call.

TAFs are relayed in an abbreviated format. The caller should have a pencil and paper ready at the start of each call. Below is an example of a typical TAF, followed by an explanation of how to interpret each section.

Example #1:

SDM TAF 0915/1015 (1004/1104NZDT) VRB04KT 1600 BR FEW010 BKN030 OVC050 QNH2855INS

BECMG 0917/0919 (1006/10008) VRB06KT 0400 SN FG OVC007 QNH2850INS

Translation:

The forecast (TAF) for Siple Dome (SDM) is in effect from 0400 NZ time on the 10th of the month to 0400 on the 11th of the month (0915/1015 (1004/1104NZDT)).

Winds will be Variable at 4 knots (VRB04KT).

Visibility will be 1,600 meters. (1600).

Mist will be present (BR).

The first layer of clouds will be Few at 1,000 feet (FEW010).

The second layer of clouds will be Broken at 3,000 feet (BKN030).

The third layer of clouds will be Overcast at 5,000 feet (OVO050).

Barometric pressure will be 28.55 inches (QNH2855INS).

Then, beginning at 0600 on the 10th day of the month NZ time (1006/10008), the weather will begin to transition from the previous forecast to a different one. By 0800 on the 10th day, the new forecast conditions should be in effect. (BECMG 0917/0919).

Winds will increase to Variable at 6 knots (VRB06KT).

Visibility will drop to 400 meters (0400).

There will be moderate snow and fog. (SN FG).

Skies will be Overcast at 700 feet (OVO007).

Barometric pressure will be 28.50 inches (QNH2850INS).

Example #2:

NBY TAF 0915/1015 (1004/1104NZDT) GRID08010KT 8000 -SN BR BKN010 OVC020 QNH2837INS

TEMPO 0920/0924 (1009/1013) 2400 -SN BR OVC010

BECMG 0923/1001 (1012/1014) VRB06KT 9999 NSW SCT010 BKN030 QNH2834INS AMD 1900

The following table explains how to interpret each section.

Terminal Aerodrome Forecast (TAF) Table

Abbreviation	Meaning	Translation for TAF Example #2	Notes/Examples
NBY	Station Identifier	Byrd Surface Camp (NBY is the abbreviation for the airstrip at Byrd Camp)	WSD – WAIS Divide NZSP – South Pole AGO3 – AGO Site # 3
TAF	Report Type	Terminal Aerodrome Forecast	
0915/1015	Forecast date and time	09 (9th day of the current month) 15 (1500, the time of issue in GMT/Z) 1015 (the forecast goes through the 10th day of the month at 1500 GMT/Z)	
(1004/1104NZDT)	Conversion to New Zealand time		Sometimes the New Zealand time will be included in parenthesis following Zulu time.
GRID08010KT	Wind Direction and Speed	GRID080 – Winds are forecast to come from Grid 80 degrees (grid east). 10KT – Wind speed forecast at 10 knots	Wind direction is always noted in three digits. 005 = 5 degrees. 040 = 40 degrees. Wind speed is always noted in two digits. 08 = 8 knots. 35 = 35 knots.
8000	Visibility in Meters	Visibility on the ground is 8000 meters (5 miles)	9999 represents unrestricted visibility. This is used for any visibility of 7 miles or greater.
-SN BR	Forecast Weather	-SN – light snow BR - mist *(a handy way to remember that BR equals mist is to think "Baby Rain")*	SN - moderate snow -SN - light snow +SN - heavy snow FG - fog IC - ice crystals BLSN – blowing snow DRSN – drifting snow NSW -no significant weather

Terminal Aerodrome Forecast (TAF) Table (continued)

BKN010	Cloud Layer 1 height in feet	The lowest cloud layer is a broken layer (covers 5/8-7/8 of the sky) at a height of 1,000 feet.	Cloud heights are given as three digits and omit the last two zeros of the number. 005 = 500 feet. 010 =1,000 feet. 100 = 10,000 feet (just add two zeros to get the height number).
OVC020	Cloud Layer 2 height in feet	The next higher of clouds is an overcast layer (clouds cover the entire 8/8 of sky) at a height of 2,000 feet	
QNH2837INS	Barometric Pressure	Station pressure is forecast to be 28.37 inches.	
TEMPO 0920/0924 (1009/1013) 2400 -SN BR OVC010 Change to one hour long	Temporary Condition	A temporary condition (for no more than 30 minutes) will occur between the exact times of 2000 Zulu and 2400 Zulu on the 9th day of the month. Visibility will drop to 2400 meters and the cloud layer will become a single overcast layer at 1,000 feet.	Since wind direction, wind speed and pressure are not included in the TEMPO, it is assumed that they stay the same as in the original forecast.
BECMG 0923/1001 (1012/1014) VRB06KT 9999 NSW SCT010 BKN030 QNH2834INS	Becoming: The forecast conditions will change to a new one during the stated times. The new forecast will be in effect by the end of the BECMG period.	From 2300 on the 9th day of the month (Zulu) to 0100 on the 10th day of the month (Zulu) conditions will begin switching from the original forecast to a new one. By 0100 winds will be Variable at 6 knots. Visibility will be unrestricted. There will be No Significant Weather. Clouds will be Scattered at 1,000 feet and Broken at 3,000 feet. Pressure will be 28.34 inches.	New Zealand time is 12-13 hours ahead of Zulu time (depending on Daylight Savings Time). Therefore, the Zulu time forecast often appears to be for an earlier date. Be sure to check the Z versus the NZDT times.
AMD 1900	Time of amended forecast	This TAF is an amended forecast issued at 1900.	

Sea Ice Assessment

A McMurdo Sound Sea Ice Report is available bi-weekly while the sea ice is open for travel. The report consists of a satellite image with sea-ice routes overlaid and current conditions noted. Personnel should review the report before traveling on the sea ice and contact the FS&T sea ice point-of-contact with questions, if any.

Safe travel on the sea ice requires paying attention to weather conditions, ice thickness, ice color, ice temperature, and cracks.

Weather

Poor weather conditions will obscure surface definition, making it difficult or impossible to detect cracks. Use extra caution if surface definition or visibility is poor. Strong winds can be particularly dangerous, especially at the ice edge, where large chunks of the sea ice can break off and blow north with little warning.

Ice Thickness

Strong currents can erode the fast ice from below. This is hazardous because there may be no obvious indication of thinning from the surface. The currents typically occur later in the season and usually over underwater shoals. Land formations that indicate a potential shoal are long, low-angle ridges or peninsulas that descend into the sea. However, shoals can also occur offshore of steep slopes, such as the north side of Little Razorback Island. At McMurdo Station, the areas adjacent to Cape Armitage (at the base of Observation Hill), Hut Point, and Knob Point/Cinder Cones historically experience strong currents and thinning ice later in the season. In addition, as the air and sea temperature rise later in the season, the sea ice becomes progressively weaker and thinner everywhere.

Ice Color

The color of the sea ice is a good indication of its thickness and safety. In general, white or milky blue ice is the safest. In McMurdo Sound, these colors indicate solid ice 24 or more inches thick. Ice that is sky blue and has a slick, scalloped surface is multi-year ice that is several feet thick.

Ice of different ages and thickness will be marked by a thin line on the surface and, usually, slight differences in elevation. If the color of the ice changes abruptly, travelers should stop immediately and investigate. Darker ice indicates a hazard. Ice that is young or has thinned to six inches or less will appear grayish, even beneath a

thin crust of snow. This ice may support an adult on skis but should never be traversed in a vehicle. Gray ice can also form as a result of surface flooding and subsequent freezing of the surface water, which often occurs at tidal cracks. It is always important to investigate areas of gray ice. Ice that appears black is very thin and should be avoided at all times.

When traveling off established routes, field team members should drill the sea ice every 100 meters if the ice surface is consistent, and much more frequently if there are variations in color or texture.

Ice Temperature

Colder ice is stronger. The colder the ambient air temperature, the more the ice grows, and the colder the sea ice, the stronger the overall structure. Just looking at the surface will not disclose the true strength of the ice. Sea ice strength is measured according to four temperature periods:

Period 1	Period 2	Period 3	Period 4
<14° F	14°- 23° F	23°- 27° F	27°- 28.5° F

Sea Ice Cracks

Cracks are fissures or fractures in the sea ice that form in response to environmental, geographical, and mechanical pressures, such as wind, waves, tidal action, and the pressure of ice shelves and glaciers pushing against the sea ice. Tidal cracks form along coastlines and around islands, grounded icebergs, and glacier tongues. Other cracks radiate out from the land, especially from headlands and glacier tongues, like the spokes of a wheel.

Cracks should be avoided whenever possible. If crossing one is unavoidable, cross it in a line perpendicular to the crack. Never cross a system of multiple, closely set cracks in a manner that places a vehicle on more than one crack at a time. Avoid sets of cracks that form triangular wedges. These could break off and turn over under the weight of a vehicle.

Snow cover on the sea ice can hide cracks. When traveling off established routes, look for continuous linear features and sagging areas of snow, sometimes of different color tones. Watch for areas where snow has drifted differently, especially if the drifted area is in a long, straight line. Good visibility and lighting are essential to seeing these features. Also, pay attention to seals or signs of seals, such as feces, urine, seal shadows, and breathing holes. Their presence anywhere on the sea ice indicates the presence of a crack.

Crack Types

There are four general types of sea-ice crack:

- Tidal
- Straight edge
- Working (active)
- Pressure ridge

Each is described and discussed during sea-ice training. Field party members working on the sea ice should learn to identify and evaluate each type.

How to Profile a Sea-Ice Crack

Stop the vehicle before reaching a crack and check for other cracks nearby.

