UNITED STATES ANTARCTIC PROGRAM

Field Manual

Continental Version 2024

This Manual was prepared for the U.S. National Science Foundation Office of Polar Programs (NSF/OPP) by Antarctic Support Contract (ASC) field support personnel and grantees. It brings together decades of first-hand field experience in Antarctica with the United States Antarctic Program (USAP).

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Suggestions and corrections are encouraged and should be sent to DEN-FieldSafety@usap.gov.

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Program Information

U.S. National Science Foundation Introduction

The United States Antarctic Program (USAP) Field Manual provides an overview of USAP field logistics, operations, and safety. It contains information relevant to living and working in an Antarctic field camp and is intended to enhance your success in the field. This reference manual provides valuable knowledge, and you should read it before deploying and take it into the field with you. It is your responsibility to be familiar with the skills and techniques covered in this manual.

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. 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 work environment in Antarctica.

This manual is designed to be used in conjunction with the USAP Participant Guide located at www.usap.gov. The USAP Participant Guide provides general programmatic information that complements the guidance in the Field Manual. 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 safe and successful field season.

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Emergency Management

The Emergency Operations Center (EOC) is on call 24/7. The EOC is initiated by the NSF station manager after receiving initial information from Central Comms. The staff will collect the caller's name, phone number, and location; classify the situation (e.g., injury or illness, spill, aircraft mishap, vehicle accident, loss of shelter); and gather the information necessary to assess needs and risks and determine appropriate actions. If a search-and-rescue (SAR) is launched, it may involve the USAP SAR team and/or the Joint

SAR Team (JSART), which is composed of both USAP and Antarctica New Zealand (AntNZ) personnel.

In the Event of an Emergency

1. Assess the situation: is it medical, mechanical, logistical.
    a. Survey the scene: is it safe, what happened, how many are involved.
    b. Primary assessment and determine the ABCDE's (airway, breathing, circulation, disability and exposure). Perform necessary first aid, or any sort of action that would stabilize the situation (in the case of mechanical, logistical), monitor.
    c. Radio for help if needed, alert other field team members.
    d. Call Central Comms to give initial report: condition of patient, plan and what is needed. Establish a call back time.
    e. Perform secondary assessment: interview patient, take vitals, perform head to toe assessment.
    f. Keep patient warm and dry, move to shelter if possible, be reassuring, and provide food and warm liquids if appropriate. Improvise toilet equipment, if necessary.
2. Document
    a. Take notes: the more the better.
    b. Write a SOAP note if managing a medical situation (SOAP note is an organized way to take notes about a patient, see reference chapter for a SOAP note template).
3. Resources
    a. Inventory of available resources.
        i. People - define roles and responsibilities.
        ii. Standard Operating Procedures
            1. Wilderness Medical Guidebook (issued from Berg Field Center)
            2. Deep Field Camp Medical Manual
        iii. Equipment (first aid, medical, mechanical)
4. Decide/Plan
    a. With the help of the EOC, a decision will need to be made.
        i. You are on the ground and the best ones to answer how outside help can be of assistance.
        ii. Have a list of questions and/or asks for the EOC.
        iii. What do you need to immediately stabilize the situation.
        iv. Continue to monitor the situation by documenting, clearly communicating to your team and establishing regular check in times.

Notify appropriate manager and other involved parties about the incident. Complete and submit the required incident report as soon as possible example Incident Form in Reference chapter.

Some Additional Tips/Tricks

Be prepared prior to calling Central Communications (Central Comms.). Iridium® phones can drop calls or cut out momentarily so have a concise message when initially establishing a call.

- Prepare focused questions.
- Be able to take notes (or have someone ready to do so).
- Have your documentation ready (Use of the Incident worksheet is helpful).
- If possible, have an evacuation/plan ready to share.
    - Urgency of situation.
    - Know your location.
    - Weather factors.
    - Terrain factors.
    - Understand a timetable for evacuation.
    - State requests for additional resources if needed (gear, food, support, etc).
    - Be prepared with a backup plan and determine timelines for continued communication with Central Comms.

Emergency Numbers for Central Communications

Phone: 42586

VHF: Channel 3

HF: 7.995 MHz 11.553 MHz

Iridium®: 00-8816-763-12464

Emergency Response Flow Chart

In response to a distress call or a failure to check-in, each of the following work centers monitor for the various types of travel.

Central Comms.
- Foot Travel
- Local Vehicle
- Vehicle Traverse
- Field Camp
- Other Stations
- Search and Rescue Satellite Beacon

Firehouse
- Foot Travel
- Local Vehicle
- Vehicle Traverse
- Other Stations

Comms. Center
- Helicopter
- Fixed Wing

Scott Base
- Request for Assistance

Failure to Check-in or Distress Call

Uncertainty Phase

Late Check in
- Foot Travel - 5 min
- Local Vehicle - 5 min
- Vehicle Traverse - 60 min
- Helicopter - 15 min
- Fixed wing - 30 min
- Field Camp - 60 min

If
Then

Emergency Operations Center (EOC) Team notified
- Pgr 563
- EOC established
- Search and Rescue (SAR) team notified

Alert Phase

Late Check in
- Foot Travel - 30 min
- Local Vehicle - 30 min
- Vehicle Traverse - 2 hours
- Helicopter - 30 min
- Fixed wing - 60 min
- Field Camp - 6 hours

If
Then

EOC activates
- SAR Team
- USAP SAR pgr 568
- JASART pgr 567
- SAR personnel report to designated areas
- Briefing sheet completed

Deployment Phase

Late Check in
- Foot Travel - 60 min
- Local Vehicle - 60 min
- Vehicle Traverse - 2 hours
- Helicopter - 60 min
- Fixed wing - 90 min
- Field Camp - 24 hours

If
Then

SAR Team deploys

Incident Objective Met (party found or life and property no longer in imminent danger)

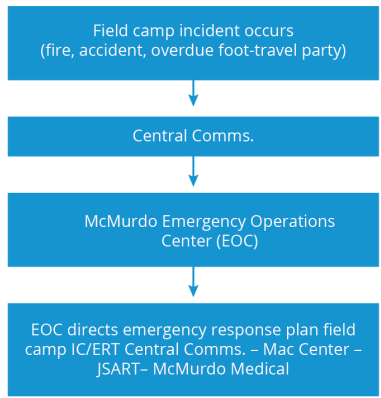
Recovery and Debrief

Field Emergency Response

Response to an emergency in the field could take as little as an hour or up to days depending on a variety of factors, so teams should be prepared to manage a situation until help arrives. Multiple people are always available to provide support via communication devices (Central Comms, SAR, Medical, Field Safety), yet having the ability to manage people during an emergency is important.

If field camp staff receive an outside distress call:

- Record vital info.
- Direct caller to contact McMurdo if Possible.
- Contact Central Comms. to relay info and confirm they heard from party in distress.



Planning

The more you know about available resources prior to deployment, the wiser your decisions will be when faced with an emergency. Questions to consider before deploying to the field:

- Roles and responsibilities of group members (consider medical, technical, communication skills).
- When will you be furthest away from additional resources (i.e., other camps, groups).
- Where do you anticipate your highest level of hazards.
- Anything unusual you can anticipate.
- How will extreme weather affect your plans, what are your thresholds for weather.
- Take some time to define the following scenarios and discuss the response:
  - High likelihood but low consequence.

  - High likelihood and high consequence (hopefully you have few of these as we would want to highly mitigate or entirely avoid).
  - Low likelihood and high consequence.
  - Low likelihood and low consequence.
- Where does emergency gear live (first aid, communication resources, paperwork that could be helpful in talking you through steps to responding to an incident, mechanical backups).
- Establish relationships with people you would rely on in the event of an emergency (face-to-face conversations with Central Comms, Medical, SAR).

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		
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 Parties

Day 1

- Arrive at NSF McMurdo Station.
- Arrival brief; receive room keys and station information.
- Meet point of contact (POC).
- Find dorm room and settle in.
- Retrieve bags from Building 140.
- 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).
- Check in with other team members.

Day 2

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

Days 3-7

- Confirm that resupply items are clearly labeled and stored in cage.
- Meet with Central Comms personnel to discuss field communication plan and establish a daily call-in time.
- Give resupply plan to the BFC supervisor and the Fixed-Wing Operations Office. Retain a copy.
- Check and test all equipment destined for the field. Call Central Comms to test communication equipment.
- Bring all material and equipment collected from the BFC, MEC, and other departments to Science Cargo for processing.
- Check that team members have been scheduled for required training,

such as Antarctic Field Safety, Crary Lab, radio and communication, fire extinguisher, environmental, Taylor 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

In The Week Leading Up To Flight

- If going to an "unsupported" field camp, make an appointment with McMurdo Medical to pick-up a field medical box.
- Meet with FS&T to go over Field Plan/Risk Assessment.

Five Business Days Before the Flight

- This is the last day to deliver hazardous cargo to Science Cargo – Building 73. This also accounts for the time that the Cargo handlers require to build cargo on pallets and deliver to airfield.

Three Business Days Before the Flight

- This is the last day to deliver all remaining non-hazardous cargo to Science Cargo - Building 73, and assist, if needed, the Cargo staff with packaging cargo and assigning shipment numbers.

Two Business Days Before the Flight

- Schedule a meeting to go over final cargo weights, cargo priorities, and passenger names to the Fixed-Wing Office.

The Day Before the Flight

- Ensure that Central Comms has your put-in plan, including camp name, camp leader, and the number of people in the camp. Set a time for the daily check-in.
- 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, clear the rooms and properly store items not going into the field. Lodging personnel will perform a room inspection.
- Fully charge batteries 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.

**Critical life safety items include: all required shelters, stove, fuel, ignition source, food, required communication devices, water for some locations.*

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 Station.
- Check with Lodging staff to confirm room assignments.
- Check with the Fixed-Wing Office regarding an updated flight schedule.

Field Planning Checklist: Helicopter Supported

In the Week Leading Up to Flight

- If going to an "unsupported" field camp, make an appointment with McMurdo Medical to pick-up a field medical box.
- Set up time and meet with Field Support and Training to go over Field Plan/Risk Assessment.

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.
- 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.
- Ensure that Central Comms has your 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 dorm rooms are not being held for field team members, clear the rooms and properly store items not going into the field. Lodging personnel will perform a room inspection.
- Fully charge batteries 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 Lodging staff to confirm room assignments.

Field Camp Put-In Procedures

Before Departing NSF McMurdo Station

- Review Field Planning checklist to be sure all items are complete.
- Turn in room keys to Lodging staff and lab keys to Crary Lab personnel (unless authorizes to keep them).
- Be sure all electronics are warm and batteries are fully charged.

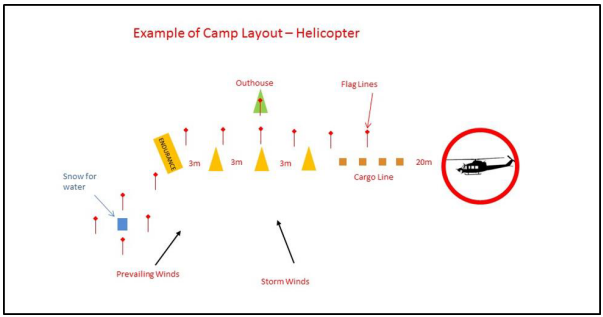
- Visually confirm that all sleep kits, communication equipment and required safety gear are loaded on the aircraft. Do not allow the aircraft to depart until this is confirmed.

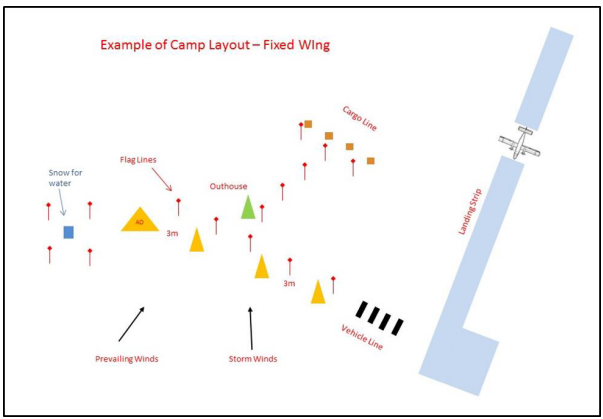
Upon Arrival at the Camp Site, While Aircraft is Still on the Ground

- Assist the flight crew with unloading the aircraft, as directed.
- If staying overnight, establish communication with Central Comms 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.
- Confirm with the pilot which is grid north by using a GPS or the sun.
    - The direction of Grid North is used 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 and helicopter pad and/or skiway location to create optimal camp orientation.
- For helicopter-supported camps, it is recommended to keep camp elements a minimum of 25 meters away from the primary flight path. Be aware of rotor wash and keep a secure landing zone at all times in case of unexpected or last-minute helicopter landings.
- Set up all tents. Appropriate spacing may vary by location but 3 meters between tents in areas with drifting potential is a good place to start.
- Set up the HF radio, solar panel, and antenna. Test the radio by contacting Central Comms.
- Set up a camp toilet area. This may be a tent with a human waste container or a hole in the snow (where allowed, in accumulation zones).





Tent Toilet Tent Snow for Water Area Cargo

As Soon as Practical

- Place all fuel containers and equipment (e.g., 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 if your location warrants this.
- Set-up a camp survival cache with spare fuel and food. Near the or in the toilet tent is often a good candidate if it's a Scott Tent (smaller toilet

tents like Kivas do not work as well). Some teams opt to place their Personal Locator Beacon with this cache.
- 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 Central Comms 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 if required by camp location.
- 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.
- Helicopter-supported camps:
  - Monitor Channel 7 at all times, especially if a helicopter is in the area, in case the pilot is trying to reach you.
  - If expecting a flight that day, call Helo Ops between 0700 and 0730 with a weather update.
- Fixed-wing supported camps: Make weather observations and call them into MacWeather at the pre-arranged times.
  - Call Central Comms after 1900 for the next day's flight schedule, or call the fixed-wing supervisor.
  - Call work centers, as necessary, to request or confirm material for any impending resupply.
  - Inform Fixed-Wing Ops of the amount and nature of items expected and the expected delivery date.
- Fixed-wing supported camps: Follow the communications plan established with the Fixed-Wing Office to arrange resupply.
- Helo-supported camps: Call Helo Ops three business days in advance of a requested flight with all flight details (e.g., passengers, cargo, mission). If you are in the Taylor Valley, then route requests through the Taylor Valley Camp Manager.

Record Keeping

- Record any pollutant spills using the "Field Spill Reporting Sheet."
- Record any information each day that will be required in the Environmental End of Season 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 Central Comms 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 Lodging personnel at least two days before arriving in McMurdo Station 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 Twin Otter or Basler leaves origin.
- Take down tent(s).
- Place all remaining camp items in the staging area and conduct a visual

sweep of the campsite to 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!

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 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.

After Return to NSF 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.

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 (x42348) 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. 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 out the cage 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.

Survival Bags Explained

Red

Orange

Blue

Local Survival Bags - Red

Needed

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

Not Needed

Within town limits or on established roadways, such as Phoenix Road or Williams Field Road.

Helicopter Survival Bags – Orange

Needed

When passengers disembark a helicopter at locations other than an established camp.

Not Needed

If passengers disembark at an established camp, at a location with a survival cache, or at a tent camp with all components of a survival bag.

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 carries 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.

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 people for 3 days.