1. Determine the nearest edge of the crack by removing snow down to bare ice.
2. Using an ice ax, probe for open water or weak spots to determine if it is safe to cross by foot.
3. If it is safe, shovel the snow out of the crack from edge to edge, clearing at least one shovel blade width.
4. Drill holes every 12 inches in a straight line, beginning outside one crack edge and ending outside the other, making certain to drill healed shelves and any visible fractures.
5. Drill each hole either to water level or to a full Kovaks drill flight length (>30 inches).
6. Measure the ice thickness in each hole.
7. Pay attention to the characteristics of the ice shavings (dry, moist, or slushy).

Safe Ice Thickness Standards for Cracks

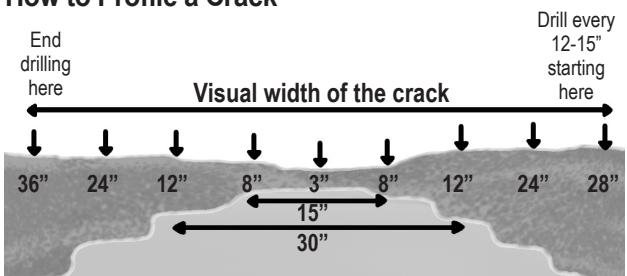
Effective crack width is the distance over which the sea ice in a crack is less than the minimum required for a vehicle, based on ice period. The effective width cannot exceed 1/3 of a vehicle track length or area of a tire in contact with the ice. Use the following Light Vehicle Sea Ice Guidelines to determine required ice thickness and effective width for the vehicle in use.

Sea Ice Guidelines

Vehicle	Maximum Effective Crack Width (in)	Minimum Ice Thickness (inches)			
		Period 1	Period 2	Period 3	Period 4
Pisten Bully	36	12	12	17	17
Hägglunds	27	15	16	21	22
Snowmobile	20	5	5	6	7
Mattracks	15	12	13	17	18

** If towing a sled or trailer, different ice thickness requirements may apply. Please contact FS&T at X2345 for more information.*

How to Profile a Crack



Effective width of the crack

In this example, for a Pisten Bully in period 1 or 2, the effective width is 30". For a snowmobile, it is 15".

Rule 1: Ice thickness must be ≥ the Sea Ice Guidelines for specific temperature periods.

Rule 2: Effective width of the crack must be ≤ 1/3 of the vehicle track length.

Cargo and Aircraft Operations

Cargo and Aircraft Operations

Overview

Field parties conducting research within 100 miles of McMurdo Station, including nearby areas inaccessible by ground vehicle, travel to their research locations via helicopter, while field parties working farther afield travel via fixed-wing aircraft.

Project principal investigators identify flight dates and destinations months in advance when submitting their Support Information Packages. When project team members arrive at McMurdo Station, flights approved in their Research Support Plan will have already been established in a weekly schedule. Shortly after arrival, the team members meet with fixed-wing or helicopter office staff to discuss field plans in detail and obtain aircraft designations and allowable cabin loads. Exact flight dates and times are established the day before each flight, though the schedule is subject to last-minute changes due to weather conditions and aircraft availability.

Cargo Procedures

Note: Field team members should carefully review field-planning checklists for critical timelines well before flights are scheduled to occur.

Field parties are responsible for preparing cargo and providing cargo information and passenger names to fixed-wing or helicopter office staff. For fixed-wing flights, cargo preparations take place at Science Cargo (Building 73), where items are packaged, weighed, labeled, and given a shipping number. Project personnel are responsible for gathering their cargo, including field gear, and transporting it or arranging for it to be transported to Science Cargo. For helicopter flights, project personnel must gather and weigh all their cargo and coordinate with helicopter technicians for transporting it to the helicopter pad. All cargo weights and dimensions must be submitted to the helicopter office 72 hours before the flight.

Shipping Numbers

Any item slated to travel by fixed-wing aircraft must be given a shipping number. Forms for creating these numbers are available from Science Cargo. The forms list the weight and cube (volume in cubic feet) of each item, a physical description, a deliver-by date, and the project number. The science cargo staff can provide assistance in

correctly assigning and recording shipping numbers. Field personnel should keep a list of these numbers and accompanying information for planning cargo loads.

Hazardous Cargo

Cargo that is flammable, explosive, poisonous, radioactive, corrosive, under pressure, or capable of causing toxic fumes is considered hazardous for aircraft operations. Field team members should consult the hazardous cargo supervisor if there is any uncertainty as to whether an item is hazardous.

Hazardous cargo must be packaged, labeled, and handled in a specific way to minimize the danger to aircraft, passengers, and crew. This process, which is critical to life and health, takes time and cannot be rushed. Field party personnel must identify hazardous items in advance and submit them to the science cargo staff a minimum of three business days before a fixed-wing flight and a minimum of two days before a helicopter flight. Field teams that do not meet these deadlines should not expect last-minute service.

Some common hazardous cargo items include:

- Acid batteries/car batteries
- Lithium batteries
- Aerosol spray cans (e.g., WD-40, paint)
- Isopropyl alcohol
- Hand sanitizer
- Burn paste
- Stove fuel (white gas)
- MSR fuel bottles (for deep-field survival bags and Whisperlite® stoves)
- Propane
- Fuel in drums (AN-8, mogas, premix)
- Jerry cans - full or empty (kerosene, mogas, premix, AN-8)
- Coleman® and Whisperlite® gas stoves
- Propane space heaters
- Kerosene heaters
- Explosives and detonators
- Generators
- Herman Nelsons
- Hurdy-gurdies
- Jiffy Drills
- Snowmobiles

- Pressurized gas cylinders (nitrogen, oxygen, helium)
- Fire extinguishers
- Matches

Shippers Declaration for Dangerous Goods

Each hazardous item transported requires a Shippers Declaration for Dangerous Goods (or "haz dec"), which provides details on the item's type, packaging, and emergency response requirements. A haz dec for each hazardous item will be included with the flight manifest paperwork. Field personnel must keep copies of all haz decs, as flight crews will require the information if the hazardous items are returned from the field.

Retrograde Hazardous Cargo

When field parties return hazardous cargo to McMurdo, the cargo must be properly packaged and labeled. Each item must have its own separate and complete haz dec to give to the flight crew. Preserving the packaging, labels, and paperwork generated for the cargo's field deployment flight makes it easier to prepare the hazardous cargo for its return flight to McMurdo.

Frozen Food

Frozen food for large, ASC-staffed field camps is pulled, packaged, and turned over to the Movement Control Center (MCC) by ASC personnel, after which the food is stored in McMurdo food service freezers. For smaller deep-field camps, field personnel pull the food as close as possible to the three-day advance deadline, after which the food is stored in the airfield freezer. A few hours before the flight, cargo personnel transport the frozen food to the aircraft. If the flight is delayed or canceled, field personnel must ensure the food is returned to the airfield freezer. For helicopter flights, the food is stored in the BFC freezer until it is ready for transport to the aircraft by the heli-techs.

Fixed-Wing Aircraft Operations

Projects entering the field via fixed-wing aircraft will fly on a LC-130 Hercules operated by the New York Air National Guard (NYANG) or on a Basler or Twin Otter operated by Kenn Borek Air, Ltd. (KBA). Flights on these aircraft are scheduled by personnel in the fixed-wing office.

Note: Before deploying to the field, project personnel should carefully review camp put-in, daily tasking, and camp pull-out checklists, and they should meet with FS&T for risk assessment.

Baslers

Baslers are twin-turbine, propeller-driven airplanes outfitted with skis. They are the larger of the two KBA aircraft used in Antarctica. Baslers are loaded and unloaded from a cargo door located toward the rear of the aircraft. They cannot accommodate Air Force pallets. In addition, a forklift must not be used to offload a Basler. Cargo and equipment should be packed in containers that can fit through the cargo door and can be moved by one or two people.

Twin Otters

Twin Otters, a smaller and more nimble aircraft than the Basler, can fly and land in a wide variety of conditions. Like Baslers, they are equipped with skis, have twin engines, and are loaded and unloaded by hand through a rear cargo door. The space in a Twin Otter is limited, but it can be maximized by preparing cargo packages that are small and easily handled by one or two people.

LC-130s

The LC-130 Hercules is the largest ski-equipped aircraft used in Antarctica. These airplanes have four turboprop engines and can carry more payload than either the Basler or Twin Otter. However, the LC-130 requires a longer landing and takeoff strip than either of the other two aircraft. LC-130s are loaded and unloaded through a large rear hatch with a ramp, which can accommodate a small forklift.

Bag Drag

A process of weighing field personnel and their baggage, called "bag drag," occurs at least 12 hours before a LC-130 flight. At this time, all personal gear (e.g., clothes and personal items) must be checked in. These things will not be available in the event of a flight cancelation. However, passengers are allowed one hand-carry bag, so passengers should place shoes, a change of clothes, and required toiletries (e.g., toothbrush) in this bag in case the flight is canceled. In addition, phones, radios, and weather kits must be hand-carried. This ensures the electronics will be warm and functional, so the field team can establish

communication with McMurdo or another field camp before the plane departs.

Air Services posts bag-drag information, the flight schedule, and updates on the transportation channel, at the MCC, and outside the dining facility in Building 155.

Flight Day

All field personnel must report to the MCC for transportation at the time listed on the flight schedule. All passengers are required to wear ECW gear or approved equivalent. At the airfield, passengers must follow the directions of the loadmaster, who directs all movement in and around the aircraft.

Do not assume that all cargo details have been addressed. Inspect snowmobiles and make sure the keys are available. All survival gear (e.g., radios, sleep kits, tents, stoves, and food) must be present. Check the cargo manifest against what is actually on the aircraft. If something is missing, immediately notify the loadmaster, who will tell the aircraft commander to halt flight preparations. Cargo staff will need to be advised that equipment is missing.

Aircraft Specifications

	Twin Otter	Basler	LC-130
Max. seating	8 passengers, 2 pilots	18 passengers, 2 pilots, 1 flight attendant	40 passengers, 2 pilots, 1 navigator, 1 flight engineer, 2 loadmasters
Max. flight time (round trip)	About 9 hrs. (with fuel stops)	About 8 hrs.	About 8 hrs.
Cargo door	Side door (4'8" x 5'1")	Side door (5'11" x 4'8")	Aft door with ramp (10' x 9'2")
Cargo area	126 cu. ft.	1,225 cu. ft.	4016 cu. ft., variable configurations, holds up to six pallets

Allowable Cabin Load

The amount of weight allotted for cargo and passengers on a given flight is called the Allowable Cabin Load (ACL). The ACL will vary depending on each aircraft's capacity, how far the aircraft must fly, and landing conditions at the destination, among other factors. The ACL for any given flight is determined during the flight's planning stage. A field team's total weight of cargo and passengers cannot exceed the specified ACL.

Cargo on KBA Aircraft

- Field parties must help load and unload the aircraft.
- Full fuel drums are unloaded by rolling them down a cargo ramp.
- Snowmobiles are lifted to and from the cargo door or slid on a cargo ramp.

Flight Time Estimates, in hours (one-way from McMurdo)

Destination	Twin Otter	Basler	LC-130
Siple Dome	3.3	2.5	2
CTAM	2.5	2	1.7
Byrd Camp	6	4.5	3
WAIS Divide	6 (including a fuel stop at Siple Dome)	5	3.3
South Pole	5 (including a fuel stop at CTAM)	4	2.7

Preparing for Camp Put-In, Fixed-Wing

Camp put-in may require multiple flights. If so, field team members must ensure all essential, life-sustaining supplies and equipment are on the first put-in flight in case the second flight is delayed. This includes radios and satellite phones, sleep kits, stoves, matches, extra clothing, tents, and enough food, fuel, and water for an extended period. There have been cases where a field party waited two weeks for a second flight that was supposed to arrive on the same day as the first. Field teams must be flexible and develop "worst case" alternative plans.

Radio Communications

Before field deployment, project personnel must obtain a frequency assignment plan and radio call sign from the Field Operations Communication Center (FOCC). Also, every member of the field party should attend the Field Party Shop radio briefing, during which shop personnel will issue field radios and provide use instructions.

Ski-Way Preparation

Field teams should discuss ski-way preparation for the pull-out flight with fixed-wing office staff before deployment. Team members should pack a few extra bamboo poles, flags, and large black gar-

bage bags to use as ski-way markers. The flags also help identify wind speed and direction.

Reconnaissance Flights

The NYANG, KBA, or personnel at the fixed-wing office may determine that an aerial reconnaissance (recce) flight is required to assess landing conditions for the aircraft before the put-in flight. Fixed-wing office staff will work with the aircraft operator and the project team to define the scope and requirements of the recce.

Camp Put-In, Fixed-Wing

Communication and Shelter

During camp put-in, but before the aircraft departs, the field team must make radio contact with MacOps. The team must also erect a tent for shelter. The most efficient way to do this is to split the team into two groups. One sets up a tent and lights a stove (well away from the aircraft and turning area), while the other sets up the radio and antenna (also well away from the aircraft) and establishes communication.

Altitude and Grid North

Also, before the plane departs, one member of the field party must obtain the altitude of the camp site and the location of Grid North from the aircraft navigator or pilot. Grid North should be marked immediately with two flagged bamboo poles. The altitude is used to set the altimeter in the meteorological kit. Both parameters are necessary for weather observations and reporting.

Camp Communications, Fixed-Wing

Daily Check-in

At a pre-arranged time every day, field parties must engage in radio communication with McMurdo via the FOCC (call sign “MacOps”). Radio communication between some areas of Antarctica and McMurdo is poor. Sometimes it is necessary for field parties to relay their daily check-in through South Pole Station, a major field camp, or another remote field party. If a field party fails to make the daily check-in, the Emergency Operations Center (EOC) is activated and the emergency response chain is started, activating the SAR team.

In addition to the daily check-in, field teams may speak with the fixed-wing office any time between 0730 and 1900 daily in order to pass along information or request resupplies, schedule changes, or camp pull-out times.

Weather Observations

Field teams may be required to provide weather observations during daily communications and should be prepared with the information in the correct order. Field teams may also be asked to relay weather information for another field party.

When an aircraft mission to the field camp is planned, field team personnel are required to report weather observations hourly, beginning six hours before the scheduled launch of an LC-130 and three hours before a Kenn Borek aircraft. These observations continue until the aircraft lands. Refer to the Weather section for more information.

Camp Pull-Out, Fixed-Wing

The camp pull-out schedule must be coordinated with fixed-wing personnel, who will need detailed information regarding the weight, cube, and type of returning ("retrograde") cargo; the estimated weights and dimensions of any cargo pallets; and specifics of any scientific samples (e.g., keep frozen, do not freeze).

Waste Removal

Remote, deep-field groups must return all waste to McMurdo. This may or may not include human waste. See the Environmental section for more detail.

Equipment Staging

The field camp must be entirely broken down. All gear must be palletized (LC-130 flights only), staged, and ready for quick loading when the aircraft arrives.

Hazardous Equipment Packaging

All hazardous items should be packaged in a manner similar to how it was originally shipped (e.g., matches in foil, 12-volt batteries in wooden boxes). Partially full fuel drums should be tightly capped and tipped on their side to confirm a good seal. Snowmobiles must have between ¼- and ½-tank of fuel. No more and no less.

Caution: When shipping fuel drums on their side, ensure that spill containment is in place to catch any leakage.

Ski-Way Preparation

The ski-way should be prepared well in advance of the aircraft's arrival, per the requirements provided by fixed-wing office staff before the field team deployed.

Weather Observations

Field teams must provide hourly weather reports for the pull-out flight, as noted above.

Communication with Incoming Aircraft

The field team member assigned to the radio is responsible for communicating all requested information to the incoming aircraft. This person should know the condition of the ski-way, the current wind conditions, and the altimeter setting. While on final approach, the aircraft commander will not want to respond to radio transmissions, but he or she will appreciate short statements regarding changes in weather, particularly wind direction.

Note: Do not interfere with the aircraft during final approach unless there is an emergency.

Returning to McMurdo Station

Return all field equipment to the appropriate work center. Package and mark cargo that will be shipped to the U.S. Specific instructions for this process are in "Instructions for Packaging and Shipping," a document sent to all researchers before they deploy to Antarctica.

Helicopter Operations

The USAP operates a small fleet of helicopters in the McMurdo area under Federal Aviation Administration regulations. There are two different models: the AS350B2s (known as either "squirrels" or "A-Stars") and Bell 212s, which are civilian versions of the Huey. The helicopters are single-piloted, which means the pilots are responsible for all aspects of the aircraft's operation.

The maximum payload and maximum flight time of a helicopter depend on several factors, but the numbers listed below can be used for general-purpose planning.

Helicopter Specifications

	A-Star 350 Helicopter	Bell 212 Helicopter
Max. payload	3 passengers or 800 lbs.	8 passengers or 1800 lbs.
Max. flight time	2 hours 30 minutes	2 hours 30 minutes
Hatch	5' 6" x 3' 6"	7' 8" x 4' 2"
Cargo bay	16" x 20" x 27"	7' 8" x 4' 2" x 7' 11"

Helicopter Pad

Aviation administrative and logistics offices, including those of the helicopter supervisor and aviation coordinator, are located in the maintenance hangar at the helicopter pad (heli-pad). The small silver structure to the side of the hangar is the passenger terminal, where field team members report for a flight. A helicopter technician (heli-tech) briefs deploying field personnel there and later escorts them to the helicopter. Personnel may walk to this terminal without clearance or escort.

Caution: Never drive onto the heli-pad without radio clearance. Never walk onto the heli-pad without escort.

Preparing for Camp Put-in, Helicopter

Before camp put-in, field parties must confirm with the helicopter office a plan for the entire season, from put-in to pull-out. This plan should include estimated dates for camp moves, day trips, close support, and resupply.

Flight Requests and Cargo

Three days before an intended flight, the field team must submit a flight request to the helicopter office via the McMurdo Intranet. This request must include estimated cargo weights, the names of the passengers, and a list of hazardous cargo. The field party is responsible for bringing hazardous cargo to Science Cargo for packaging no later than two business days before the scheduled flight.

The day before the flight, the field party must collect all cargo, including BFC equipment, MEC equipment, and science equipment, and arrange for its transport to the heli-pad. Special arrangements can be made for gear or equipment that the team needs to use until the day of the flight. A heli-tech will prepare the cargo load(s) and provide a final manifest to the pilot.

The helicopter schedule is posted by 1900 on the McMurdo Intranet. A copy is also sent to each of the passengers. Unexpected or emergency flight requests should be communicated to the helicopter office as soon as possible.

Planning Information for Helicopters

Since weight is critical in determining cargo capacity, each passenger will be weighed before the flight. All cargo must be weighed and its volume (cube) determined by science project personnel.

Resupply Cargo

To reduce flight hours for camp put-in, field teams should use the resupply system. If teams intend to move camp locations during the season or use helicopter support for day trips from a camp, resupply is an economical use of helicopter time to receive additional food, fuel, and equipment. The helicopter is coming anyway and may have room for the requested items.

Field teams prepare resupply by packing boxes with desired items and keeping a careful inventory of each box. Boxes are marked and equipment items tagged with the science group number, the item or box number, the destination, and the weight in pounds. If the project has been allocated a cage, non-hazardous items are stored there. When resupply of a hazardous item is required, field teams must give two days notice for the USAP cargo staff to deliver it to the helicopter pad.