- 2 sleeping bags
- 2 bivy bags
- 2 Ensolite™ pads, 24”x48”
- 1 mountain tent with instructions and repair kit
- 1 collapsible snow shovel
- 1 snow saw
- 1 first aid kit
- 2 bottles white gas, 22 or 33 oz bottles in Ziplock™ bag and PVC

Tent Stake Bag

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

Cook & Stove Set Bag

- 1 cook set, 1-2 pots with lid
- 1 signal mirror
- 1 MSF Whisperlite™ Stove with instructions, repair kit, and 4 boxes of matches (35 matches per box) wrapped in foil

Toilet Paper

- 1 roll toilet paper

Food Bag

- 6 dehydrated meals
- 3 large (or 6 small) chocolate bars
- 12 tea bags, assorted
- 12 hot chocolates
- 2 packs of Mainstay™ food bars, 9 bars per pack (2 per person per day) or 10 Bumper™ Bars

Utensil Set

- 1 pot handle
- 2 mugs, hard plastic
- 2 spoons
- 1 tube or bottle burning paste wrapped in foil
- 1 pocketknife

Clothing Bag

- 1 bag of miscellaneous clothing, e.g., hat, mittens, gaiter

Ziplock™ Bag

- May contain a book or game, not essential
- Survival manual
- Parachute cord, 50 ft
- 1 contents list

Deep Field Survival Bag Contents

Blue, Shiny, Dry Bags

Supports 2 people for 3 days.

Note: 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 sleeping bags
- 2 bivy bags
- 2 Ensolite™ pads, 24”x48”
- 1 mountain tent with instructions and repair kit
- 1 collapsible snow shovel
- 1 snow saw
- 1 first aid kit

Tent Stake Bag

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

Cook & Stove Set Bag

- 1 cook set, 1-2 pots with lid
- 1 signal mirror
- 1 MSF Whisperlite™ Stove with instructions, repair kit, and 4 boxes of matches (35 matches per box) wrapped in foil

Toilet Paper

- 1 roll toilet paper

Food Bag

- 6 dehydrated meals
- 3 large (or 6 small) chocolate bars
- 12 tea bags, assorted
- 12 hot chocolates
- 2 packs of Mainstay™ food bars, 9 bars per pack (2 per person per day) or 10 Bumper™ Bars

Utensil Set Contains

- 1 pot handle
- 2 mugs, hard plastic
- 2 spoons
- 1 tube or bottle burning paste wrapped in foil
- 1 pocketknife

Clothing Bag

- 1 bag of miscellaneous clothing, e.g., hat, mittens, gaiter

Ziplock™ Bag

- Survival manual
- 50 ft parachute cord
- 1 contents list

Survival Cache Contents

Staged at Fixed Camps

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

Supplies

- Sleeping bags
- Ensolite™ pads, 24"x48"
- Collapsible snow shovel
- Snow saw, ice ax, sledge hammer
- Assorted tent stakes
- Ice screws
- Snow flukes
- Mountain tents (large camps do not have tents since there are several Jamesways or Rac-tents)
- Parachute cord, 100 ft
- Signal mirror
- Pocket knife
- Pee bottles
- Human-waste buckets
- Toilet paper rolls
- Sledgehammer

First Aid

- First aid kit, group
- Books - Medicine for Mountaineering, Cold Injuries

Cooking

- Coleman fuel
- Coleman two burner stove
- MSR Whisperlite™ stove
- Pot, 10 qt
- Pot, 5 qt
- Pot, 3 qt
- Plates
- Utensils (fork, knife, steak knife, spoon)
- Mugs, hard plastic
- Pot grips
- Fry pan
- Matches
- Cleaning pads, scrubbies

Food

- Dehydrated meals
- Oatmeal
- Meals-ready-to-eat (MREs)
- Hot chocolate
- Bars (granola, chocolate)

Environmental Guidelines

Environmental stewardship and protection in the Antarctic are essential. The United States 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 (ACA) 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. Adherence to 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 Title 45, sections 640, 641, and 670 through 674. For questions or to obtain additional information regarding the information presented below, contact ASC Environmental at environmental@usap.gov.

Spill Prevention, Clean-up, and Reporting

- All spills of designated pollutants (e.g., fuel, glycol, transmission fluid) must 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 Central Comms).
- All spilled, designated pollutants must 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 sea ice, 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 Waste Department at each station.
- 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 with 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 emptied and cleaned by personnel before they leave the station (McMurdo Station has dedicated pee-bottle cleaning stations at the Science Support Center (SSC) and the BFC).
- Human waste and gray water must be returned to McMurdo Station. For planning purposes, the table below provides estimates of volumes generated.

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 must not interfere with wildlife unless they have an ACA permit and are specifically trained for the activity being conducted.
- Maintaining a distance of 15 to 20 feet from animals is generally sufficient, but if an animal's behavior is altered or disturbed, individuals 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.

Environmental End-of-Season Report

Purpose

To meet Antarctic Conservation Act reporting requirements. Information gathered on the report is used in USAP annual reporting to the NSF.

Submit

At the conclusion of field activities, all events must submit their Environmental End of Season (EOS) Report to ASC Environmental. The form and instructions will be emailed to you.

Continental Field Manual

Risk Management

Risk Management is the foundation to all we do in the field, from bigger risks that we analyze for weeks or months leading up to a project to daily hazards that are a part of any fieldwork. Understanding the hazards and how we manage them as a team can ensure that we have successful field seasons.

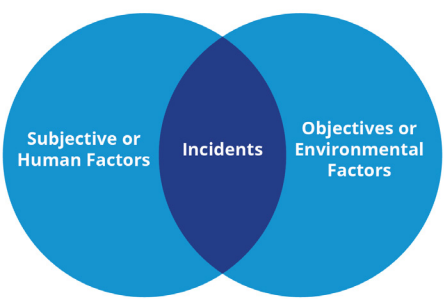
Defining Risk Management

Hazard and risk assessment are the foundations for risk management. They form the basis of how we make decisions and plans while in the field. The terms hazard and risk are often used interchangeably, but it is helpful to think of them as two distinct terms. Simply put, a hazard is a source of danger and risk is the possibility of loss or injury due to exposure to the hazard. Generally, we identify hazards and manage the risks associated with them. We cannot change the hazard, but we can manage our interaction with it.

When thinking about risk management, we often are concerned with "accident potential", which is the interaction of subjective/human factors and objective/environmental factors. Objective hazards are those aspects of the natural world and its forces that present risks. These include weather, terrain, ice, snow, rockfall, moving water and wildlife.

Subjective or human factors are the characteristics, personalities and behaviors of people. These include communication styles, fatigue, complacency, personalities, risk perception and tolerance, overconfidence, and experience level.

Incidents occur when the subjective and objective intersect. For example, while traveling on a glacier, crevasses can exist (objective - out of our control), yet how we communicate and plan for managing them is the key to not falling in one and getting injured (subjective - within our control).



Risk Management Process

The risk management process involves the systematic application of management policies, procedures, and practices to the activities of communicating, consulting, establishing context, and identifying, analyzing, evaluating, treating, monitoring, and reviewing risk. From the proposal stage to implementation, risk management is taken into account on all levels – from big picture oversight to everyday decisions.

Daily decision making and managing risks ultimately allow for projects to be successful. Teams need tools to be able to recognize hazards, mitigate the risk, and communicate effectively with their team.

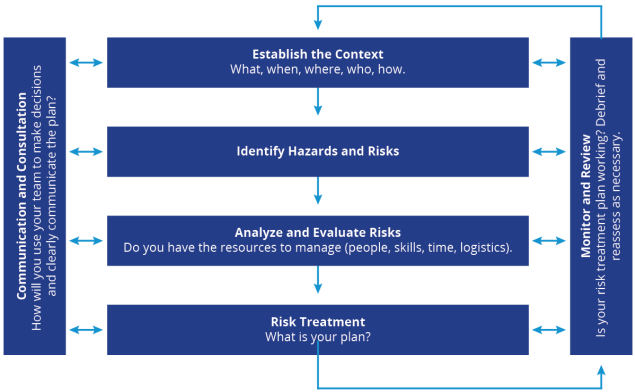
Using sets of questions in the risk assessment and evaluation process has proven successful. The following set of questions could be considered the fundamental beginning of the risk assessment process:

1. What can happen?
2. How likely is it to happen?
3. If it does happen, what are the consequences?

Considering these three questions helps us identify a scenario or set of scenarios that describe (in a hypothetical sequence of events) the exposure of the element(s) at risk to the hazard. The sequence of events includes the initiating conditions through to one of the final states (e.g., reduction of hazard or loss to the element at risk). A second set of questions builds on the general answers gained from the questions above:

1. What is tolerable?
2. How safe is safe enough (i.e., what is acceptable)?
3. What needs to be done?

This latter set of questions arrives at a choice of mitigation measures.



The risk management process is shown in the diagram above. It is deliberately not presented as a flow chart to demonstrate the continuous iteration between the steps and that communication, consultation, monitoring and reviewing occurs at all stages.

Practical Risk Management in the Field

Daily, we are constantly making decisions, assessing hazards and communicating with our team. Risk management does not stop once the Field Plan is complete and you have arrived in the field. There are many ways to approach practical, everyday risk management. Here are a few:

- Daily briefing and debriefing.
  - Morning briefing can include:
    - Run down of activities for the day and associated hazards.
    - Mitigation plan for hazards.
    - Physical and mental check in for all team members.
    - Plan for self-care throughout the day (e.g., food, water, personal needs).
    - Equipment and resource check list.
  - Afternoon debrief can include questions such as:
    - Did we make good decisions or did we get away with it?
    - What happened, so what, what next?
    - What do people need to be at their best?

- Assess likelihood versus consequence.
  - We often do this unconsciously.
  - A quick check in: what is the likelihood of injury/incident and what would that consequence me for me and my team?
- Come up with common language and terminology to identify risks.
  - Red, yellow, green means stop, caution, or go.
    - This can be applied to all sorts of terrain and hazards.
- Practice situational awareness.
    - Observe, orient, decide and act.
    - Be observant of changing conditions – with individuals, the team and environment.
    - Effectively make decisions based on those observations.
    - Reflect (in real time) on those decisions to refine course of action.

Positive Work Environment

Successful fieldwork is a result of a high functioning team. Expeditions and teams with extended time in the field tend to have their own culture. The culture is characterized by team member's shared values and practices. USAP believes in, and supports, creating an inclusive, respectful, and welcoming work environment leads to teams that successfully manage and plan for risks. To help this happen, we ask that you as a team make time to discuss these ideas:

- Intent is to facilitate foundational conversations around equity, inclusion and respect as it relates to individuals and teams.
- Actively invest in a working culture that promotes proactive risk management and support for all team members.
  - Team creates an individualized Positive Work Environment (PWE) that is pertinent to team make-up, location, work, schedules, etc.
  - AM/PM meetings include dialog about both subjective and objective hazards.
- Be inclusive by being curious and appreciating other's individualities and identities.
  - Build in time that does not center around work. Ensure there is space for building relationships, morale and downtime.
- Interrupt behaviors that are counter to a PWE and actively solicit feedback about impact on others.
  - How does your group plan to hold one another accountable to this?
- Be inclusive of all people regardless of race, ethnicity, color, religion, sexual orientation, gender identity, national origin, language, age,

disability and marital status.

- Exclusion based on any of these factors will not be tolerated.
- Be mindful of humor, jokes and references that could alienate team members.

Sexual misconduct is a serious offence. Online and in-person meetings, both before deployment and at McMurdo Station, are good ways to understand and address team dynamics, review existing sexual misconduct policies of relevant institutions and employers, and consider the logistical impact of Antarctic field camp life has on the implementation of those policies. Early discussions are opportunities to build trust and rapport within the group, work through scenarios, and formulate agreements on how the group will process conflict and promote accountability while in the field. Teams are encouraged to memorialize these discussions in a field safety agreement and ensure all members are aware of and have access to the material.

Self-Care and Personal Leadership

Effective risk management starts with YOU! Having a good understanding of your skills, attitudes, comfort level and risk tolerance/perception allows you to be a solid team member.

Working in the cold and harsh environment of Antarctica has its challenges, yet learning to thrive and not just survive is the goal.

Self-Awareness

Situational awareness should be augmented with accurate self-awareness. Self-awareness, simply put, means being aware of both our mood and our thoughts about that mood. By being aware of our emotions we have greater knowledge of ourselves, and helps us understand how we will respond or react to a variety of situations. Self-awareness can be broken down in to three types: cognitive (thoughts, beliefs, biases, assumptions), emotional (feelings, moods), and behavior (language, actions).

Strong teams make a habit of giving and receiving performance feedback objectively and without creating defensive responses.

Pro Tips

- Prior to deploying to the field, consider talking with your team to express what you need to be successful For example, I like to have my hot drink in the morning before talking to anyone, it's important to me to laugh and have fun, I like to find time to connect with loves ones at home.
- As part of field planning, discuss some scenarios and ask team members

to be realistic about how they would respond or react.
- As a team, determine how you will make space for each other to get what you need.
  - What does leadership, communication and feedback look like?
- Think about intent versus impact when communicating.
- Curiosity over assumptions – we all come with our own belief system which causes us to act in a variety of ways. Ask questions before assuming there is ill intent.

Stress Management

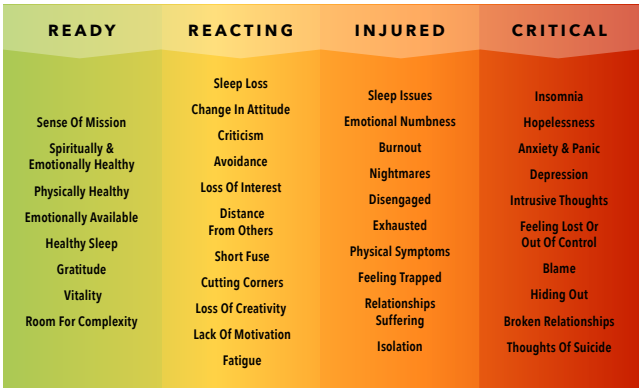
Stress and fatigue are normal components of fieldwork. Working in the outdoors in general is characterized by a very strong work ethic. Team members work hard, both physically and emotionally, regularly putting in long days for the duration of the field season. Teams can be under enormous stress from the physical exertion of living outdoors in the cold, time pressure, aspects out of our control, living with strangers (for some teams), and adapting to a new diet and routine.

The effects of stress and fatigue on performance (personally and within a team) are well documented. Our strength, stamina, mental and emotional health, and immune responsiveness decline if we are chronically tired, under nourished or under stress. We can become more susceptible to injury when we are tired and hungry.

How to manage stress and fatigue:

- Make it normal to ask for help. Role model this regularly.
- It is not a character flaw to be tired or need time to recharge. Ask team members before deployment what they need to be successful in the field. Know how you will support one another before it is needed.
- Have a plan for your team to get good, consistent sleep.
- Ensure mealtimes are consistent and that meals are nutritious.
- Have regular check ins as a team and perhaps 1-on-1, depending on team makeup.
- Allow for personal time so people can recharge in the best way for them.
- Mix up camp responsibilities throughout the season.
- Use the stress continuum to use common vocabulary to describe how you are feeling.