Field teams provide copies of the resupply inventory to the BFC supervisor and helicopter office, and they take a copy into the field. When resupply is required, field teams need only contact the heli-pad staff and request a specific box (e.g., box #2) from the cage. If no one is available in the helicopter office, team members can make the resupply request through MacOps.

Camp Put-In, Helicopter

The helicopter office must be able to notify the field team quickly of schedule changes, if any, on the day of the flight. If a member of the field team was issued a pager, it must remain switched on. If the team doesn't have a pager, helicopter office staff must know where to contact team members. Changes to flight schedules often occur and are generally the result of deteriorating weather.

All personnel and equipment must be at the heli-pad 30 to 45 min-

utes before the flight. All passengers are required to wear ECW gear or an approved equivalent. For safety reasons, no one is allowed to board a helicopter unless properly attired.

Note: All USAP personnel must attend a helicopter training course before boarding a helicopter for the first time.

Loading the Aircraft

In McMurdo, the heli-pad staff will load and unload the helicopter. At field locations, field team members must perform this function. The pilot is ultimately responsible for passenger safety and will determine if the helicopter can be loaded or unloaded with the rotors running. At certain times, the pilot may request that a heli-tech accompany the aircraft into the field to help load or unload cargo.

Boarding

A heli-tech will lead field team members to the helicopter when the pilot is ready for boarding. At the helicopter, either the pilot or a heli-tech will give a final safety briefing and point out where survival bags are located. Once seated, passengers must strap themselves in and connect to the helicopter intercom system. Passengers must not talk to the pilot during takeoff or landing.

Helicopter Safety Guidelines

- Any movement on the helicopter pad must be authorized by the heli-pad staff, either on the pad or in the hangar.
- ALWAYS obey the pilot's orders.
- NEVER approach a helicopter until the pilot gives a thumbs-up signal.
- NEVER walk near the tail rotor; always approach from the front of the helicopter.
- Carry long loads, such as bamboo poles, Scott tents, or survey rods, low and level to the ground.
- Do not smoke in or near the helicopter.
- Remain seated with seat belts fastened at all times.
- Wear a helmet.
- Assume the crash position if so warned by the pilot.
- In the event of an emergency, remain in the aircraft until all motion has stopped.
- Know the location and operation of emergency exits.
- Know the location of first-aid kits.
- Know the location of aircraft survival equipment.

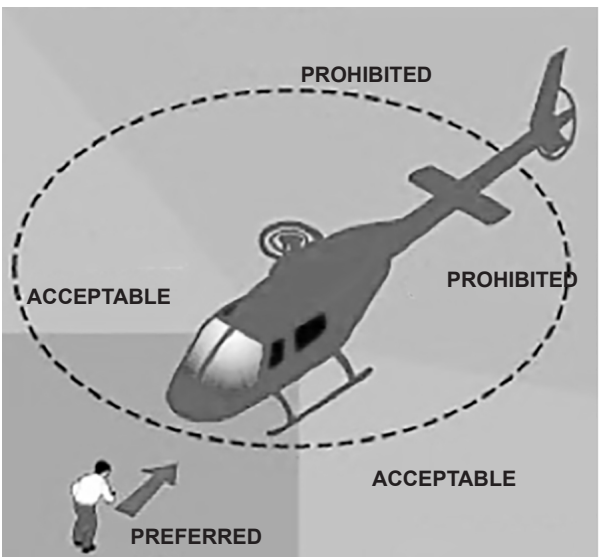
Survival Equipment

For all flights, helicopter pad staff will ensure sufficient survival bags are on board to accommodate all passengers. If a flight is for a camp put-in and all the required camp survival gear is aboard the aircraft, no survival bags are required.

Day Trips

Projects intending to remain in the field for the day must have at least two people, survival bags, proper clothing, urine bottles, plastic bags for human waste, and a VHF radio. All personnel should keep in mind that there is a chance they may be stuck in the field over-

Safety Around Helicopters



Do not approach without the pilot's visual acknowldegment. Remain in the pilot's view. Proceed in a crouching manner. Never, ever reach up or chase after a hat or other article that has blown away.

Carry supplies and tools horizontally and below waist level.

Always approach or exit on the downslope for more clearance.

If blinded by snow or grit, stop, crouch lower, or sit down and wait for help.

If disembarking while the helicopter is at the hover, get out and off in a smooth unhurried manner.

Never approach or leave when the engine and rotors are running down or starting up.

night. It is wise to pack extra water, extra high-energy food, extra warm clothes, reading material, and a toothbrush. Sunscreen, ear plugs, and a thermos with hot liquid are also recommended.

Flight Time Estimates (one way)

Destination	Time from McMurdo
Allen Hills	One hour
Cape Crozier	35 minutes
Cape Bird	30 minutes
Dry Valleys	35 to 40 minutes
Koettlitz Glacier	30 minutes
Marble Point	31 minutes (47 minutes with external load)
Minna Bluff	30 minutes
Mount Erebus	30 minutes
Lake Hoare	34 minutes (50 minutes with external load)

Camp Communications, Helicopter

Radio Equipment

All groups departing for the field are required to have VHF radios with the field party frequency plan. During the pilot brief, team members should discuss which channel will be used for helicopter-to-field-team communications. For a camp put-in, field teams must have the following equipment:

- HF radio(s)
- Handsets
- Antennas
- Batteries and recharging capabilities for the duration of the field stay
- A complete back-up radio

Daily Communications

After passengers disembark, the helicopter cannot leave until a team member has communicated with the pilot on the VHF radio. If communication cannot be established because of radio malfunction, the field party will be flown back to McMurdo. **Note:** Field parties should test radio equipment before deploying to the field.

Every field group must make daily radio contact with MacOps. Established field camps with phones can simply call in. Field teams at

camps using HF radio communication have various options if radio contact with McMurdo is poor; they can relay through another camp, South Pole, or Scott Base. The required daily check-in is extremely important, and various levels of SAR response will be initiated if a field party fails to make its daily check-in.

If a flight is scheduled for a field camp, the field party will be asked to provide a local weather observation between 0700 and 0730. Also, if the field party needs to make changes or if there is any other information to convey regarding support for that day, they must contact the helicopter office at that time. It is important to impart this information before 0730, which is when helicopter operations personnel begin developing the operational plan for that day.

Before returning from the field, all field parties need to contact the housing department in McMurdo to arrange accommodation.

Field Resupply

In camps with phone access to McMurdo, field parties can call individual departments for resupply items. These departments will notify the helicopter office of the resupply. Resupply requests can also be communicated via radio to the helicopter office. If no one is available there, field teams may communicate directly with MacOps, which will relay the information to the helicopter office. Helicopter operations staff will coordinate the requests with work center personnel, who will provide weight and cube information for load planning.

Schedule Changes

New flight requests and changes to flight schedules must be submitted three days in advance. Requests may be communicated over the radio or telephone, or they may be written and passed to the heli-pad staff via a pilot.

Camp Pull-Out, Helicopter

Field teams that return material and equipment to McMurdo throughout the season will find their camp pull-out relatively easy. To ensure that all camp items are picked up and nothing blows away, two team members should remain in the field to accompany the last flight.

Returning Material from the Field

The most efficient way to return material from the field is to use re-

duces the number of pull-out flights. During the daily communication with the heli-pad staff, field groups can pass information concerning retrograde material so it can be incorporated into the flight schedule. Remember: helicopters can sling loads back to McMurdo or to Marble Point for staging, so don't let boxes and barrels pile up at camp. Retrograde it early! Label waste properly, per instructions from the environmental and waste management departments.

Scientific Sample Shipment to McMurdo

Introduction

Scientific samples represent the end product of years of planning, months of work, and extensive funding by the NSF. They are irreplaceable. Therefore, all personnel involved with handling or transporting samples should follow an established procedure to ensure the preservation of scientific data.

This procedure addresses the unaccompanied transport of scientific samples from the field to McMurdo Station via helicopters or fixed-wing aircraft. It is designed to minimize the potential for loss or damage of these samples during transport, receipt, and storage. However, it is not meant to reduce flexibility. For example, if a field team member wishes to load samples on a helicopter but does not have the proper form, the samples will still be accepted, and all personnel will do their best to ensure they are properly handled.

Procedure

If a field team intends to send unaccompanied samples from the field to McMurdo Station, team members should discuss the process with the Crary Laboratory staff before deploying to the field. Crary staff will provide the team with either "Sensitive Sample" Chain of Custody (COC) forms and green DayGlo labels or "Non-Sensitive Sample" COC forms and pink DayGlo labels, depending on sample requirements.

In general, grantees package the samples, notify either the Crary Laboratory point of contact (ext. 4188, pager 855, or at mcm-LabSamples@usap.gov) or the Science Cargo supervisor, schedule pickup with aviation operations, and make necessary entries on the appropriate COC form.

It is the grantee's responsibility to package samples in a manner

that adequately protects them against temperature variations and vibration during transport. Packaging should be sufficient to cover extended periods due to weather or other delays. Appropriately colored DayGlo notices should be attached to sample boxes for ease of identification and tracking. These brightly colored labels draw attention to the boxes and reduce the likelihood that they will be misplaced or overlooked.

It is also important to enter on the COC form the aircraft tail number and the time samples were placed on the aircraft. The pilots, loadmasters, helicopter technicians, ground crew, Crary personnel, USAP cargo personnel, and others involved in the cargo process will fill out their portions of the COC and deliver the samples to the appropriate location.

The following information should be provided in any correspondence or radio communication regarding the samples:

- Number of containers
- Storage requirements
- Time of pickup
- ETA in McMurdo

COC forms and labels are available for all samples sent unaccompanied to McMurdo from the field.

Reference

Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times 30 minutes 10 minutes 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph)

Fuel	Tank Size		Gross Weight	Tare Weight	Cube
	55-Gallon		400lbs	50 lbs	16
	5-Gallon		45 lbs	10 lbs	2
Propane	**Tank Size**	**Net Quan-tity**	**Gross Weight**	**Tare Weight**	**Cube**
	100-pound	45kg	155 lbs	55 lbs	16
***Supply fills propane tanks to approximately 75% of capacity*	40-pound	18kg	69 lbs	29 lbs	4
	20-pound	9kg	37 lbs	17 lbs	3
	10-pound	5kg	23 lbs	13 lbs	2
Mechanical Equipment Center	**WEIGHT (lbs)**	**CUBE (ft^3)**	**Dimensions (LxWxH in.)**	**Fuel**	**Tank Size**
SNOW MOBILES					
Tundra snowmobile	400	123	115x37x50	Mogas/Oil	6.9 gallons
Skandic WT (1995, 96, 99)	575	136	119x41x48	Mogas/Oil	11 gallons
Skandic SWT 503 snowmobile	625	165	119x42x56	Mogas/Oil	11 gallons
Skandic SWT 550 snowmobile	675	160	124x43x52	Mogas/Oil	11 gallons
2009/11 Skandic WT 550 snowmobile	600	165		Mogas/Oil	12 gallon
Alpine I	685	118	114x35x51	Mogas/Oil	6.0 gallons
GENERATORS, BOXES					
1.0 Kw Honda generator	30	1.5	17x9x15	Mogas	0.61 gallons
1.8 Kw Honda generator	110	3.5	20x17x17	Mogas	2.9 gallons
Field Box; 1.8 Kw gen	65	9	27x22.5x24.5	n/a	No tank

GENERATORS, BOXES (continued)					
2.0 Kw Honda generator	50	2	18x18x10	Mogas	.96 gallons
2.5 Kw Honda generator	110	3	20x16x16	Mogas	2.9 gallons
3 Kw honda generator	68	3	17.3x15.7x18.9	Mogas	2.7 gallons
3.5 Kw Honda generator	145	5	24x20x19	Mogas	4.5 gallons
Field Box; 3.5/5.0 Kw gen	85	12	30x25x27.5	n/a	No tank
5.0 Kw Honda generator	180	6	26x20x20	Mogas	4.5 gallons
HEATERS					
Herman Nelson BT400-10 w/ cover	320	14	56x20x22	Mogas	16 gallons
Herman Nelson BT400-45 OCH w/ cover	350	34	54x23x48	Mogas	16 gallons
Herman Nelson BT400-45 OCH w/ cover and trailer	526	120	81x44x58	Mogas	16 gallons
Hermie Prime Mover, Honda GX 160, goes with -45	44	3.5	19x15x19	Mogas	No tank
Hermie Prime Mover, AU7-B-344, with -10	60	2.5	16x16 diam.	Mogas	No tank
Hermie Prime Mover AU7-B-344, with -10 w/ box	100	5	20x20x20	Mogas	No tank
Arcotherm (Field unit with skiis)	395	115		JP8	
TRIWALL					
Triwall	20	3.5	20X20X16		
Triwall	35	31	41X36		
Triwall, large (44 cube)	42	44		None	No tank
Triwall, small (18 cube)	26	18		None	No tank

Conversion Table

	To Convert	To	Multiply By
Weight	Pounds	Kilograms	0.4536
	Kilograms	Pounds	2.2046
Distance	Inches	Millimeters	25.4
	Millimeters	Inches	0.0394
	Inches	Centimeters	2.54
	Centimeters	Inches	0.3937
	Meters	Feet	3.2808
	Feet	Meters	0.3048
	Meters	Yards	1.0936
	Yards	Meters	0.9144
	Kilometers	Miles	0.6214
	Miles	Kilometers	1.609
	Kilometers	Nautical Miles	0.5396
	Nautical Miles	Kilometers	1.853
	Statute Miles	Kilometers	1.6093
	Kilometers	Statute Miles	0.6213
Density	Cubic Feet	Cubic Meters	0.0283
	Cubic Meters	Cubic Feet	35.3145
	Cubic Yards	Cubic Meters	0.7646
	Cubic Meters	Cubic Yard	1.3079
Volume	Liters	Gallons	0.2642
	Gallons	Liters	3.7854
	Liters	Pint (liquid)	2.1134
	Pint (liquid)	Liters	0.4732

NZDT - Zulu Time Conversion

NZDT	Zulu	NZDT	Zulu
0:00	11:00	13:00	0:00
0:30	11:30	13:30	0:30
1:00	12:00	14:00	1:00
1:30	12:30	14:30	1:30
2:00	13:00	15:00	2:00
2:30	13:30	15:30	2:30
3:00	14:00	16:00	3:00
3:30	14:30	16:30	3:30
4:00	15:00	17:00	4:00
4:30	15:30	17:30	4:30
5:00	16:00	18:00	5:00
5:30	16:30	18:30	5:30
6:00	17:00	19:00	6:00
6:30	17:30	19:30	6:30
7:00	18:00	20:00	7:00
7:30	18:30	20:30	7:30
8:00	19:00	21:00	8:00
8:30	19:30	21:30	8:30
9:00	20:00	22:00	9:00
9:30	20:30	22:30	9:30
10:00	21:00	23:00	10:00
10:30	21:30	23:30	10:30
11:00	22:00	11:30	22:30
12:00	23:00		
12:30	23:30		

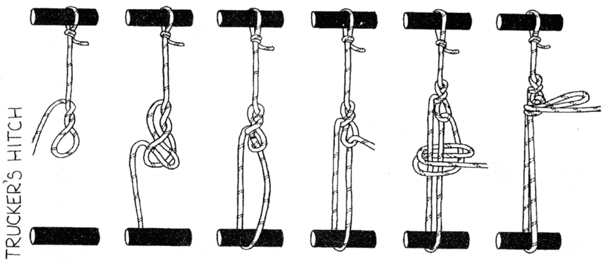
Weather observations are reported in Zulu Time. For example, the 8:00 am weather observation from a McMurdo-based field camp operating on New Zealand time would call in the 1900 Zulu observation.

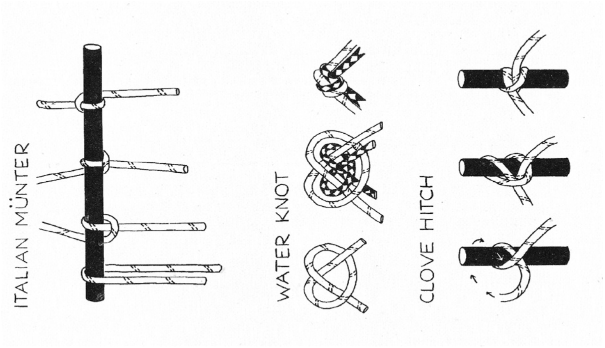
New Zealand Daylight Savings (NZDT) time is generally September to April. NZDT to Zulu is GMT+13 hours.

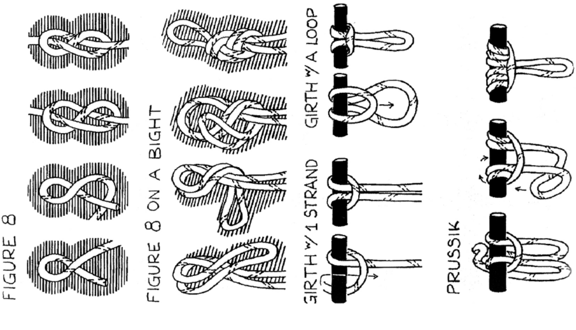
Temperature Conversions

Fahrenheit	Celsius
40	4.44
35	1.67
32	0
30	-1.11
25	-3.88
20	-6.66
15	-9.44
10	-12.22
5	-15
0	-17.77
-5	-20.55
-10	-23.33
-15	-26.11
-20	-28.88
-25	-31.66
-30	-34.44
-35	-37.22
-40	-40.00
Fahrenheit to Celsius: (F degree-32) x (5/9)	
Celsius to Fahrenheit: (1.8 X C degree)+32	