RESPONDER STRESS CONTINUUM



ADAPTED FROM COMBAT AND OPERATIONAL STRESS FIRST AID BY LAURA MCGLADREY | RESPONDERALLIANCE.COM

The Stress Continuum is a simple tool for self-awareness that allows us to make informed decisions and manage risks. This tool was first created by the U.S. Marine Corps for use in combat settings but has been adapted for use in many industries.

Individuals closer to green are ready to respond when stressful situations arise. The ability to communicate stress levels will allow teams to better approach situations that require a higher degree of focus and risk mitigation.

Staying Warm

Staying warm and dry in the field is of the utmost importance for comfort and health. We make better decisions, sleep better and are happier if we are warm. It is far easier to stay warm than to warm up once you are cold.

Ways We Lose Heat

1. **Conduction**: Direct transfer of heat from one object to another: sitting on ice/snow with no insulation, picking up cold objects with bare hands.
2. **Convection**: Losing the warmed air close to the body to the colder air outside the body: through open collars, untucked shirts, unzipped jackets, no warm hat, etc.
3. **Radiation:** Transfer of electromagnetic energy from a hot object to a cold

object, primarily through exposed skin.

4. **Evaporation**: Wet clothing or perspiration has a cooling effect as it evaporates.
5. **Respiration**: Heat is lost through breathing and can cause rapid heat loss through heavy breathing, particularly in cold weather.

Ways We Generate Heat

1. All of the above ways to lose heat can also be ways to get warmer.
2. Activity or exertion can produce heat: i.e., shoveling snow.
3. Food, especially simple sugars that are quick to break down, can produce some quick heat.
4. Dress for warmth (see Clothing section below).
    a. Layer: wearing layers of lightweight, medium weight and heavier weight clothing allows "dead" air space which can trap warm air in between your clothing.
    b. Wear materials that "wick" moisture away from the skin such as synthetic and wool materials.
    c. Wear clothing that will retain warming properties even when wet such as wool or fleece.
    d. Do not wear constricting clothing - let circulation take place. *Tip: try all layers on together and play with a variety of strategies before going into the field.
    e. Avoid wearing too many clothes while being active. This will cause your clothes to get wet through perspiration and eventually cause cooling through evaporation.

Pro Tips

- Take short, frequent breaks while doing strenuous work to avoid sweating, which can cause chills through evaporation and perspiration.
- Change out of wet clothes or, if clothes are only damp, layer up and do light activity. Synthetic and wool will dry as your body produces heat.
- Eat throughout the day! Remember that lunch starts as soon as breakfast is over and ends when dinner begins. This will help regulate body temperature throughout the whole day.
- Stay hydrated! Not only will the dry environment take its toll on your body but drinking fluids will keep you warm.
- Wear a warm hat and gloves most of the time.
- Always have layers available so you can fine tune for activity and location.

Sleeping Warm

Part of thriving in the field is getting a good night's rest! If sleep is missed or inadequate, it can affect our physical and psychological well-being. Everyone has different sleeping needs and metabolic rates so you may need to experiment during the first few days.

Pro Tips

- Always use multiple pads for both comfort and insulation from the ground (foam and air mattress are standard issue from the BFC).
- Eat well before going to bed, making certain there is a combination of fats and carbohydrates (fats will take longer to digest thus keeping the furnace fueled for the entire night).
- Don't wear all your clothes to bed. Start with base layers and add if needed. The goal is not to sweat.
- Urinate before getting into your sleeping bag and don't ignore the call to urinate in the middle of the night. Use your pee bottle!
- Do some light calisthenics as you get into your bag to heat up your body.
- Consider wearing a warm hat as so much heat loss happens through your head.
- Take a hot water bottle (or two) to bed with you. Place them under your arm pits, in between your legs or at your feet. You won't regret it!
- Have a pair (or two) of sacred sleeping socks that are solely for the bag.
- If your sleeping bag is little big for you, consider filling the voids with other dry clothing to warm up the dead space.
- Keep snacks nearby for the midnight need to fuel the furnace.

Clothing

In addition to your extreme cold weather gear that is issued to you from the program, you will need a variety of layers to assist in your comfort and "thriving" in the field. Before leaving home, your team should provide a gear list to help guide you in acquiring the proper gear.

In general, a good rule to live by for living in cold environments is to get lots of insulation between you and environment, and to remove that insulation layer by layer when you get warmer. You need a clothing system that allows you to shed layers quickly and easily before you get damp from perspiration. Several thinner garments will serve this purpose better than one bulky layer.

Layering

Having a choice of layers will ensure that you can be comfortable in a

multitude of temperatures and work conditions.

Base Layers: Your first layer should fit snugly against your skin and be lighter weight. This layer works by wicking away water and keeping your skin dry. Synthetic fabrics, such as "polypro", or merino wool work great. Cotton is a poor choice and should be reserved for hanging out around camp and sleeping in warmer temperatures. Depending on location, you may wear 2-3 base layers of varying weights. This will help trap air and prevent heat loss.

Insulation Layers: This can be a thicker long underwear layer (light fleece or wool) and their role is to absorb. Thickness is warmth! Often, insulation layers are worn while working and it is best to ensure that you are not wearing the thickest layers for high output. For sedentary activities or extreme cold, an outer garment with several inches of loft is recommended. Down is great for dryer locations, and synthetic insulation is preferred for wetter locations.

Shell Layers: This is often the most important part of your layering system, and the most used besides your base layers. Windshells worn over any garment can add up to 25°F of warmth and 50°F in very windy conditions. In a place like Antarctica, we need constant protection from the wind. Ensure your windshell can fit over all layers before going into the field.

Pro Tips

- Bring comfortable, synthetic fabric underwear, which is easy to wash and quick to dry. If you are allergic to synthetic fabrics, you can bring merino wool underwear. Also, bring some cotton underwear for sleeping.
- Sports bras are popular and comfortable, but many are thick and slow to dry (even in the cold, you will sweat). Try out a few before deployment to see which are comfortable and dry quickly.
- It is tempting to go to sleep with all your layers on, but best to take off any wind resistant clothing and sleep in breathable layers so as not to sweat.
- Bring lots of socks. Our feet can be some of the hardest working parts of our body so do not skimp on good quality socks. Change into sleep socks at night (affectionately called "sacred sleeping socks" which live in your sleeping bag only).
- Wear materials that "wick" moisture away from the skin such as synthetic and wool materials.
- Wear clothing that will retain warming properties even when wet such as wool, fleece, synthetic insulation (i.e., Primaloft).
- Do not wear constricting clothing - let circulation take place. *Tip: try all layers on together and play with a variety of strategies before going

into the field.
- Avoid wearing too many clothes while being active - this will cause your clothes to get wet through perspiration and eventually cause cooling through evaporation.

What to Do When Clothes Are Damp or Wet?

More times than not, clothes will not dry on their own or when hung outside when working in the field in Antarctica (maybe in the Dry Valleys). Keeping clothes dry is work!

Pro Tips

- Your body can often be the best "dryer" for layers. Sandwich damp clothes in between your layers as you work around camp. Your body heat will dry them.
- Often simply putting layers in your sleeping bag won't be enough to dry them. Hot water bottles in the bag will aid in a quicker dry.
- Socks are often the most likely to become damp from wearing them all day while working. To dry them overnight, you can put socks in between layers on your body while sleeping and your body heat will dry them.
- Beware of hanging clothes too close to heaters!

Staying Found

While most fieldwork happens during the summer months with 24-hour daylight, the possibility of getting disoriented can happen. As you set up camp, part of the plan should be to discuss a plan should anyone become disoriented.

It can be easy to become disoriented in the wind when moving between tents or huts at larger camps. In really bad conditions, visibility can be considerably diminished in a matter of minutes. To stay found, have a plan if you are moving around camp in bad weather:

- Tell someone where you are going.
- Carry a radio.
- Have a check in time.
- Have rope lines set up in advance of weather.
- Determine how one would signal distress if lost in or around camp (e.g., use of whistle, radio).
- Determine a time away from camp that one would need to carry extra supplies (i.e., survival bag, food, layers). Suggested time would be 15 minutes or more, but this may change due to location.

If you do become lost or disoriented:

- Stay calm, positive and alert.
- STOP once you know that you are disoriented. Make a plan and take a deep breath.
- Do not wander around aimlessly. You are better off staying where you are.
- Make contact or noise.
- Minimize heat loss by putting on layers if you have extra clothes.
- Stop and think. Try to remember your movements and figure out a way back.

Hygiene

A big part of self-care is personal hygiene. If you are comfortable, you will be more focused and able to make good decisions. It may be the first time you will spend a prolonged time camping in a wilderness environment and you may feel some anxiety regarding hygiene. The tips below should help alleviate this anxiety.

Bathroom Hygiene Tips

You'll learn how to 'pee and poo' in the field in a way that is environmentally responsible and sanitary. Depending on the field location, there will be different parameters on human waste containment. Many camps require all gray water (pee) and human waste (poop) to be contained in buckets and barrels. Some deep field camps simply dig large holes in the snow in which to deposit all human waste. Toilet paper is provided for all camps.

You will be issued at least one pee bottle along with your sleep kit. If you have a vagina, you can ask for a pee funnel (i.e., "Lady J", "Shenis") from the BFC. It is best to practice before leaving for camp in the comfort and warmth of your dorm bathroom stall.

Hand washing is an important aspect of maintaining backcountry hygiene and health. Alcohol-based hand sanitizer is readily available, but traditional hand washing is preferred when possible. All camps should plan to have a hand washing system with soap and water.

If you have a vagina you are encouraged to wash your pubic area with mild soap and water daily and bring an extra bandana to clean yourself after urinating. Baby wipes are also a good alternative to soap and water. Bandanas can be hung outside of your tent in the sunlight to dry. Consider sleeping in cotton underwear instead of synthetic fibers.

Menstrual Hygiene Tips

For those who menstruate, your menstrual cycle may change while living in the outdoors, so plan to bring extra supplies.

You could also consider using a reusable menstrual cup in lieu of tampons or pads. If you are using a new method, practice before your deployment so you are comfortable using the method in the field.

All camp outhouses should have both a human waste bucket and a "sani" waste bin. Used menstrual products can be disposed of in the sani waste. As an added measure, it is always a good idea to carry a stuff sack with menstrual products and a zip lock to dispose of products if away from camp for the day. An aspirin tablet or two (not Tylenol) placed in the bag will help keep odors down.

Changes in Your Cycle or Abnormal Symptoms

If you experience changes in your menstrual cycle or abnormal signs such as itching and/or soreness in the vaginal area, excessive and/or smelly discharge, increased frequency or pain on urination don't hesitate to bring this to the attention of your team (Field Medical lead or with whomever you feel most comfortable discussing). USAP field medical kits have medication to treat the more common genito-urinary infections, including urinary tract infections and yeast infections.

Continental Field Manual

Communications

Regional Travel Communication Requirements

*This refers to NSF McMurdo Station regional travel only. NSF South Pole Station and field camps have their own rules for travel away from station/ locations.

Travel off established roadways is tracked by Central Comms.

Established roadways include snow roads to the Long Duration Balloon (LDB) site, Williams Field, and Phoenix Runway, and dirt roads between NSF McMurdo Station, 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. This process involves both NSF and Field Safety to determine a well managed plan that is dependent on location and type of work.

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. "Central Comms, Central Comms 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 Station) and phone/pager number.
- ETR to McMurdo Station or estimated time of arrival (ETA) at destination.

Overnight Stays

- Before departing McMurdo Station, 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, deputy field area manager, search and rescue supervisor, information technology manager, and fire chief.

Call to extend time. There is NO grace period!

Field Camp Communication Requirements

Field camps are required to have a minimum of two unique types of voice communications, which must be approved devices issued by the USAP. Field camps may use any combination of the following: VHF radio, HF radio, Iridium® Satellite Phone or Telephone (e.g., radiophone or VoIP).

Before Departing NSF McMurdo Station

- Comms equipment pickup: contact communications coordinator at Building 159, ext. 42378.
- Test the gear - call Central Comms. for communications check.
- Ensure you have a copy of Radio Communications Equipment User Guide.

Arrival at Field Site

Put-in call required before aircraft departs camp:

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

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 Central Comms when leaving camp vacant.

Aircraft Daytrips

- No communications with Central Comms required - the flight is tracked by MacCenter and Aviation Ops.
- Establish communications with helicopter pilot on VHF Channel 7 before the helicopter departs.
- Central Comms is available for comms checks, message relays, or to record a location.

Emergencies

- Notify Central Comms directly.
- Medical - call Central Comms transfer line and indicate if URGENT.

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 fire chief .

NSF McMurdo Station Vicinity Communications Systems

Communication Systems

USAP uses five systems for field party communications, depending on field party location: telephone, VHF radio, HF radio, Iridium® satellite phone and InReach® devices.

Telephone

Field camps in the McMurdo Station vicinity that are equipped with telephone service can contact Central Comms directly by dialing 42000. This number rolls over to four available lines, so callers are always able to get through.

HF Radio

Speak clearly, loudly, slowly. Point the antenna at Black Island for comms check with Central Comms before departing McMurdo Station.

7.995 MHz: Central Comms

11.553 MHz: Central Comms

9.032 MHz: Air Traffic Control – only field party emergencies

Iridium® Satellite Phones

If your field team has multiple Iridium®® phones, the lowest phone number is assigned as ALPHA (primary) phone followed by BRAVO, CHARLIE, etc. For any group spending one night or more in the field, a community phone will be issued to the team. See below for expectations.

All Iridium® phones issued at McMurdo Station are pre-programmed with several important operational numbers.

Pre-Programmed Iridium Numbers		
MR1	MacOps 00-8816-763-12464	Calls cannot be transferred
MR2	MacOps Transfer 00-697-720-568-1042	Calls can be transferred to McMurdo business lines
MR3	MacWeather 00-8816-763-20030	McMurdo weather department
MR4	Helo Ops 00-8816-763-29073	Helo hangar
MR5	Medical 00-8816-763-15142	**Do not use unless directed** Call MacOps for emergencies
MR6	Search & Rescue 00-8816-763-15141	**Do not use unless directed** Call MacOps for emergencies

These numbers are also printed and attached to the outside of your phone's storage case for redundancy. Your phone number is printed and attached to the phone's case as well as the outside of your phone. MR# stands for Memory Recall number. These are simply numbered storage slots in the phonebook. The order of these phone number assignments is consistent across all McMurdo Station satellite phones.

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.

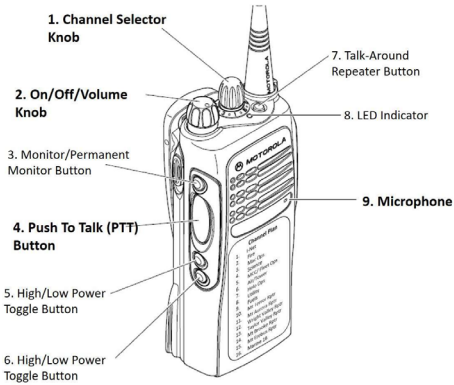
Option 1: Send message using website: http://inah.pac.disa.mil/sms.shtml

Option 2: Send message via email using format:

8816xxxxxxxx@inah.pac.disa.mil

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

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. Users should maintain proper radio etiquette 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 become disabled in periods of poor weather and heavy communications traffic.

McMurdo Station deploys three VHF systems:

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, Utilities,

Aerospace Ground Equipment/Air National Guard (AGE/ANG), Marine 16, and all air band channels.