Knots

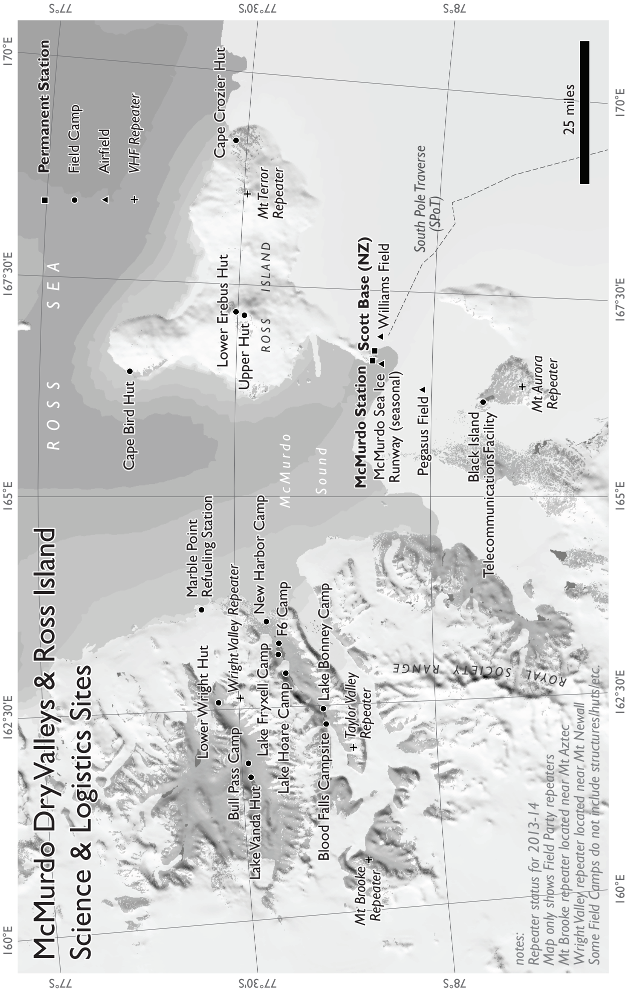






REFERENCE

Dry Valley and Ross Island Science Logistics

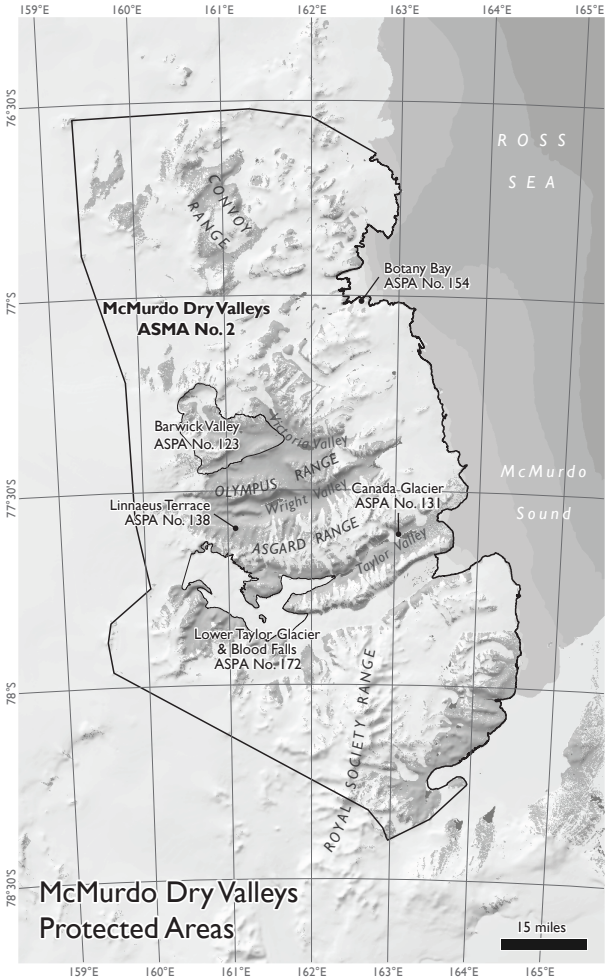


REFERENCE

Taylor Valley camps

REFERENCE

Dry Valley ASMA



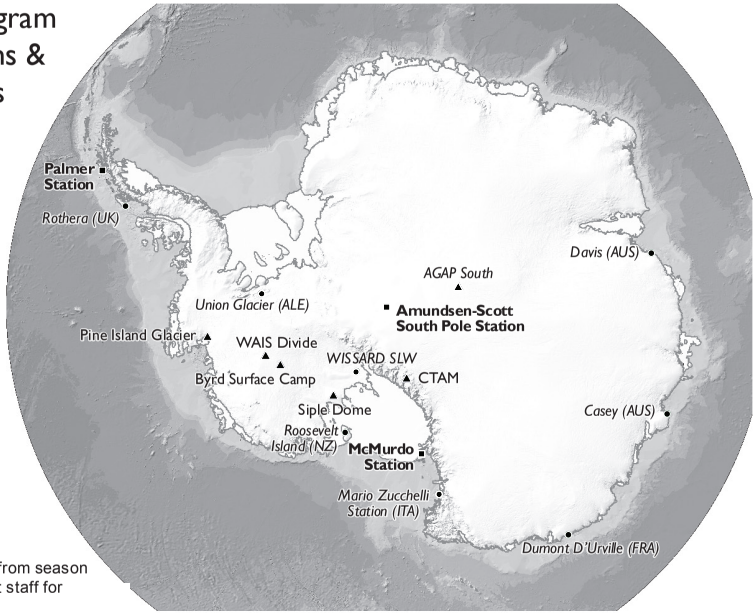
REFERENCE

Ross Island ASMAs

REFERENCE

U.S. Antarctic Program Permanent Stations & Deep Field Camps

- ■ **Permanent U.S. Station**
- ▲ Deep Field Camp
- • *Other USAP or International Site*



Note: Deep-field camps change from season to season. Contact Field Support staff for current locations.

First Aid

Basic Field First Aid Manual

This First Aid Manual describes some of the medical issues that may be encountered in an Antarctic field environment. This is not an exhaustive manual, but it will serve as a guide to those with limited medical background to help treat their companions. It should be read in advance to help field team members recognize dangerous situations and help prevent injuries from occurring or becoming more serious if they do occur.

Antarctica is an inherently risky environment. Participants are often dehydrated, mildly hypothermic, and sleep deprived. This can lead to an increase in accidents. It is essential that all team members slow down, assess each task, and ensure the safety of the team.

There are a variety of medical kits provided to teams depending on their activities, locations and needs. Team members should familiarize themselves with the contents of the the kit – before there is a need to use it.

Hygiene

Occasionally, people deploying to the deep field use the remote environment as an excuse to abstain from normal hygiene and sanitation. Extreme cold temperatures, lack of running water, and communal living make bathing, brushing teeth, and basic hygiene a chore.

People must continue with a normal hygiene routine to avoid painful and distracting issues that can occur in the absence of cleanliness, such as dental abscesses, gum pain, yeast infections, skin rashes, cracked skin, and trench foot.

Wet-wipe and sponge baths are the norm. If wet wipes are preferred, personnel should bring enough for the anticipated time in the field. Blanket partitions can be set up in large tents to create a semi-private space.

Sprains and Strains

Sprains and strains are the most common injuries in Antarctica. People must work carefully, thoughtfully, and deliberately to avoid them. A sprain is an injury that involves tearing the ligaments that help keep joints intact. A strain involves overstretching a muscle.

Sprain and Strain Signs and Symptoms

Sprains and strains will manifest as pain at the site of the injury that may radiate outward. There will also be swelling and discoloration.

Sprain and Strain Treatment

- **R** Rest: Stop activity, make the patient comfortable, and set up shelter if necessary.
- **I** Ice: Cool down the affected area with water, snow, or ice for approximately 15 minutes. Don't apply directly to the skin.
- **C** Compression: Wrap the affected area with an elastic bandage.
- **E** Elevation: Keep the affected limb raised to reduce swelling.

Immobilize the Joint

Fingers: Wrap them together.

Wrist: Splint it if it is very swollen. If not swollen, or when the swelling subsides, bandage it from the palm to the elbow, including the thumb, with an elastic (ACE™) bandage. The patient should exercise the fingers, elbow and shoulder regularly.

Knee: If it is very swollen, suspect a more serious injury. With the knee as straight as possible, wrap a thick layer of cotton wool around the leg from mid-calf to mid-thigh and then apply an elastic bandage.

Ankle: The foot must be kept at a right angle to the leg. Remove the boot. Using an elastic or tape bandage, bandage the foot from the toes to just below the knee, keeping the foot up and covering all the skin. If the ankle is very swollen, especially on both sides, then a more severe injury should be suspected.

Caution: Do not wrap bandages too tightly. Toes must remain warm and pink and have feeling.

Bleeding and Wounds

Treatment of External Bleeding

Check the wound for foreign bodies, while being careful not to disturb any clots. If no foreign object is seen, apply direct pressure over the wound with your fingers, palm, or whatever is necessary to cover the wound, attempting to hold the edges of the wound together. This may be maintained by using Steri-strips® or tape. Place a sterile-dressing pad over the wound, ensuring that the edges of the pad

extend well beyond the edges of the wound. Secure the pad with a bandage.

If bleeding is not controlled by the first dressing, then apply another dressing on top. Do not remove the previous dressing before applying the second, as this might destroy any clotting that has occurred. If the bleeding is from a limb and no fracture is suspected, the limb should be elevated and supported.

Foreign Bodies

If foreign bodies are present on the surface of the wound, carefully remove them if they can be wiped off easily with a swab. If a large foreign body is embedded, never attempt to remove it. It may be plugging the wound and restricting bleeding. Moreover, the surrounding tissues may be injured further if it is pulled out. If the embedded foreign object is too tall to cover, place rolled up dressings on either side of it. Secure the dressing(s) with a bandage.

Treatment of Wounds

Clean all wounds with Betadine® antiseptic liquid and apply a sterile dressing. Small wounds can be taped together with Steri-strips® or Band-Aids®. Dry the edges of the wound, squeeze together, and stick the Band-Aid® across the wound. Several may be needed to hold the cut together. Apply a sterile dressing over the top and bandage it. If a serious infection is indicated, advise medical personnel as soon as possible. Infection may be present if there is increasing pain, swelling, redness, and/or fever.

Carbon Monoxide Poisoning

Carbon monoxide (CO) can be produced by burning anything containing carbon, including fuel in open flames, gas cookers, or engines. CO poisons by attaching itself to the hemoglobin in the blood. It does so about 200 times more readily than oxygen, easily displacing inhaled oxygen. When enough hemoglobin is compromised, the remainder cannot carry sufficient oxygen to the rest of the body. Oxygen starvation of the brain will cause permanent damage, even if the patient is revived. Furthermore, the toxicity of CO increases with altitude.

Carbon Monoxide Signs and Symptoms

Often there are none. However, the following may occur:

- Slight headache
- Shortness of breath
- Panting
- Confusion
- Nausea
- Chest pains
- Dimming of vision
- Feelings of exhilaration or lassitude
- Dizziness
- Excessive yawning
- Ringing in the ears

In latter stages, the patient's skin color becomes pink to cherry red, though the red and yellow polar tents will make it difficult to notice any skin color change. Unconsciousness and death is often rapid.

Carbon Monoxide Treatment

If carbon monoxide poisoning is suspected:

- Immediately move the patient to fresh air or to an uncontaminated tent.
- Provide the patient with 100% oxygen, if available.
- Contact Medical and describe the incident and symptoms.
- Keep the patient quiet and resting for at least eight hours. Early exertion may cause cardiac arrest.
- If breathing stops, commence cardio-pulmonary resuscitation (CPR).