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 Station base station: I-Net, Fire, Fuels and Helo Ops.

Semi-Duplex

For areas farther from McMurdo Station, such as camps in the McMurdo 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. It receives a signal on one frequency (F1) and automatically retransmits the signs 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 Station semi-duplex system: Central Comms, 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 Central Comms 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 overuse repeaters to conserve power.

Call Signs

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

Phonetic Alphabet							
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 Channel Use

VHF Channel Use			
Simplex (Line of Sight)	**Name**	**General Use**	
	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)	
Semi-Duplex (Repeaters increase range)	**Name**	**Repeater Location**	**Areas of Coverage**
	Mac Ops	Crater Hill (above McMurdo Station)	McMurdo Station area, sea ice areas south of Erebus tongue
	Mount Aurora	Black Island	McMurdo Station 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

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).

VHF Frequency Assignments at NSF McMurdo Station

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.

Most users will receive radios with pre-programmed frequencies and there is no need to manually enter these.

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

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

South Pole Station uses the same authorized VHF frequencies as McMurdo Station, but the channels are not permanently assigned to specific work centers or functions, so you may not be able to use your McMurdo Station-issued radio at South Pole Station. Instead, VHF assignments for channels 1 through 7 are determined seasonally or on demand. 129.7 MHz is reserved for monitoring aircraft, same as McMurdo Station.

Deep Field to NSF McMurdo Station

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.

Note: 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.

At South Pole Station, the US-17 circuit is used for passing information between outlying stations and McMurdo Station, as well as for daily camp check-ins. The following two frequencies are monitored continuously and used in the listed order of priority:

Primary	Secondary	Tertiary
7.995 MHz	4.770 MHz	11.553 MHz

Iridium® Phone

Deep-field camps are also issued at minimum two Iridium® satellite phones. Iridium® satellite phones, or "sat phones" are devices that operate in the UHF (Ultra High Frequency) portion of the radio spectrum. Instead of connecting to other radios directly (through line of sight or line of sight to repeaters), they connect to satellites orbiting the Earth. The signal from the phone bounces from satellite to satellite as needed to direct the call to the intended target.

To support this radio connection, users should make calls when they have a clear view of the sky. 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.

Community Phone

If you will be overnighting in the field, the USAP requires that you have at least two satellite phones available to your group. This additional phone is known as the Community Phone and is intended to be a safety and morale line. The Community Phone should be stored in a central location so all team members have easy access to it. A list of helpful phone numbers (e.g., NSF, USAP confidential victim advocate, ASC HR, on station counselor)

are provided with the phone. Groups who are working alone in isolated environments will be issued their own Community Phone. Other groups, who work at shared sites will also share a Community Phone. The phone will be staged in a central location at camp.

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 text messages. 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/logistical purposes. They should be informed that the Iridium® phones are a shared resource. As a team, you can determine which phone can be used for texts.

Receiving Messages

To check for Iridium® text messages in the field, power up the Iridium® and place a call. This places the Iridium® phone in the satellite constellation and begins the download of queued messages. The Alpha line may be used.

If there is no need to talk to anyone in particular, call this number: 00-697-720-568-2211. Once the device attempts to connect, you can end the call. At this point, the satellites should forward any queued messages.

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. 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.

No automated "read confirmation" is sent to the message originator. If the originator requests or requires confirmation that the message was read, the recipient should call the originator.

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

Iridium® Troubleshooting

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

Note: Protect the antenna! Plastic cracks! Be gentle when swapping out Iridium® components. Most of the adapters are made out of thin plastic - especially for the 9575s. Plastic does not hold up well in cold environments and will become brittle and crack. Work from sheltered environments when you can and don't force any connections. We have limited replacements.

InReach® Devices

USAP has a limited number of InReach® devices that are issued to field teams. They are not considered one of the two primary forms of communication but are becoming an increasingly popular communication tool in the field. Many people bring their personal InReach®. Anyone bringing their own device must register these with Central Comms prior to deployment to the field.

USAP InReach® devices are a useful and efficient way to communicate short messages back to McMurdo Station. Due to the way they are managed, messages are not private as they go to an email that many people can access. Please do not rely on these to send private and sensitive messages.

Before going into the field, it is important to discuss with the support team

(i.e., Field Safety, Science implementers, Aviation support) how you will primarily communicate. Pre-determine your communication needs so all teams involved will know what to expect.

Frequently Used Iridium® Numbers

Department	Routing	Number
MacOps	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 Hangar Office	Via Denver, NZ Telecom, Iridium	**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
Deputy Field Area 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
Information Technology & Communications		
Communications and Technicians	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 Preferred Number**		

Continental Field Manual

Field Gear

The majority of gear (group and personal) you take into the field will be issued to you upon arrival at McMurdo Station. All of the gear you receive will be tagged "RFI", ready for issue. This means it has been serviced, checked and ready to deploy into the field. It is an expectation that your team check all gear before going into the field. This ensures that teams are familiar with operation and set-up in a controlled environment, as well as catching any problems (e.g., malfunctioning equipment, broken parts) before arriving to their field location.

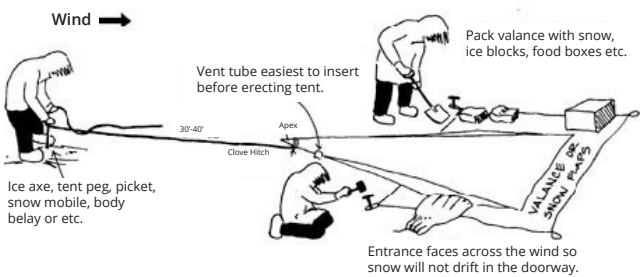
Shelters

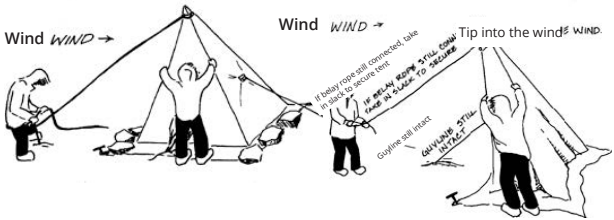
Before field teams deploy to the field, they should become experienced in erecting the tents they are issued. They should set up tents at McMurdo Station and double-check their condition.

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 (knots that are fixed and cannot be adjusted. Reference section for a variety of knot options) 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

Setting Up a Scott Tent in High Winds





Establishing Wind Direction

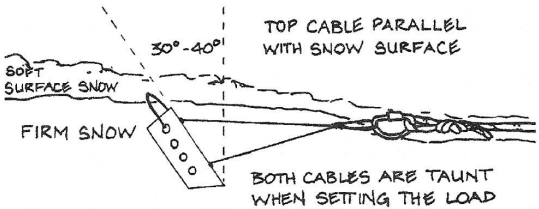
The most important factor in the set-up process is securely anchoring the tent so it can withstand high winds. Field teams should first determine the prevailing wind direction by observing patterns in the snow. For example, long rows of drifts (sastrugi) in a north-south orientation will indicate that 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 ("deadman") 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 deadman to the tent, via a slot cut in the snow. The deadman 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 deadman anchor should be buried two feet deep or more.

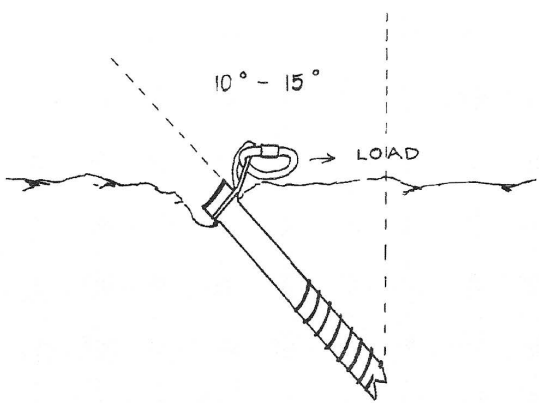
Snow flukes and snow bollards represent additional ways to anchor tents, camp items, or other objects in hard snow areas (see illustrations on following page).

SNOW FLUKE ANCHOR



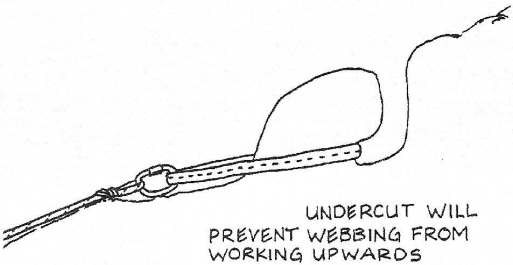
SLICE A SLOT FOR CABLE WITH PICK OF YOUR ICE AXE

ICE SCREW ANCHOR

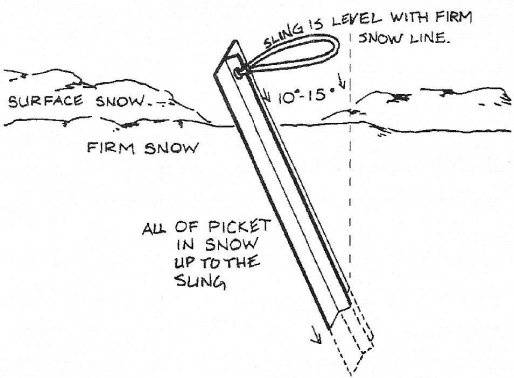


CHOP A SMALL LEDGE FOR THE EYE TO REST AT THE PROPER ANGLE, FLUSH AGAINST THE ICE.

SNOW BOLLARD ANCHOR



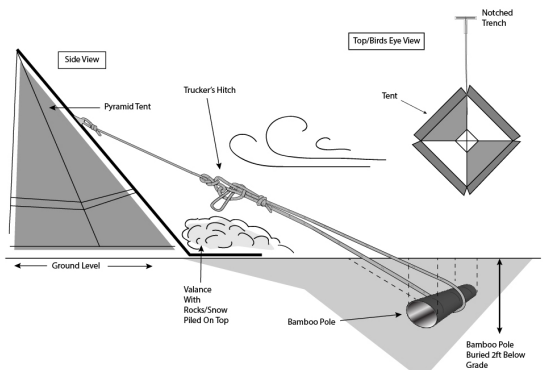
SNOW PICKET ANCHOR



CLEAR AWAY SOFT SURFACE SNOW TO INSURE THE PICKET IS IN FIRM SNOW.

Anchoring in Soft Substrate

If the snow, sand, or soil are soft, bury a long stake or piece of bamboo ("deadman") 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 deadman to the tent, via a slot notched in the ground or snow. The deadman 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 deadman anchor should be buried two feet deep or more.



Note: If anchoring on rocky land, especially in a volcanic area with sharp rocks, be aware that the guy line exiting the ground from the deadman could abrade in windy conditions. Monitor it frequently and replace it if necessary. Alternatively, fabricate a make-shift sheath around the line from rock sample bags or whatever else may be on hand.

Tent Valance

Most issued tents have a valance or "skirt" on either the tent fly or body. These should be fanned out flat and weighted down with snow or rocks to help keep the tent anchored in windy conditions. This also prevents wind from going underneath the valance and lifting and damaging the tent. It also helps keep the tent warmer. Be careful not to pile rocks onto the wall of the tent, as this could abrade and tear the fabric in high winds.

Snow Walls

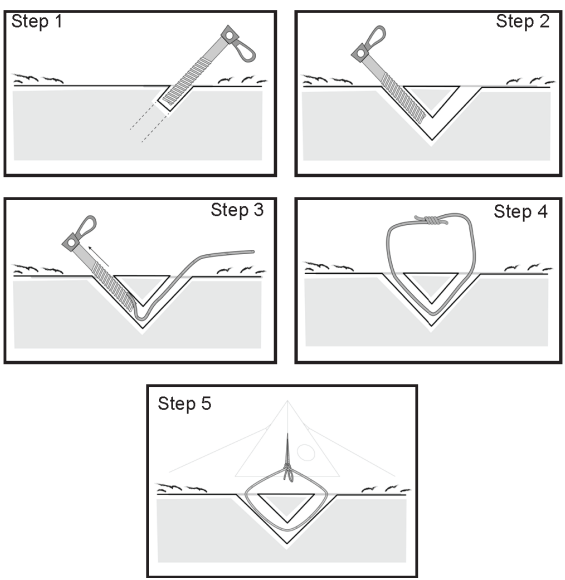
Snow walls, which are constructed with blocks cut from the snow, shelter tents

from wind. If it is a windy day or if the camp is at a windy 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. Since it may not be possible to issue enough ice screws for every guy line, team members may also drill V-threads (two holes that intersect to form a V-shaped channel), use an ice screw or ice drill to feed a guy line through the channel, and attach the line to the tent.

V-Thread Anchor



Erecting Tents in the McMurdo Dry Valleys

It is important that field teams adhere to environmental regulations and consider helicopter restrictions for site selection and camp set-up in the Dry Valleys. Team members should consult with the environmental department before departing for the field. The most commonly visited McMurdo 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 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 (Quinzhee 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 repositioning snowmobiles and sleds.

Stoves and Heaters

The Berg Field Center (BFC) issues propane and white-gas cooking stoves to field parties. The Facilities 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 Facilities 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. Cooking in Scott tents is safe with the right mitigations (see below).
- Insulate base of stove so it does not melt through 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.

Stove Use in Scott Tents

Note: It has been common practice in Antarctica to use stoves inside Scott Tents. Historically, many camps were small, and Scott Tents were the main "home" for a field camp, and thus stoves were used inside. This is still a practice used in a variety of locations, either for full kitchen duties, or to heat water and heat the tent in places with extreme cold or dampness.

Pro Tips

Using a stove in the tent on a daily basis to stay warm and comfortable can lead to complacency. Here are a few pro tips:

- Ensure all sleeping bags, pads and personal clothing are stowed away from stove before starting.
- If running the stove, throw a kettle on to boil some water for hot water bottles (this also prevents an open flame).
- Communicate any signs or symptoms of carbon monoxide (CO) poisoning.
- Does your camp have readily available oxygen? Oxygen can help alleviate symptoms of CO poisoning.
- CO poisoning is exacerbated at altitude.

Carbon Monoxide Risks

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

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 (see WhisperLite instructions for direction on lowering pressure).

Note: 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.

MSR WhisperLite™ Troubleshooting

MSR WhisperLite™ Troubleshooting		
Problem	**Location**	**Solution**
Fuel Leaks	Control Valve	Replace torn or damaged control valve o-ring.*
		Replace with new pump if control valve threads are damaged or stripped from over tightening.
	Pump/Fuel Bottle Connection	Use only MSR fuel bottle.
		Replace bottle if threads are damaged or bottle is dented.
		Replace torn or damaged fuel bottle o-ring.*
	Fuel Line/Pump Connection	Replace torn or damaged fuel tube o-ring.*
		Replace damaged or missing fuel tube bushing.*
	Fuel Line	Replace fuel line or entire stove if line is damaged.
	Shaker Jet	Tighten if necessary with jet and cable tool.*
		Replace if damaged.*
		If fuel leaks through the shaker jet when control valve is off, the pump is damaged from over tightening the control valve; replace pump.
Erratic Performance	Erratic Yellow Flame	Insufficient priming.
		Fuel bottle is over pressurized.
		Improper fuel used or jet installed. Change the jet.
		Old or poor quality fuel.
		Incorrect flame ring installation under burner cap.
		Correct flame ring order from top (burner cap) to bottom (flame reflector): (**Wire Leg Stoves**: 7 Rings - Wavy, Flat, Wavy, Flat, Wavy, Flat, Wavy) (**Flat Leg Stoves**: 8 Rings - Wavy, Flat, Wavy, Wavy, Flat, Flat, Flat).
		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.
Reduced Performance	Diminishing Flame/Slow Boil	Insufficient pressure in fuel bottle.
		Pump plunger as required to increase pressure.
		Remove any obstructions from jet and/or fuel line.
		Incorrect jet installed for fuel type.
		If the burner cap becomes bright red and a dull roar is heard, the flame is burning back under the burner cap rather than through the flame rings. Clean the jet, ensure the correct jet is installed, and ensure flame rings are clean and installed correctly.
	Pump Not Pressurizing	Dry leather pump cup – needs oiled.*
		Dirt in check valve assembly.
*Signifies stove and pump replacement parts that are available in the repair kit.		

Safety Tips

- Do not use these stoves in mountain tents, except in an emergency.
- 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.

Coleman® Gas Stove

Operating the Stove

- 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 the fuel does not vaporize, 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 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:

1. Unscrew the burners.
2. 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.
3. Remove the metal tray for access to the burner and control valve assemblies.

Coleman® Gas Stove Troubleshooting		
Problem	**Location**	**Remedy/Cause**
No pressure	Pump	Remove and inspect pump, checking for cracks, dryness, creases, or tears. Replace and oil.
	Tank	Possible pressure leak: check tank lid gasket.
		Flooded pump cylinder = faulty pump valve: replace.
		Broken seal at valve assembly and tank junction: tighten by 1 rotation if possible.
Loses pressure too fast	Tank	The tank will lose pressure the longer it sits without periodic pumping. If pressure is lost soon after pumping check, all joints and gaskets.
	Cap	Check cap gasket. Replace gasket or cap.
Yellow flame	Burners	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.
		Make sure tank and generator seated properly.
Flame at generator tip		Tip of generator is loose: tighten.
Poor gas flow to burner		Possible clogged generator. Clean or replace.
		Check needle at end of generator. Determine if the cleaning needle is functional or bent. Replace if necessary.
		Make sure tank and generator seated properly.
Weak flame		Preheat generator, increase pressure, check for flooding, clean or replace generator, contaminated fuel.
		Make sure tank and generator seated properly.
Flaring	Generator	Tip of generator is loose: tighten.
		Make sure tank and generator seated properly.
	Burner	Flooded burner: shut down and dry out. Excessive pressure in tank, insufficient priming, premature switch to "on" position of fuel flow switch, and/or bad fuel.
		Make sure tank and generator seated properly.
	In stove	Clean grease out of stove. Line the bottom of the stove with foil and change when dirty. This will aid in ease of cleanup.
		See "yellow flame @ Burners".

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 huts 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 in too much air.
- 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).

Kuma® Stoves, ARCTIC Heater

Kuma Stoves will replace the old Preway heaters and are installed in sea-ice huts, some Dry Valleys huts, and at deep-field fixed camps.

Caution: The handles on the side of the heater are surprisingly hot.

Do not touch or hang towels or clothing over the handles. Please read instructions completely before lighting the stove.

Starting the Heater

- Be sure that the burn chamber is clean before lighting.
- Open stove door and remove stainless steel mesh cylinder and burn ring from the burn pot.
- Turn on all supply valves (tank and in-line valves).
- If there are any leaks in the system, turn off all valves immediately.
- Turn control knob on carburetor to setting 1.
- Move ON/OFF lever on carburetor to the correct position to start the flow of fuel oil into the burn pot. Depending on what model of carburetor is on your particular stove, it may need to be pressed down for ON, or be pulled up for ON. The correct orientation will be indicated on each carburetor near the ON/OFF lever.
- When enough fuel has entered the burn pot to fill the center groove (~ 4 tablespoons), turn the control knob AND the carburetor lever OFF.
- Replace burn ring into the burn pot so the cupped part of the ring is face-up (as if it would hold water). The stove will not burn properly if the ring is face down.
- Squeeze a small amount of burn paste (about the size of a marble) onto the end of the metal wire, light the paste, and place the fireball into the puddle of oil in the burn pot. Using the wire, spread the fireball around the fuel puddle.
- Replace the stainless mesh cylinder and close the door tightly (turn door handle until it is snug). Do not over-tighten!
- Wait for the fuel in the burn pot to catch fire. After the flame begins to die down (it could take several minutes), turn the carburetor ON again (ON/OFF lever) and turn the control knob to setting 1.
- The flame should gradually get larger and within a few minutes the stove should begin burning a blue flame.
- Run the stove for at least 15 minutes on low (setting 1) to allow chimney and stove to heat up before adjusting the temperature. Failure to allow proper heating time will cause the system to soot up.
- After fifteen minutes, turn control knob (1 to 6) to achieve desired heat level. Repeat: Make sure the flue and stove are warmed up before making any carburetor adjustments. Adjustments should be of no more than one-quarter turn, and each should be allowed to stabilize for five minutes before making any further adjustments.

Warning: Do not light a flooded or hot stove!

Warning: Do not throw foreign objects in burn chamber! No paper, wrappers, matches, or used tissues!

Note: Tissue paper can be used to light fuel if you run out of burn paste, but do

not leave burned tissue paper in burn pot.

Shutting Off the Kuma Heater

- Trip the float switch on the carburetor and turn the dial on the carburetor to 0 or "off" (clockwise).
- The ball valve near the fuel filter can also be turned off to stop the flow of fuel to the heater. Do not adjust the "firematic" valve that is between the fuel filter and the stove (the only round handle on the fuel line that resembles a spigot).

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.

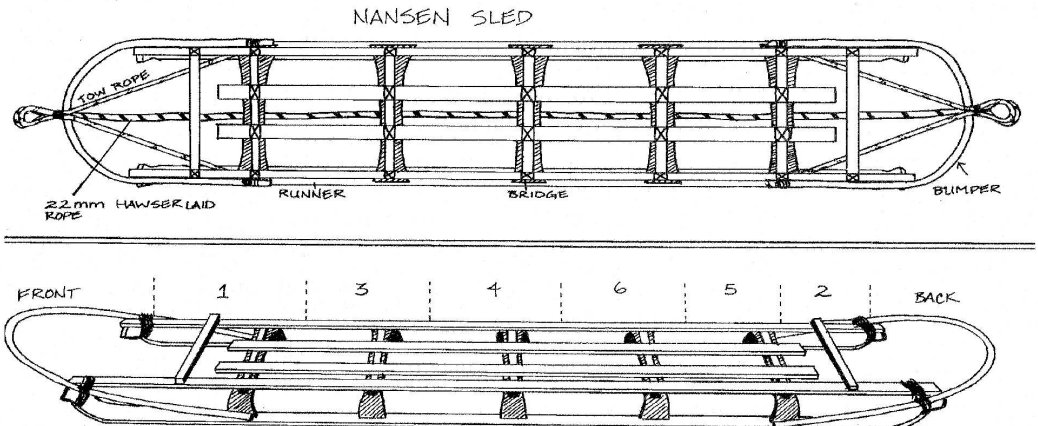
Load the heaviest items on the bottom. Place small items in sled bags. The survival bag should be placed at the top of the load, along with anything the team members might need during the day. Rock boxes (18" L x 12" H x 12" D wooden boxes) make convenient containers for fieldwork and can be loaded with 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.

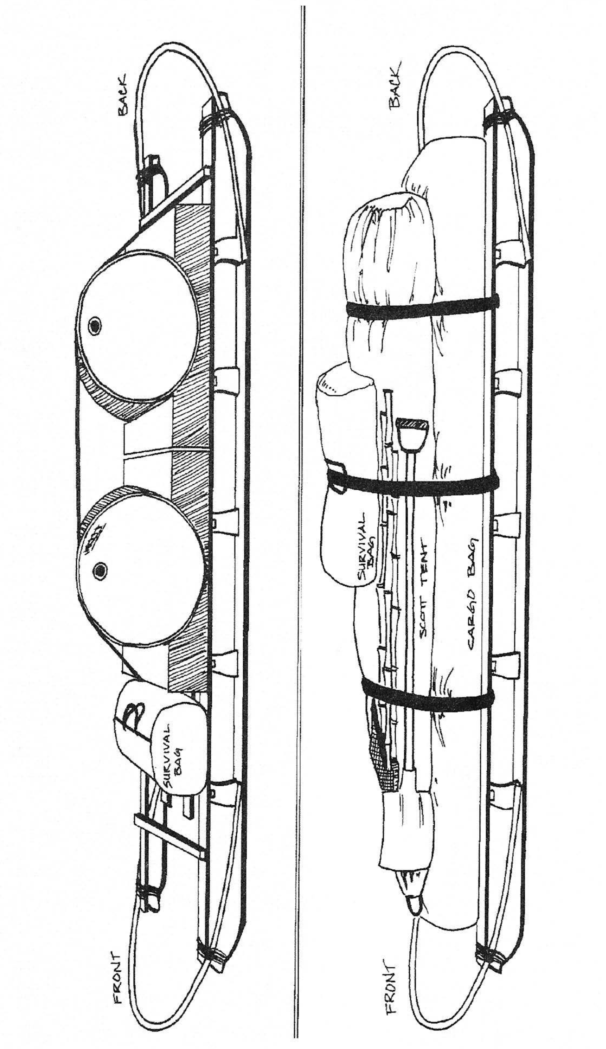
- Nansen sleds can haul two drums side to side.
- Siglin® ultra high molecular weight (UHMW) sleds can also accommodate two drums side to side.
- Komatik sleds can carry up to five drums side by side.

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. Also inspect the snowmobile, tow plate, ropes, and sled at the same time 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.



WEIGHT DISTRIBUTION WHERE 6 IS THE MOST AND 1 IS THE LEAST.


FRONT
BACK
SURVIVAL BAG
FRONT
BACK
SURVIVAL BAG
SCOTT TENT
CARGO BAG

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.
- 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.

Snowmobiles, Generators and Renewable Energy Power Systems

The MEC provides training in the operation and maintanence of generators and other equipment that help power camps to science team members before they deploy to the field. Snowmobiles are maintained by the MEC, but Field safety and training provides the training. 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 the 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.

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 on head: "OK, ready to depart."

Fist in air, elbow at right angle: "Stop" or "Stopping."

Arm outstretched, palm up, pushing up: "Speed up" or "Speeding Up."

Arm outstretched, palm down, patting down: "Slow down" or "Slowing down."

Arm oustretched, pointing: "Watch out for crevasses and other hazards."

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

- Check the fuel level in the tank.
- 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.
- 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.
- 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.
- If fuel will neither flow nor pump, then either the line or the fuel filter is clogged. Clean the line or replace the filter.
- 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.
- 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

- 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.
- 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

- 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.
- 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.
- 503/550: These models have an electronic ignition, so the problem is probably the igniter box. Replace the igniter box.
- 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

- 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.
- 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.

- 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 hot during operation and re- mains hot for a while after stopping the engine. Do not touch the muffler or engine until the generator has cooled down. Let the engine cool before storing the generator indoors.

Pre-Operation Check

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

Starting the Engine

- Make sure the AC circuit breaker is in the "off" position. It may be hard to start the generator if a load is connected.

- Turn the fuel valve to the “on” position.
- Pull the choke rod or lever to the closed position. Note: Do not use the choke if the engine is warm.
- If the generator is so equipped, make sure the auto-throttle switch is off.
- Move the engine switch to the “on” position.
- 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.
- Once the generator has started, push the choke rod or twist the choke lever to the open position as the engine warms up.
- Allow the engine to warm up for three to five minutes; do not apply a load during this time.
- Once the generator is warm, turn on a breaker or plug in a load.

Stopping the Engine

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

Engine Problems

Symptom

The engine will not start.

Diagnosis and Cure

- Check that the engine switch is on.
- Check to see if the oil-alert lamp flashes when the starter is pulled. If it does, add oil.
- Ensure all loads are disconnected from the AC receptacles.
- 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.
- 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

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

Symptom

There is no electricity at the receptacles.

Diagnosis and Cure

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

Mini-Portable Field Power Systems

The Mini-Portable Field Power System 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:

- Open the box and inspect the unit for damage or loose wires. Correct as necessary.
- 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.
- Connect the three-pin solar plug to the three-pin receptacle.
- Connect the five-pin extension cord to the five-pin receptacle.
- 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.

Continental Field Manual

Weather & Sea Ice

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 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 temperature.

NSF McMurdo Station 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 Station, 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 the U.S. Antarctic Program is done under the auspices of the U.S. National Science Foundation and is coordinated through the Naval Information Warfare Center (NIWC). 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, which produces twice daily forecasts for the Antarctic continent.

Terminal Aerodrome Forecasts

Weather forecasts for remote sites are called Terminal Aerodrome Forecasts (TAF), and they are generated each day for sites scheduled to receive an LC-130 aircraft, the only aircraft the program utilizes with instrument landing capabilities. 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 also issued when there is misinformation on the original TAF.

Area Forecasts

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. This should be determined while still in McMurdo Station so expectations and roles are clear.

When to Make Observations Each Day

If no aircraft activity is planned:

- Make three daily weather observations and report them to MacWeather at 6-hour increments, i.e., 1800 Zulu (Z), 0000Z, and 0600Z. You only need to report three out of the four 6-hour increments.
- On holidays, only two observations need to be reported: morning (1800Z) and evening (0600Z).
- All observations should be recorded and called in to MacWeather within 15 minutes of the scheduled time.
- Begin the observation about 15 minutes before the top of the hour. Weather observations should take 10 to 15 minutes to complete.
- Call in the observation within five minutes of the hour.
- If a fixed-wing aircraft is scheduled to arrive:
  - 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.
  - Hourly observations continue while the aircraft is on the ground at camp.
  - If there is a change in the weather before an hour has passed since the last observation, a special observation is reported.
  - Observations return to the normal daily schedule when the aircraft is halfway back to origin.
- If a helicopter is scheduled to arrive, camp personnel should call the hangar Iridium® with a weather update between 0715 and 0730 or between 0745 and 0800.

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 will be able to identify grid north. This will assist in setting up the flagged weather-observation site.

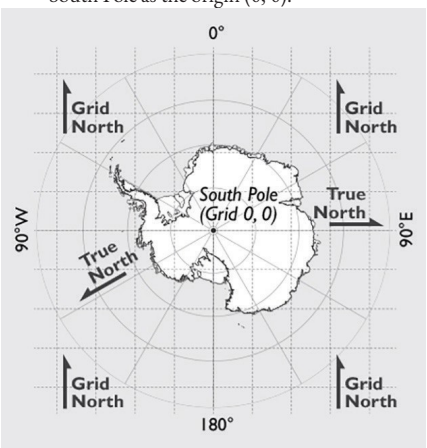
Grid North Versus True North

To avoid confusion, especially when traveling where lines of longitude converge near the South Pole, fixed-wing aircraft pilots navigate using directions based on an artificial grid pattern overlaying the continent, rather than on true compass directions. The designated weather observer in a fixed-wing supported camp should use these grid directions and not true or magnetic direction readings 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

To determine grid north, face true north and treat your meridian as the prime meridian (00 or 360). For east longitude camps, grid north will be true north (360) minus the longitude of the camp.

For west longitude camps, grid north will be true north (0) plus the longitude

of the camp. Once grid north has been identified, grid south, east, and west can be determined easily.