Carbon Monoxide Poisoning Prevention

Field parties must utilize the issued carbon monoxide detector. Team members must ensure there is adequate ventilation at all times in all buildings, shelters, and vehicles. Tents or other shelters must be thoroughly ventilated during cooking and before personnel bed down each night.

Hypothermia

Hypothermia occurs when a person's core temperature is reduced to a level where normal brain and body functions are impaired. Hypothermia progressively affects a person's judgment, perception, and coordination.

Wind greatly increases the chilling effect of cold. The faster the air

moves, the more heat it can drag away. This is wind chill. The cooling effects of air can be seen by referring to the wind chill chart in the reference section.

Wet clothes, from sweating, marine dampness, or precipitation also cause chilling. Finally, fatigue reduces a person's ability to protect himself or herself, and it diminishes the physiological capacity to thermoregulate and maintain a proper core temperature.

Hypothermia Prevention

Hypothermia is prevented by wearing the proper clothing and by supporting and regulating the body's heat production. Proper nutrition and hydration help prevent hypothermia, and adequate rest is critical. Exhaustion promotes the onset of hypothermia and precedes its development in almost all cases. The tendency to "press on" has led to many unnecessary deaths.

A layered clothing system should be employed, where layers can be added or removed as needed. Field team members should not allow themselves to get either cold or hot and sweaty.

Hypothermia Signs and Symptoms

Hypothermia manifests in three stages:

- Mild: This stage includes shivering and personality changes. A person may become withdrawn, apathetic, or irritable. There is a loss of fine motor control. Field party members should always be on the alert for a team member displaying the "umbles": stumbles, mumbles, fumbles, and grumbles.
- Moderate: At this stage, hypothermia progresses to violent shivering, altered mental states, and disorientation. Moderate hypothermia also manifests as a loss of gross motor skills, such as balance and coordination (ataxia).
- Severe: In this stage, shivering stops and the level of responsiveness drops. A person becomes unresponsive and may appear dead, with very slow and weak pulse and respiration rates. An individual will appear cold and blue, and he or she may have associated frostbite. Cardiac arrest is possible.

Hypothermia Treatment

The essential and immediate treatment for hypothermia is to prevent further heat loss by insulating the body. If any member of a field party shows signs of developing hypothermia, the individual must be

moved into shelter immediately.

Mild hypothermia may be turned around quickly. A person with this condition should be:

- Helped into additional clothing layers and fed quick-energy carbohydrates and warm, sweet drinks, such as hot chocolate or warm electrolyte beverages.
- Encouraged to run in place or perform another exercise.
- Provided dry clothes, if necessary, and external heat sources, such as hot pads or water bottles filled with warm fluid.

If moderate to severe hypothermia is suspected, contact Medical immediately. The patient should be placed in a hypothermia wrap, which is a bundle made of sleeping bags and reflective sheeting, with warm heat sources on the patient's neck, armpits and groin. (Body-to-body rewarming in a sleeping bag is of limited usefulness and may result in two cold people.)

Frostbite

Frostbite is freezing of body tissue. Areas most at risk are the extremities and exposed skin (ears, nose, face). Factors that lead to frostbite are:

- Previous frostbite injury
- Cold temperatures and wind
- High altitude
- Overexertion (fatigue and dehydration)
- Touching metal or super-cooled liquid fuel
- Poor circulation
- Constrictive clothing or footwear
- Underlying medical problems
- Hypothermia

Frostbite Prevention

Frostbite is almost always avoidable. A buddy system should be established to observe any whitening on the face or ears of a companion. If any whitening or tingling of the face, ears, feet, or hands occurs, these areas should be warmed immediately. Socks and bootsshould fit snugly, with no points of tightness. Liner gloves should be worn so that skin is never exposed when performing work that can't be done in heavy gloves.

Strenuous exercise should be avoided in extreme cold, particularly at high altitudes. Very cold air brought too rapidly into the lungs will chill the body's core. Perspiration under conditions of extreme cold should be avoided. Perspiration evaporates, chilling the body.

Plenty of food should be consumed to produce maximum output of body heat. Food items in cold weather should tend toward quick energy first, such as fats and carbohydrates, and then proteins. In addition, personnel should drink two to three liters of water per day to stay hydrated.

Avoid the following, which can promote the occurrence of frostbite:

- Smoking
- Alcohol
- Excessive coffee and tea drinking
- Excessive fatigue
- Improper or inadequate eating habits
- Unnecessary medication
- Exposure to fuel, especially on bare skin

Mild Frostbite Signs and Symptoms (pre-thaw)

There is an uncomfortable sensation of coldness, followed by numbness and skin anesthesia. In superficial frostbite (frost nip), the skin turns red, then pale or waxy-white. In partial thickness frostbite, the skin becomes cold and frozen on the surface, but remains soft and pliable when gently pressed.

Full-Thickness Frostbite Signs and Symptoms (pre-thaw)

The skin is waxy-white. Toes and fingers become solid (like a piece of chicken taken from the freezer). They feel wooden, and the skin cannot be rolled over the bone.

Full-Thickness Frostbite Signs and Symptoms (post-thaw)

The entire hand or foot swells, which limits the mobility of the injured toes or fingers. Blue, violet, or grey (the worst) discoloration appears. After two days, the patient suffers severe throbbing and shooting pains. Huge blisters form, usually between the third and seventh day. These usually dry up, blacken, and slough off, leaving an exceptionally sensitive thin, red layer of new skin.

Frostbite Treatment

Frostbite should not be rubbed, as this will cause additional tissue damage from the ice crystals within. Treatment in the field for any-

thing beyond superficial frostbite is full of challenges and additional risk for the patient. Prevention is paramount!

Superficial Frostbite Treatment (Frost Nip)

Superficial frostbite can be treated effectively in the field. If noticed promptly, it can usually be treated by the firm, steady (no rubbing) pressure of a warm hand or by blowing onto it with warm breath. Superficially frostbitten feet are best treated by removing the patient's footwear the moment there is any suspicion of danger and rewarming the feet immediately. After warming is complete, the affected feet should be covered with dry socks. If footwear is replaced, it should be done loosely to ensure adequate circulation and warmth is maintained.

Partial-Thickness Frostbite Treatment

Partial-thickness frostbite of a small body area should be reheated in water that is between 42°C and 43°C (107°F and 109°F). Water at higher temperatures can burn the skin. The injury should then be treated to prevent infection, bandaged for protection, and kept warm. Refreezing must be prevented, as this will cause major additional damage. Medical personnel should be consulted if necessary.

Full-Thickness Frostbite Treatment

Because of limited resources in the field, full-thickness frostbite is a major medical emergency. Medical personnel should be contacted immediately for consultation and to discuss evacuation plans. Rewarming should not be attempted in the field if there is any possibility that the affected part may become refrozen. In such cases, the affected part must be kept frozen until it can be re-warmed rapidly under controlled conditions.

If rewarming is recommended, remove jewelry (especially rings) if possible. Immerse the injured part in 42°C to 43°C (107°F to 109°F) water, continually adding water and stirring it to maintain a constant temperature, until the digital tips (ends of fingers or toes) turn pink or burgundy red. This takes approximately 20 minutes to one hour. When adding water, take care that the water is not more than 44°C and is not poured directly over the injured body part.

Significant pain, swelling, and blistering will develop after re-warming. Do not puncture the blisters, and do not allow the injury to refreeze.

Protect the thawed injury with sterile, soft, fluffy dressings. Separate toes and fingers with cotton wool. Wrap the whole part lightly with

gauze bandages. Do not change dressings unless they get dirty, and never rub the skin. Keep the patient and the injured body part warm. Pain medication will be needed, and medical personnel will advise on specific type and dose. In addition:

- Elevate the injured limb(s)
- Commence antibiotic treatment, per medical personnel instruction
- Keep the patient absolutely still, lying down
- Evacuate to a medical facility as quickly as possible

Immersion Foot

Immersion foot, or trench foot, is a medical condition caused by prolonged exposure to cold, damp, and unsanitary conditions.

Immersion Foot Prevention

Feet should be kept warm and dry by wearing protective footwear, and they should be checked frequently during wet and cold conditions. Footwear should not be constrictive, and it should be cleaned and dried at every opportunity. In the field, extra pairs of dry socks should be carried next to the abdomen under the shirt. Wet socks can be dried by placing them next to the abdomen, either inside or outside the shirt.

If feet get wet, they should be dried as soon as possible. They can be warmed by the hands. Foot powder should be applied and dry socks put on. If it is necessary to wear wet socks and footwear for any length of time, then the feet should be exercised at regular intervals by wriggling the toes and bending the ankles.

Immersion Foot Signs and Symptoms

The area becomes cold, swollen, waxy-white and mottled with burgundy-to-blue splotches. The skin becomes numb, deep sensation is lost, and movement of the affected area becomes difficult.

If allowed to continue untreated, the area becomes red, hot, and swollen, and blisters appear. The victim experiences constant throbbing and a burning sensation. Skin numbness is aggravated by heatand relieved by cold.

Immersion Foot Treatment

Remove wet footwear. Gently and rapidly rewarm the affected foot by immersing it in warm water (about 40˚C). Once the foot is

warmed, dry it completely and elevate it in a warm room. Swaddle it with clean bandages or cloth to keep it warm and clean.

The injury must not be rubbed or massaged. Blisters should be kept clean and dry. Do not apply ointments. Two 200 mg ibuprofen tablets every four hours may be administered for pain, if required. Evacuate the victim to a medical facility.