Examples: For a camp located at 1670 E, subtract 1670 from 3600. Place the flag for grid north at 1930 true (i.e. "true" to your subjective orientation, where 1670 E is treated as 00).

For a camp located at 600 W, add 600 to 00 (true north). Place the flag representing grid north at 600 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 member picking it 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 -14°F (-10°C). 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

Record weather observations on the Surface Weather Observations form (METAR/SPECI). MacWeather provides this form. Review how to fill it out at your weather briefing with MacWeather personnel before deploying to the field. Guidance is also provided in the following sections.

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).

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 can 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 9,000 m and precipitation steady.

Snow Grains
Visibility is less than 9,000 m. 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 1,200 m.

Mist
Looks like fog; reported when visibility is between 1,200 and 9,000 m.

Snow Showers
Visibility less than 9,000 m; precipitation intermittent.

Ice Pellets
Visibility less than 9,000 m in steady precipitation of tiny hailstones <5mm (rare event).

Blowing Snow
Visibility less than 9,000 m.

Drifting Snow
Visibility greater than 9,000 m.

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
100	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	7818
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
Unrestricted 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 (4,800 to 9,000 m).

Heavy Ice Pellets
Visibility reduced by ice pellets to less than 3 miles (4800 m).

Light Snow
Visibility greater than ½ mile (800 m).

Moderate Snow
Visibility between ¼ and ½ mile (400 – 800 m).

Heavy Snow
Visibility less than ¼ mile (400 m).

Cloud Layers

Each cloud layer is usually reported using two entries: the first rep- resents the amount of sky covered by a layer and the second rep- resents 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 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

** Altocumula 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 deter- mine 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 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 (e.g., 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.

This is a critical planning detail for helicopter pilots, as they are not allowed to fly over poor surface definition. Helicopter-supported groups on the ice shelf or sea ice must convey this information to the helicopter coordinator or helicopter supervisor if they are expecting a flight.

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 objects appear to float in the air. The sun is totally obscured. The overcast may have considerable glare, which 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 is 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 Central Comms. Provide Central Comms 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 abbreviationfor 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

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 Field Safety and Training personnel 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 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, 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. Sea ice that appears black is thin and should always be avoided.

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**: <14°F
- **Period 2**: 14°F through 23°F
- **Period 3**: 23°F through 27°F
- **Period 4**: 27°F through 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.

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.

Vehicle	Maximum Effective Crack Width (in)	Minimum Ice Thickness (in)			
		Period 1	Period 2	Period 3	Period 4
Pisten Bully	36	12	12	17	17
Hägglunds	27	15	16	21	7
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 Field Safety and Training at X2345 for more information.					

How to Profile a Sea-Ice Crack

- Stop the vehicle before reaching a crack and check for other cracks nearby.
- Determine the nearest edge of the crack by removing snow down to bare ice.
- Using an ice ax, probe for open water or weak spots to deter- mine if it is safe to cross by foot.
- If it is safe, shovel the snow out of the crack from edge to edge, clearing at least one shovel blade width.
- 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.
- Drill each hole either to water level or to a full Kovaks drill flight length (>30 inches).
- Measure the ice thickness in each hole.

- Pay attention to the characteristics of the ice shavings (i.e., dry, moist or slushy).

Sea Ice Crack Profile Example

Effective Width of the Crack

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

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

Rule 2: Effective width of the crack must be less than one-third of the vehicle track length.

Continental Field Manual

Aircraft and Cargo

Overview

Field parties conducting research within 100 miles of NSF 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 desired flight dates and destinations months in advance when submitting their Support Information Packages. Deadlines for submittal to USAP Cargo, commonly referred to as Science Cargo, are established each season by Science Cargo staff and included with the Fixed Wing or Helicopter instructions in the Crary Grantee Binder on arrival.

When project team members arrive at NSF McMurdo Station, flights approved in their Research Support Plan will have 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 assist 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 five business days before a fixed-wing flight and a minimum of three days before a helicopter flight. Field teams that do not meet these deadlines should not expect last-minute service.

Common Hazardous Cargo Items

- 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, commonly known as 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 Station, 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 Station.

Frozen Food

Frozen food for large, ASC-staffed field camps is pulled, packaged and turned over to Science Cargo by ASC personnel, after which the food is stored in McMurdo Station 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 helicopter-technicians.

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

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. Cargo and equipment should be packed in containers that can fit through the cargo door (84"L x 63"H to 93"L x 76"H) and can be moved by one or two people.

Twin Otters

Twin Otter is a Canadian Short Takeoff and Landing utility aircraft that 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 an 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 cancellation. 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 Station 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 Movement Cargo Center (MCC), and outside the dining facility in Building 155.

Flight Day

All field personnel must report to MCC for transportation at the time listed on the flight schedule. All passengers are required to wear ECW gear, either USAP-issued or personal. If wearing personal ECW gear, passengers must present the yellow Bring-Your-Own ECW Clothing Program form. 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.

Note: All USAP personnel must attend a fixed-wing aircraft training course before boarding an aircraft for the first time.

Aircraft Specifications

Aircraft Specifications			
	Twin Otter	**Basler**	**LC-130**
Max. seating	19 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)	~10 hours (with fuel stops)	~10 hours	~8 hours
Cargo door	Side door (4'8"x5'1")	Side door (5'11"x4'8")	Aft door with ramp (10'x9'2")
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 and is subject to change up until the day of flight. 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 Station)

	Twin Otter	Basler	LC-130
Siple Dome	3.3	2.5	2
Byd Camp	6	4.5	3
WAIS Divide	6 (including a fuel stop)	5	3.3
South Pole	6 (including a fuel stop)	4.5	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 Central Comms. Also, every member of the field party should attend the Field Party Shop radio briefing, during which shop personnel will issue field radios and Iridium® phones 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 garbage bags to use as ski-way markers. The flags also help identify wind speed and direction. This task will be specific to location so prior planning is essential.

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 Central Comms. 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

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 Station via Central Comms. Radio communication between some areas of Antarctica and McMurdo Station 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 is activated and the emergency response chain is started, activating the Search and Rescue team. In addition to the daily check-in, field teams may speak with the fixed-wing office anytime between 0730 and 1730 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 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 launch. 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 ("retro") cargo; the estimated weights and dimensions of any cargo pallets; and the handling requirements of any scientific samples (e.g., Keep Frozen, Do Not Freeze). Ice core samples can require additional lead time, so please discuss this in advance of pull out.

Waste Removal

Remote, deep-field groups must return all waste to McMurdo Station. 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 staged and ready for quick loading when the aircraft arrives. For LC-130 flights, all gear must be palletized.

Retrograde Hazardous Cargo

When field parties return hazardous cargo to McMurdo Station, it must be properly packaged and labeled, in a manner similar to how it was originally shipped (e.g., matches in foil, 12-volt batteries in wooden boxes). Each item must have its own separate and complete hazardous declaration (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 cargo for its return flight to McMurdo Station. Partially full fuel drums should be tightly capped and tipped on their side to confirm a good seal.

Caution: When tipping the drums, ensure that spill containment is in place to catch any leakage. Containment must also be used if the drums are shipped on their side. Snowmobiles must have between ¼- and ½-tank of fuel. No more and no less.

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 in the weather section.

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 they 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 NSF 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

USAP operates a small fleet of helicopters in the McMurdo Station area under Federal Aviation Administration regulations. There are two different models: the AS350B3s (known as either "squirrels" or "A-Stars") and Bell 212's. 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

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″
Cago 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 (helo-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 helo-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 three 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 helo-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 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-day notice for 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 helo-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 Central Comms.

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 does not 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 helo-pad 30 to 45 minutes before the flight. All passengers are required to wear ECW gear, either USAP-issued or personal. If wearing personal ECW gear, passengers must present the yellow

Bring-Your-Own ECW Clothing Program form. 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 Station, the helo-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.

After passengers disembark the helicopter, the pilot will listen on Channel 7 and will not depart until a field team member establishes radio contact and calls out the helicopter's tail number. If communication cannot be established because of radio malfunction, the field party will be flown back to McMurdo Station.

Note: Field parties should test radio equipment before deploying to the field.

Helicopter Safety Guidelines

When exiting or approaching the helicopter, remain in the pilot's view. Proceed in a crouch. Do not approach the helicopter without the pilot's visual acknowledgment. Never, ever reach up or chase after a hat or other article that has blown away.

- Any movement on the helicopter pad must be authorized by the helo-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 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.

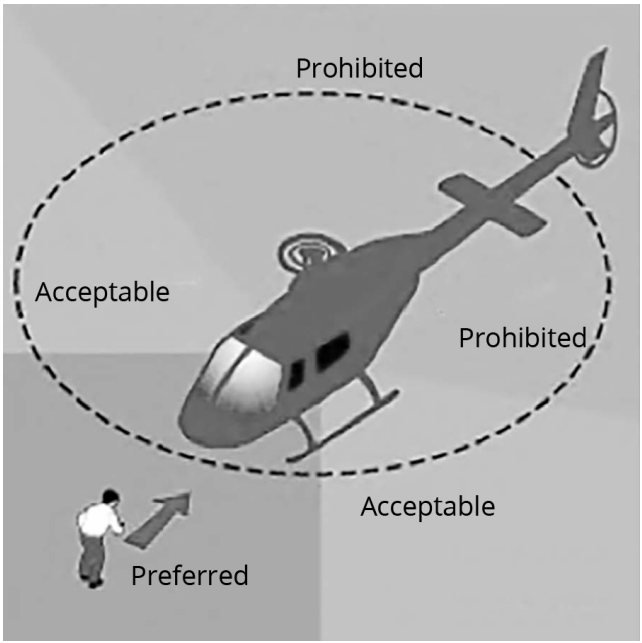
Survival Equipment

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.

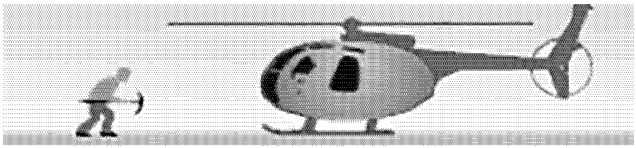
Day Trips

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 overnight. 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.

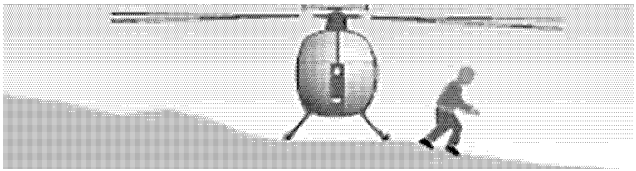
Safety Around Helicopters



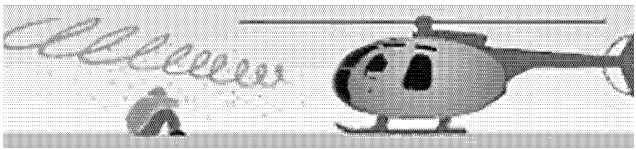
Do not approach without the pilot's visual acknowledgment. Remain in the pilot's view. Proceed in a crouching manner. Never, ever reach up or chase after a hat or other article that has blown away.



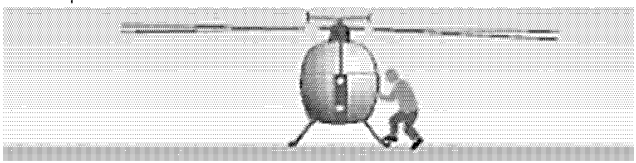
Carry supplies and tools horizontally and below waist level.



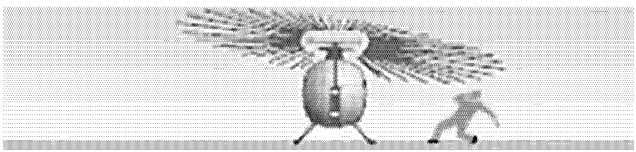
Always approach or exit on the downslope for more clearance.



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.

Flight Time Estimates

(One-Way)

Destination	Time from McMurdo
Allan 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 Station.

Note: Field parties should test radio equipment before deploying to the field.

Every field group must make daily radio contact with Central Comms. 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 Station is poor; they can relay through another camp, South Pole

Station 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 Station to arrange accommodation.

Field Resupply

In camps with phone access to McMurdo Station, 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 Central Comms, 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 helo-pad staff via a pilot.

Loading the Aircraft

In McMurdo Station, the helo-pad staff will load and unload the helicopter. In the field, field team members must perform this function. On most 212-supported missions, a heli-tech will be on board to assist with loading and unloading, but heli-techs do not fly on A-Stars, so all field team members are responsible for knowing how to 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 turning. However, all passengers have the right to request that the rotors be shut down if there is any safety concern.

- 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 a 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.
- **NEVER** approach a helicopter from the rear.
- **NEVER** move upslope near a helicopter when the rotors are in motion.

Boarding

On 212-supported missions, a heli-tech will lead field team members to the helicopter when the pilot is ready for boarding. On A-Star flights, the pilot will indicate when passengers should board. Once seated, passengers must strap themselves in and connect to the helicopter intercom system. They must not talk to the pilot during takeoff or landing.

Survival Equipment

For all flights, helicopter pad staff will ensure sufficient survival bags are on board to accommodate all passengers.

Camp Pull-Out, Helicopter

Field teams that return unneeded material and equipment to McMurdo Station 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 resupply flights, camp moves, and day- use helicopter flights. This reduces the number of pull-out flights. During the daily communication with Helo Ops staff, field groups can pass information concerning retrograde material so it can be incorporated into the schedule on flights of opportunity. Remember: helicopters can sling loads back to McMurdo Station 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 NSF McMurdo Station

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

In general, grantees package the samples, notify either the Crary Laboratory point of contact (ext. 44188, pager 855, or at mcm-Lab-Samples@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

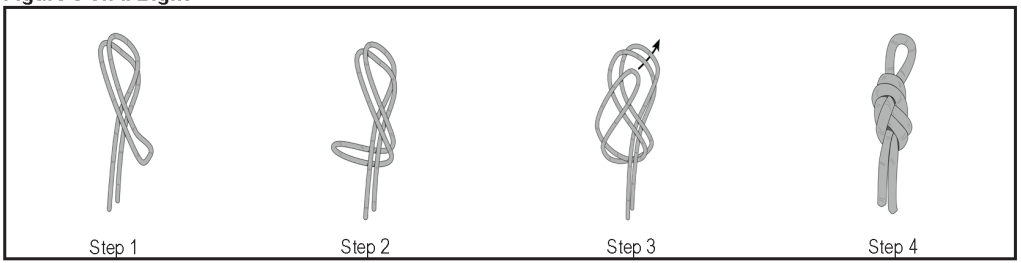
- Time of pickup
- ETA in McMurdo Station

Continental Field Manual

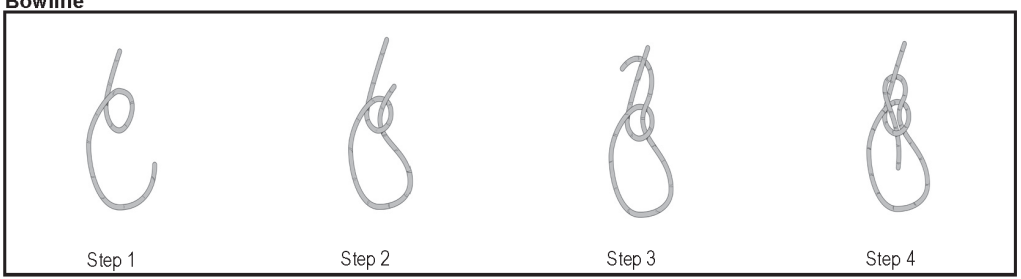
References

Knot Illustrations

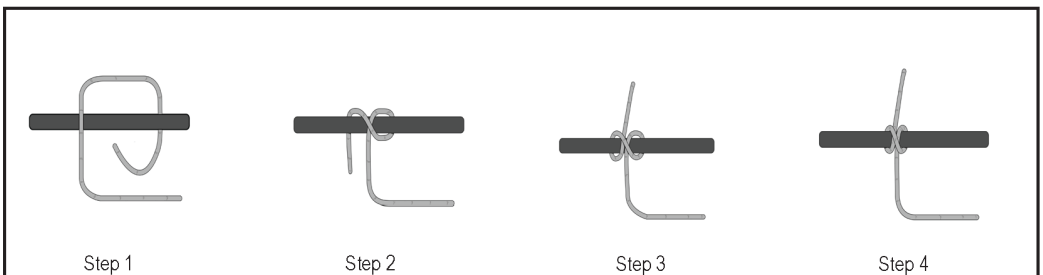
Figure 8 on a Bight



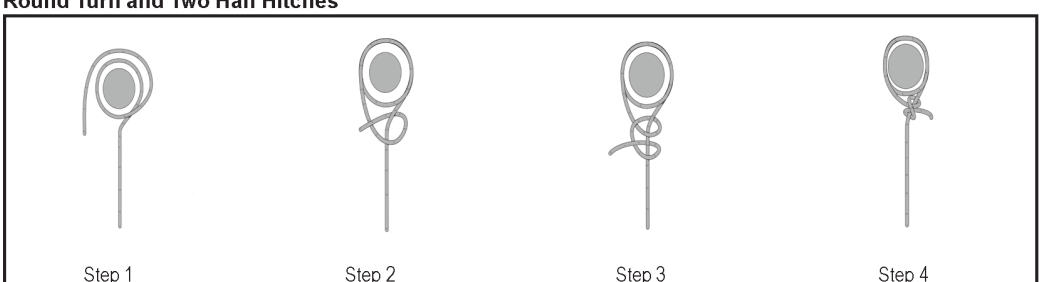
Bowline



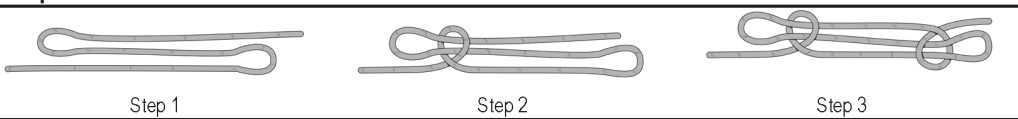
Clove Hitch (Double Hitch)



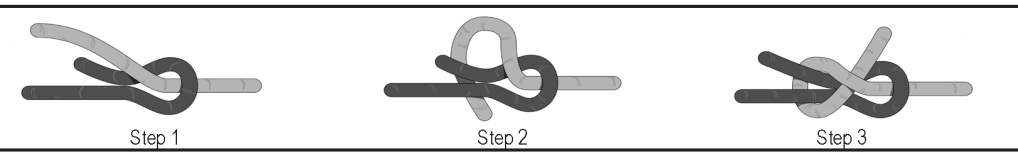
Round Turn and Two Half Hitches



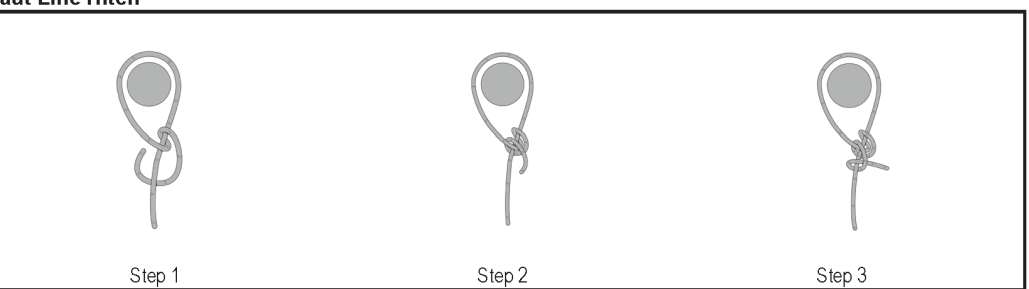
Sheepshank Knot



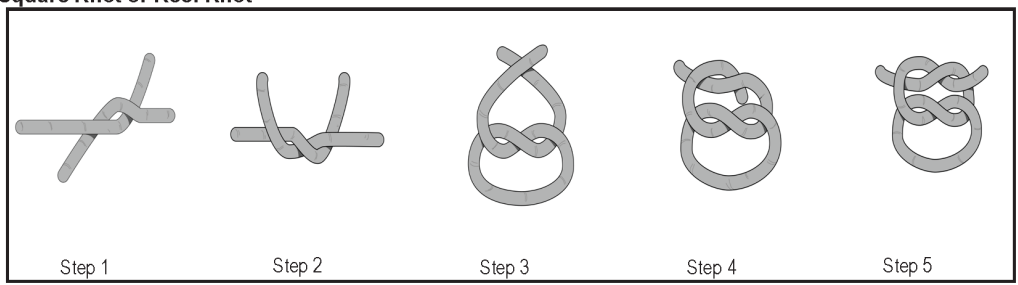
Sheetbend



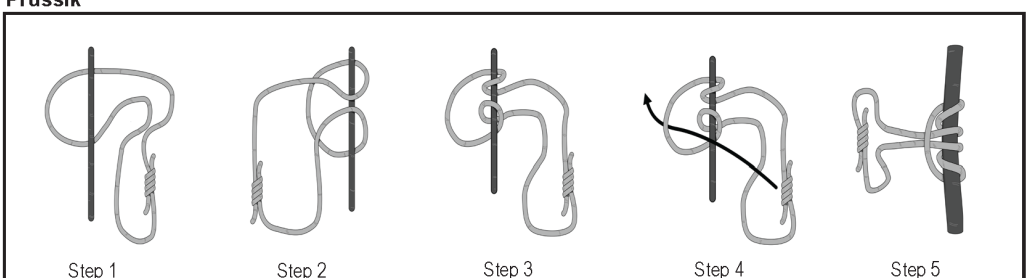
Taut Line Hitch



Square Knot or Reef Knot

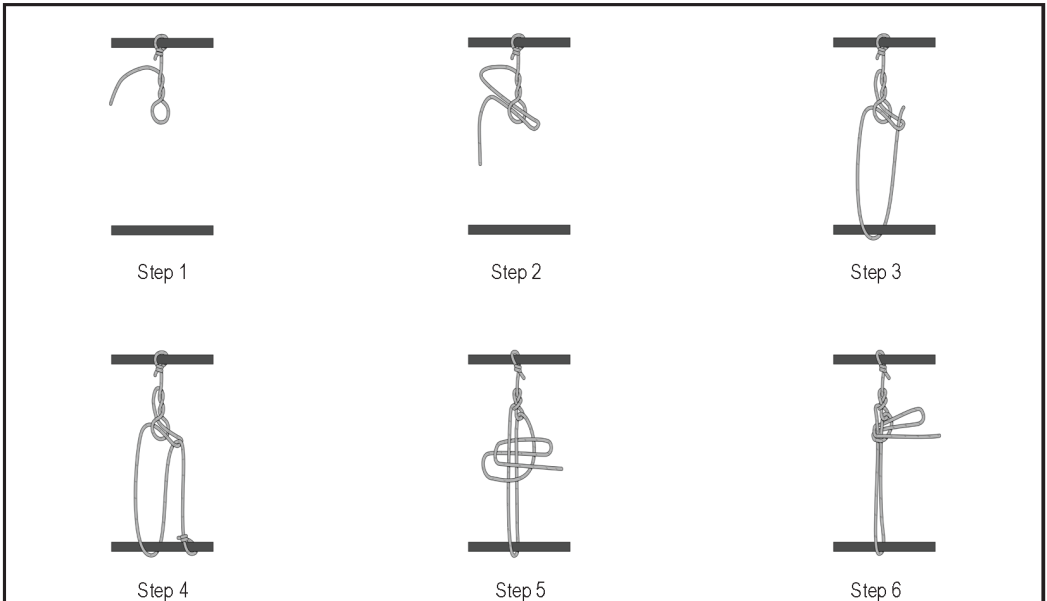


Prussik

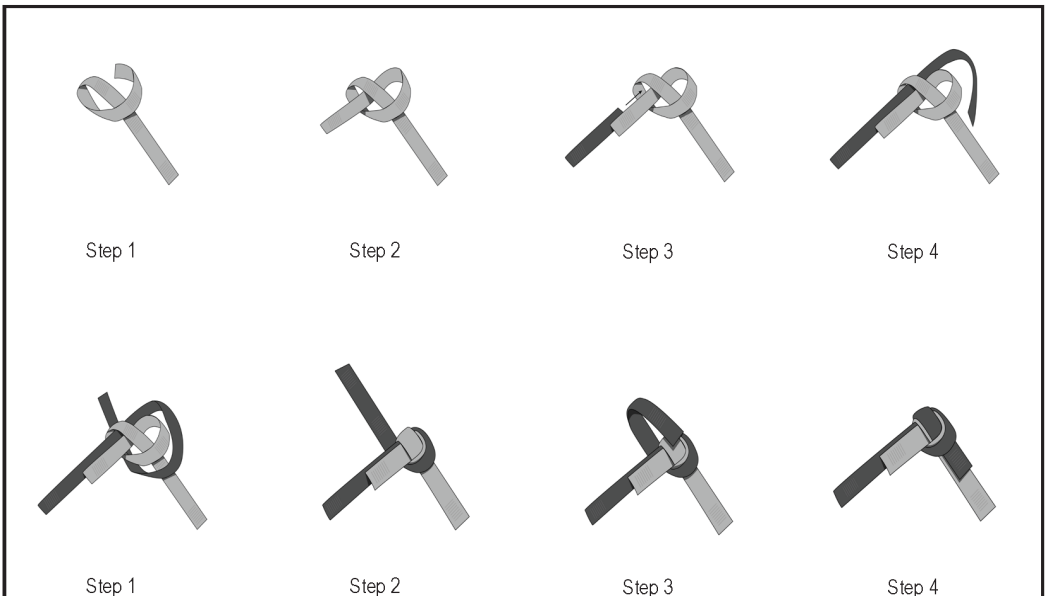


References

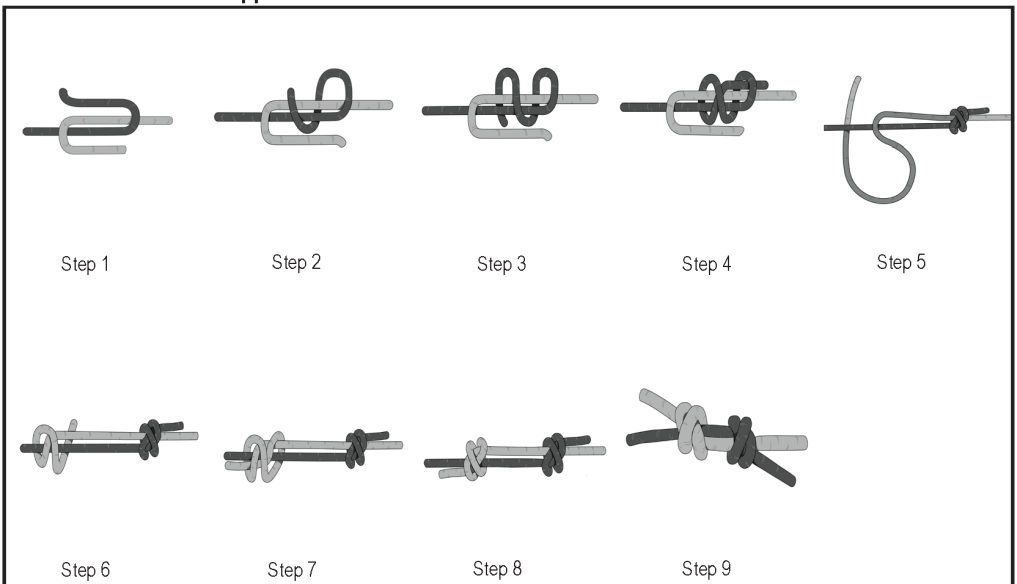
Trucker's Hitch



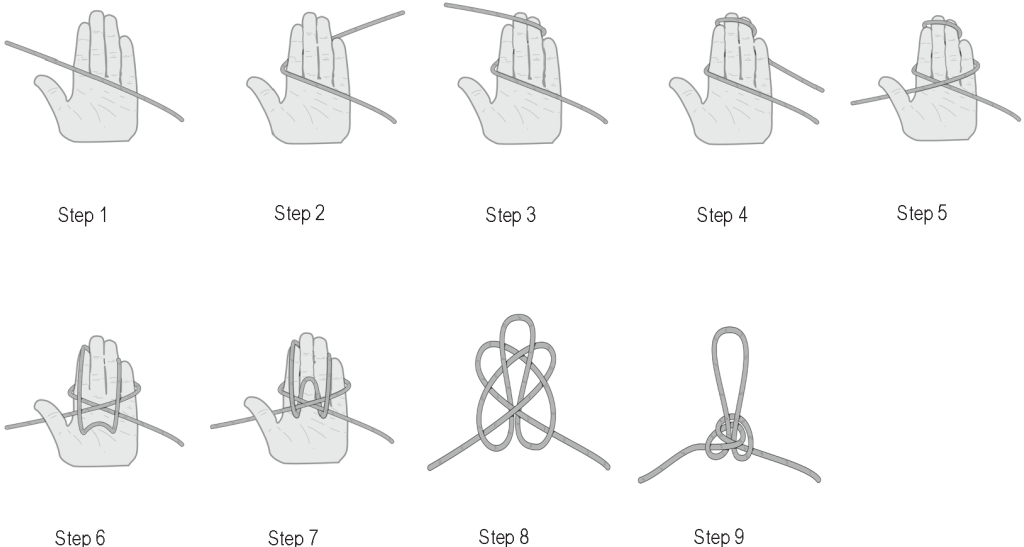
Water Knot



Double Fisherman's Stopper



Alpine Butterfly Loop



Knots are essential for camping and life in the field. This section contains illustrations showing how to tie thirteen useful knots. Below are descriptions of these knots, as well as suggestions regarding when each one might be most useful.

Knot Terminology

Knot – Ties a rope to itself.

Hitch – Ties a rope to another object (post, stake, or eye-ring grommet).

Bend – Ties two different pieces of rope together.

Bight – A curved or slack section of rope between two ends.

Useful Knots

Figure 8 on a Bight

Forms a secure, non-slip loop at the end of the rope. Use the tail end to make a stopper knot. Difficult to untie after a heavy load.

Examples of when to use in the field:

- Climbing and mountaineering.
- Creating a loop for a carabiner to attach sleds to snowmobiles.

Bowline

A loop knot that creates a closed, fixed circle at the end of a line. This is a secure knot that doesn't slip when loaded and is easy to untie. Learn to tie it with one hand for fun or rescue situations. Make a small loop, then the rabbit comes out of the hole, around the tree, and back down the hole. Use a stopper knot.