Altitude Sickness

Altitude sickness (also called acute mountain sickness, or AMS) is caused by the body not adapting to the reduced availability of oxygen at altitude (as elevation increases, barometric pressure decreases). The higher the altitude, the more common AMS becomes. Symptoms may range from minor lethargy to a coma, and death may result, so any symptom must be treated with caution. Anyone can be affected by altitude sickness, regardless of age, fitness level, or previous experience at altitude. Healthy individuals may experience symptoms as low as 2,500 meters (8,200 feet). Beyond 3,000 meters (9,840 feet), 75% of people will experience some level of AMS. The symptoms usually start 12 to 24 hours after arrival at altitude and begin to decrease in severity around the third day. Mild AMS does not interfere with normal activity, but anyone experiencing symptoms should communicate this to others so the person can be monitored.

Many work sites in Antarctica, such as Amundsen-Scott South Pole Station and Mount Erebus, are at high altitude. The Fang Glacier acclimatization camp on Mount Erebus is at 2,900 meters (9,500 feet), with South Pole Station only slightly lower. Since the polar atmospheric effect raises the pressure altitude 10% to 15% above actual elevation, both of those locations will feel like 3,200 meters (10,500 feet) or more, increasing the risk of AMS.

AMS risk is also increased by rapid ascent to altitude (e.g., by aircraft), so team members must factor sufficient time for acclimatization into their schedule when flying to a high-altitude site. Minimum work should be planned for the first few days.

Altitude Sickness Prevention

It is common to fly to altitude in Antarctica, thus increasing the risk of altitude sickness. For those traveling to Mount Erebus (3,794 meters, 12,450 feet), spending at least two nights acclimatizing on the Fang Glacier seems to reduce altitude-related problems. Unfortu-

nately, it is usually not possible to have acclimatization camps for polar plateau work. For those traveling to the plateau, bring altitude medicine (if medical personnel advise doing so), and pack Gamow bags and oxygen, if possible. In addition, taking these steps can reduce the incidence of AMS:

- Do not overexert upon arrival at altitude (take it easy for the first three days)
- Avoid depressant drugs like sleeping pills and narcotics
- Avoid alcohol and tobacco
- Get plenty of sleep
- Stay hydrated
- Consider taking Diamox® (discuss this with Medical beforehand)

Above all, adjust expectations of how much work can be completed in the first few days at altitude. Team members should check in on each other constantly and let each other know how they are doing. Stoically withholding information could be dangerous and is poor expedition behavior. If a team member is still not feeling better after 72 hours, follow up with Medical.

Altitude Sickness Signs and Symptoms

Mild/Moderate AMS - Most people arriving at altitude will see their breathing rate increase immediately. Other mild symptoms include headache, nausea, fatigue, and lack of appetite. The average time to recover from mild AMS is approximately three days. Full acclimatization may take two months. Yet, a small number of individuals are unable to acclimatize at all. Prior experience at altitude does not exclude a person from contracting altitude-related illnesses, nor does a high level of fitness.

Moderate AMS - Moderate AMS will manifest as a more severe headache (which is not relieved by medication), increased nausea and vomiting, increased lethargy, loss of appetite, light-headedness, disturbed sleep, shortness of breath (even while resting), and decreased coordination. Normal activity becomes difficult. Though these symptoms may be due to other causes, it is wise to assumethey are due to AMS until proven otherwise. The only treatments for moderate AMS are advanced medication or immediate descent to a lower altitude, with the latter being the preferable option. Without treatment, moderate AMS could become more severe.

Severe AMS - Severe AMS may manifest as High Altitude Cerebral Edema (HACE) or High Altitude Pulmonary Edema (HAPE), or

both. Signs and symptoms of severe HACE are loss of muscular coordination (ataxia), decreased mental status (confusion, coma), severe headache, weakness, and vomiting. It appears that persons who have had HACE in the past are more susceptible to developing it again.

HACE is a potentially fatal condition. Altered consciousness and loss of coordination are the base markers for HACE. The individual will be unable to take care of basic needs (eating and dressing). Within a day of losing coordination, HACE victims slip into a coma. Without proper medical care, death will result.

HAPE, however, is the most common altitude-related cause of death. Earliest signs are decreased exercise performance and increased recovery time. Specific HAPE signs and symptoms are dry cough, shortness of breath at rest, a gurgling/crackling noise heard in chest during breathing, and pale or blue color to skin and nail beds (cyanosis). In the late stages, a wet, productive cough will be present. As with HACE, people who have had HAPE in the past have a high likelihood of developing it again. Both the Lower Hut on Mount Erebus and South Pole Station have seen more than a few cases of HAPE over the decades.

Altitude Sickness Treatment

*Acetazolamide (*Diamox®*)* is used as a preventive measure before going to altitude. It is a diuretic and respiratory stimulant that accelerates the body's acclimatization. With the consent of medical personnel, team members should begin taking it several days before ascent.

*Dexamethasone (*Decadron®*)* is another preventive pharmaceutical that reduces swelling of the brain. It also used as a treatment. In the latter case, medical personnel can authorize its administration.

Mild to moderate AMS requires rest, medication for headaches and nausea, hydration, proper nutrition, and supplemental oxygen, if available. If AMS occurs, the best treatment is rapid descent. Contact medical personnel to discuss the severity of the case and recommendations for evacuation. Supplemental oxygen is helpful, in addition to using Diamox® and/or Decadron®.

A Gamow bag is a portable hyperbaric chamber that simulates rapid descent. It has saved hundreds of lives at altitude worldwide since its introduction in 1990. If descent isn't possible because of flight delays or because team members cannot take the victim down

themselves, a Gamow bag is the best asset to have. The elevation at which teams will be working will determine if the members need to be trained in Gamow bag operation and issued one for the field.

HACE Treatment

Early, simple tests (similar to roadside sobriety tests) can be conducted to look for the loss of coordination that is the hallmark of HACE. Individuals may be asked to stand with eyes closed and arms extended to the side, then asked to touch their nose. Also with eyes closed, they may be asked to walk forward, heel to toe. Be sure that someone is ready to catch them if they stumble. However, differentiating between moderate AMS and the initial stages of HACE may be difficult. Assume the worst and treat for HACE.

Severe AMS/HACE requires an urgent call to Medical. Evacuation is likely. If immediate descent is not possible, the patient should be placed in a Gamow bag. Provide the patient with oxygen. Medical personnel may also prescribe Diamox® and Decadron®.

HAPE Treatment-URGENT

If HAPE is suspected, contact Medical immediately to request an evacuation. Immediately descend 600 to 1,200 meters (2,000 to 4,000 feet), if possible. Use a Gamow bag while waiting for evacuation, and provide the patient with oxygen. *Nifedipine* may be helpful. Medical can authorize administration of this medication.

Eye Injuries

Tent Eye

Antarctica's extreme low humidity may cause the film of tears protecting the eye to dry up, making the cornea susceptible to damage from stove fumes in the tent. The condition can be treated by applying Chlorsig® ointment to the eye when it occurs and/or before going to sleep.

Snow Blindness

Snow blindness is caused by ultraviolet (UV) light burning the eyes. The danger of snow blindness is greatest not on clear, bright days but on dull, cloudy (whiteout) days, when crystalline snow mist is present. There is no warning that damage has been done until the symptoms begin to appear two to twelve hours after exposure.

Snow Blindness Signs and Symptoms

Snow blindness manifests as intensely painful, red, watering eyes that are sensitive to light. The victim will also feel as though there is grit in the eyes.

Snow Blindness Treatment

A single episode of snow blindness may last up to five days, even while being treated. The eyes should be rested for at least 24 hours. That means closing them and covering them with a non-fluffy pad. If the temperature is above freezing, a cold compress may be placed over the affected eyes to relieve pain. Medical should be contacted for treatment recommendations and possible medications. Medical personnel may recommend providing the victim two tablets of ibuprofen (400 mg) every four hours, as required, or putting Chlorsig ointment on the eyes every three hours.

Snow Blindness Prevention

This condition must be avoided, as it is a crippling injury that may seriously delay a field party. Team members should wear dark, UV-protective glasses or goggles with the appropriate lenses (not yellow) at all times when in the field, especially on overcast days.

Skin Injuries

Sunburn and Windburn

Direct exposure to the sun, especially when it is very windy or the body is wet with sweat, can result in a sunburn and chaffed skin. Because the Antarctic air is cleaner and thinner, there is greater ultra-violet penetration, so sunburn can occur even on overcast days. If sunburn occurs, apply aloe vera gel to the burn and provide the victim 400 mg of ibuprofen every four hours, as necessary, to relieve pain.

Sunburn and Windburn Prevention

Prevent sunburn by applying sunscreen ChapStick® to the lips and regular sunscreen to other areas of exposed skin. Covering the face with a balaclava will prevent both sunburn and windburn to this frequently exposed area.

Dental Health

Oral Hygiene

Oral hygiene can be inconvenient in the field, but it is just as important as bodily hygiene. Failure to maintain good oral hygiene may result in increased tooth decay (especially around the edges of fillings) and gingivitis. Ideally, teeth must be brushed after every meal, with snow if no water is available. Use toothpicks or waxed dental floss to clean gaps between the teeth that are hard to clean with the brush.

Controlled Medications

Issue of Restricted Drugs

The McMurdo clinic issues a field medication kit containing over-the-counter, prescription, and controlled medications (restricted drugs) to each designated field party medical lead. The field medication kit is the responsibility of this person. The medical lead (or any USAP participant) must contact a station doctor for consultation and authorization before administering any medication. Always check for any known allergies before administering drugs.

Chain of Custody

McMurdo clinic personnel will fill out a controlled drug Chain of Custody form and provide it to the field medical lead. The lead must account for all controlled substances when the kit is checked out, weekly, and when the kit is returned. If the lead departs before the end of the season, he or she must complete a new Chain of Custody form and count the medications before transferring the kit to another person. At the end of the season, the medical kit must be returned to the clinic.