Examples of when to use in the field:

- Tying around a tent loop to use as a guyline.
- Tying down cargo.

Clove Hitch (Double Hitch)

Great all-purpose hitch to secure a rope when pulled from a post in two directions. It consists of two half hitches around an object then passes under itself, making it a good binding knot. It's easy to untie but needs tension or it will come undone. It can be tied from the middle of the rope.

Examples of when to use in the field:

- Starting or ending lashing.
- Attaching a rope to a carabiner, eye ring grommet, stake or post.

Round Turn and Two Half Hitches

A hitch ties a rope to an object, such as a post or ring. This is a great all-purpose hitch to secure a rope when pulled from a post in one direction. It is strong, doesn't slip, and is easy to untie.

Examples of when to use in the field:

- Lowering survival bags from deck of ship to small boat below.
- Securing survival bags to a bamboo or metal stake so they don't blow away.

Sheepshank Knot

A shank knot is used to shorten a rope or take up slack. It requires tension.

Example of when to use in the field:

- When you need a short length of rope, but don't want to cut the line.

Sheet Bend

A bend knot that joins together two ropes of different sizes or thicknesses. Use the thicker or more slippery rope as the bight, with the thinner rope going around it.

Examples of when to use in the field:

- Lengthening a guyline.
- Fixing a boot lace with paracord or string.
- Using scraps of line to make one of useful length.

Taut Line Hitch

An adjustable loop knot that can slide back and forth along a line. The loop easily adjusts under tension but remains secure once the knot is pulled tight. It is secure, as long as there is tension.

Note: The taut line hitch is a combination of the clove hitch and the round turn hitch.

Examples of when to use in the field:

- Replacing a tent guyline.
- Adjusting the tension on a guyline to achieve optional line tension.

Square Knot/Reef Knot

A binding knot used to tie two ends of a single rope together: right over left, left over right.

Examples of when to use in the field:

- Lengthening a rope by tying two lines together.
- Tying up a bundle of bamboo poles.

- Tying bandages.

Prussik

Friction hitch used to attach a loop of 5mm cord around a rope.

Examples of when to use in the field:

- Climbing and mountaineering.
- Tying items to a guyline so they don't blow away.

Trucker's Hitch

Stretches a rope between two anchor points. It's essentially a block and tackle knot that uses mechanical advantage and friction. Form the loop with the slack part of the line so it does not tension on itself and can quickly be undone and re-tensioned. This knot can be tightened with more force than the Taut Line.

Examples of when to use in the field:

- Tensioning guylines between deadman anchors and the tent.
- Tying and secure sled loads.

Water Knot

Joins two lengths of webbing or straps.

Examples of when to use in the field:

- Lengthening two pieces of webbing.
- Joining two cargo or cam straps together.

Double Fisherman's Stopper Knot

Joins two lengths of rope and is very easy to tie. It is two overhand knots.

Examples of when to use in the field:

- Making slings in climbing.
- Making adjustable necklaces and bracelets.
- Camping crafts on bad weather days.

Alpine Butterfly

Forms a fixed loop in the middle of a rope without needing access to either end. Shortens a long climbing rope or creates a bight in the middle of a rope.

Example of when to use in the field:

- Connecting members of a roped-up mountaineering team See the following pages for descriptive illustrations.

Wind Chill Chart

Wind Chill Chart

Temperature (°F)

Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
Calm																		
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)

weather.gov

References

Weights and Cubes of Common Items

	Convert From	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 Yards	35.3145
	Cubic Yards	Cubic Meters	0.7646
	Cubic Meters	Cubic Yards	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

Weather observations are reported in Zulu Time. For example, the 8:00 a.m. 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.

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

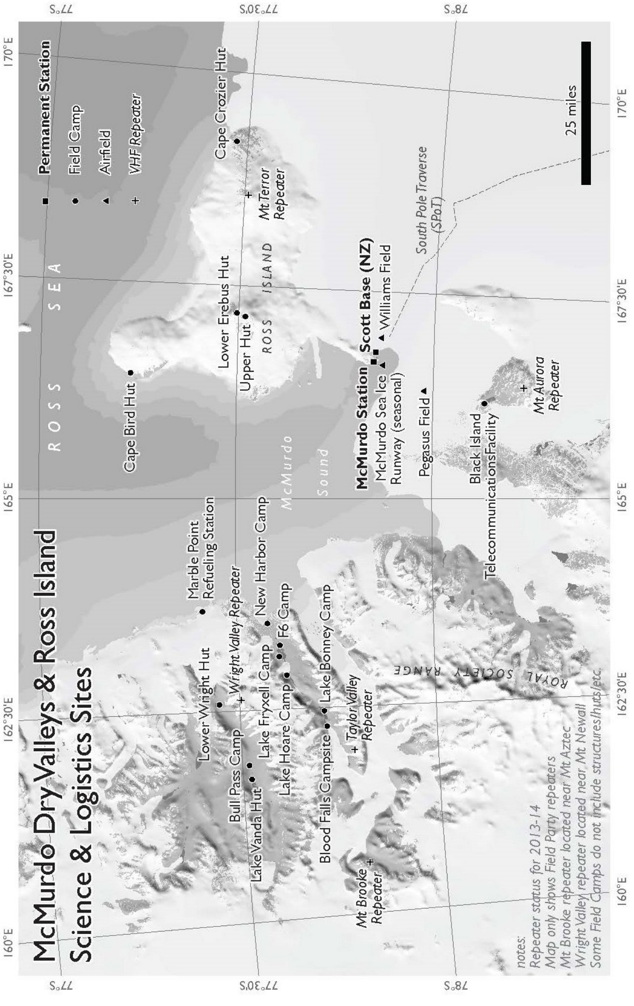
Temperature Conversions

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
Fahrenheit to Celsius: (Fahrenheit-32)x(5/9)	
Celsius to Fahrenheit: (1.8xCelsius)+32	

Emergency Incident Worksheet

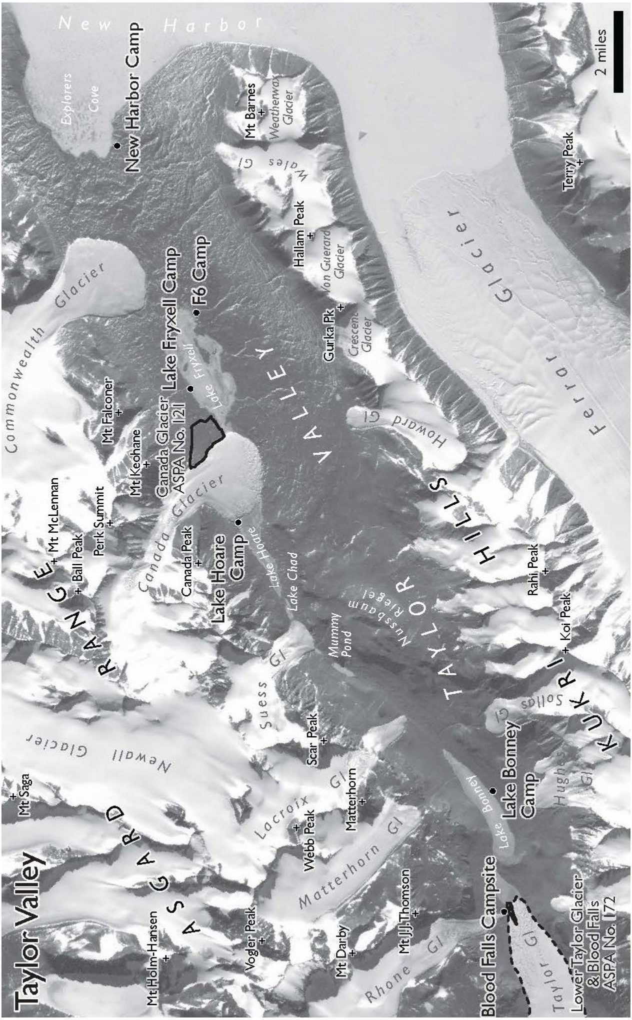
INITIAL INFORMATION				
Time:	**Freq/Phone:**	**Caller Name:**		
Location:				
Situation:				
INJURY OR ILLNESS				
Patient Info – Name, Gender, Age:				
Conscious?		**Yes / No**	**Yes / No**	**Yes / No**
Symptoms or Type of Injury – Area of Body, Bleeding, Deformity				
Mechanism of Injury - Possible Back/Spine, Neck, or Head Injury?				
Pain Level (1-10) - 10 is Highest Level of Pain				
Highest Level of Caregiver's Training				
SPILL				
Active Spill? Yes / No	**Fluid Type (e.g., Fuel, Glycol)**			
Related Injuries?		**(Use Injury/Illness Section)**		
Fire or Risk of Fire?				
Volume of Spill (Gallons)				
Dimensions of Spill Area				
LOSS OF SHELTER OR INFRASTRUCTURE				
Shelter(s) Available – Type and Quantity				
Already Set Up?				
Fire?				
Related Injuries?		**(Use Injury/Illness Section)**		
Food Available? (Estimate Person-Days)				
Fuel Available? (Cooking and Heating – Estimate Days)				
Comms, Power, Batteries?				
AIRCRAFT MISHAP				
Aircraft Type and Call Sign				
Related Injuries?		**(Use Injury/Illness Section)**		
Crew Status?				
Aircraft Engine/Prop/Rotor Still Running?				
Fire or Risk of Fire?				
Spill?		**(Use Spill Section)**		
VEHICLE ACCIDENT				
Vehicle Type and ID				
Related Injuries?		**(Use Injury/Illness Section)**		
Vehicle Still Running or Moving? Stable?				
Fire or Risk of Fire?				

Dry Valley and Ross Island Science Logistics



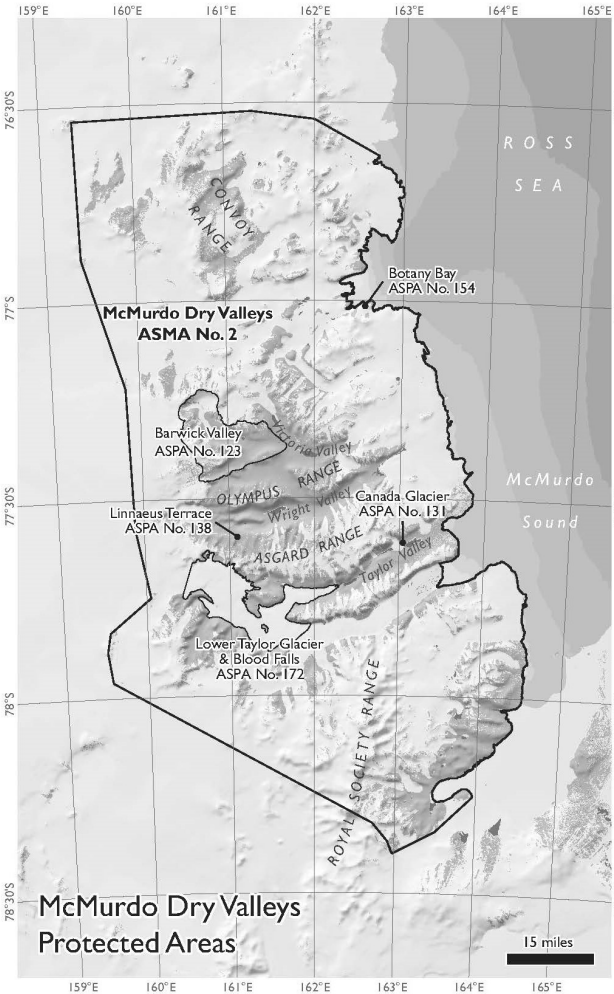
References

Taylor Valley Camps

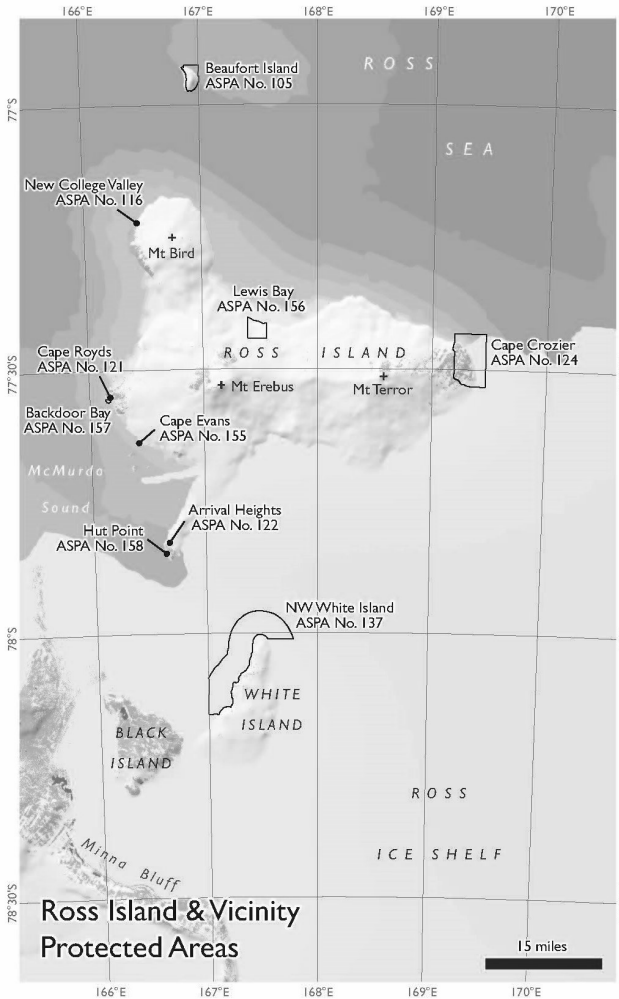


References

Dry Valley ASMA

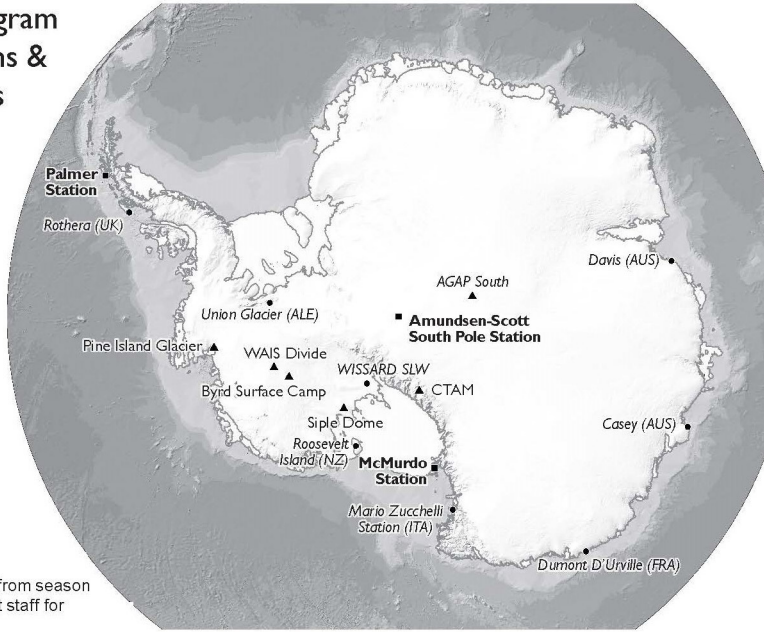


Ross Island ASMAs



References

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



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