SUMMIT STATION GUIDE 2022

Battelle Arctic Research Operations
https://battellearcticgateway.org/

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Summit Station Guide

The pristine environment of the ice sheet surrounding Summit Station, and the historical context of the GISP2 paleoclimate record, has made Summit Station an ongoing research site for investigating high-latitude physical processes, atmospheric and snow science, ice core interpretation, and climate change. Astrophysical research projects are drawn to the site'shigh altitude, northern latitude, and isolation. As the only such year-round facility located on the Greenland ice sheet, Summit Station has an expanding role as an access point for international science activities in the region. The purpose of this document is to acquaint researchers with the research environment at Summit Station, and to identify responsibilities and processes for ensuring a successful cooperative endeavor. The station and its surroundings are carefully managed to minimize the impacts of activities on current or future science, and the participation of science groups is important to this process. Ongoing upgrades will continue to facilitate cutting-edge science at this unique observation site.

COVID-19 update

Since March 2020, travel to Greenland for research and operations has been hindered by the COVID-19 pandemic. Significant requirements have been introduced by NSF and Greenland that may impact fieldwork. The Battelle Arctic Research Operations (Battelle ARO / B-ARO) science project manager will provide current information regarding travel to Greenland, which may supersede information within this guide.

Current information on Greenland travel restrictions:
https://visitgreenland.com/articles/corona-virus-status/

The NSF has published information regarding COVID-19 and research:
https://www.nsf.gov/news/special_reports/coronavirus/

Additional questions can be answered by the Battelle ARO contacts contained within this guide.

Planning Process

Those wishing to work at Summit Station must contact Battelle ARO Science Planning Administrator, Naomi Whitty (arctic.planning@battelle.org +1.303.551.3505). Battelle ARO will distribute a *Requirements Questionnaire* to the researcher to determine the scope, impact, and feasibility of the project. B-ARO can also answer logistical questions and will provide a project cost estimate, which must be included with proposals to the NSF and other funding agencies. Learn more about available proposal assistance at https://battellearcticgateway.org/program-information/proposal-estimate-support B-ARO will work closely with the research teamto keep logistics and support within scope. Planning will be an ongoing process that will be finalized a few weeks before the project deploys for the field.

After initial contact with Battelle ARO, the PI must ensure that the project meets the Government of Greenland permitting requirements. Visit www.nanoq.gl/expeditions to view requirements and download forms from the Ministry of Nature and Environment Section of Industry, Energy, and Research for conducting scientific research in Greenland. Almost all projects require government approval; the webpage provides detailed guidelines and criteria. Also, contact the Battelle ARO project manager to determine if the project will fall under the existing expedition permit that Battelle ARO maintains for Summit Station.

Conducting Research: Roles and Responsibilities

Science Coordination Office (SCO)

The diverse and interconnected research conducted at Summit Station and the dry snow zone of the Greenland ice sheet is facilitated by the Science Coordination Office (SCO) https://geo-summit.org/sco. The role of the SCO is to support decision-making processes concerning current and future Summit Station activities, and to protect the pristine character of the site as a long-term resource for science. The SCO is composed of researchers who have a comprehensive understanding of the operational requirements, science activities, and infrastructure at the station. Researchers considering fieldwork at Summit Station must contact the SCO at sco@geo-summit.org during the proposal stage.

Science Project Manager for Summit Station

The Battelle ARO science project manager (PM) coordinates logistical support for research projects at Summit Station. They work directly with researchers to develop season plans prior to deployment to Summit Station. These plans include details of facility access, technician assistance, equipment usage, lodging, transportation, cargo, and other support provided by Battelle ARO. The PM coordinates with research teams and the SCO to efficiently use Summit resources and to avoid conflicts between science projects. The PM also supervises the year-round Summit Station science technicians and their support of ongoing research, and coordinates with the site supervisor and other staff to ensure that project needs are met while groups are in the field.

Contact the science project manager (Sam Dorsi, sam@polarfield.com) with questions regarding Summit Station, project support, and any changes to project plans.

Summit Station Science Technicians

Science technicians are available year-round at Summit Station to provide hands-on project support. Science technician responsibilities include inspection of instrument components, frost removal, sample collection, routine service and calibration, reporting and documentation, as well as diagnostics and repairs in close coordination with researchers.

Researchers requiring science technician services must request this support at the project planning stage. The researcher then works with the PM to provide comprehensive science protocols. This information will be reviewed by Battelle ARO to ensure the protocol provides adequate guidance for the science technicians and is supportable within the staffing level planned for the season.

Experimental research sometimes requires extended troubleshooting. However, if the time committed to any given project routinely exceeds the anticipated level by 25% or more, it may adversely impact other projects. In such an event, the PM will assist with identifying solutions. All equipment, instrumentation, and science protocols must be fully operational before the science technicians can assume responsibility for an experiment.

Effective science technician support requires researcher engagement. Researchers must communicate with the science technicians to ensure that support requirements are met. When

contacted by the science technicians regarding an experiment, it is the researchers' responsibility to respond promptly.

Construction Support

All requests for construction support must be communicated to the PM during the proposal estimation process. This includes even seemingly small requests such as cutting of wall penetrations or minor carpenter assistance in mounting equipment. The construction team works on a closely planned schedule, and unforeseen tasking can be very impactful or unsupportable.

Because of electrical and safety code requirements, special power demands must be coordinated in advance, so a licensed electrician can be assigned as needed. Project power requirements should be communicated during planning, as station power production and power loads are closely tracked. Power at Summit Station is typically provided as 110 VAC, 60 Hz, with US-style power outlets. Requirements outside these parameters must be discussed during the planning process. In no case will researchers be allowed to modify grid-tied electrical components themselves.

Summit Station Site Supervisor

The Summit Station Site Supervisor has the final authority on safety and operational issues at Summit Station. They lead a daily morning briefing to discuss weather, planned work activities, flight operations, and any other station-wide concerns. Attendance is required for all station personnel, including researchers, unless coordinated in advance.

Based on weather conditions, the site supervisor may limit or prohibit travel or other activities.

Any concerns or requests concerning onsite operations should be promptly addressed to the site supervisor. The site supervisor will redirect researchers to their PM as appropriate.

Harassment

NSF-supported Arctic Research field sites, camps, and stations are managed by Battelle ARO using the following guidelines**.** Professional conduct and acceptable behavior are mandatory for participants during work and non-work hours. Participants are expected and required to work cooperatively, to treat others with dignity and respect, to follow the site-specific policies and procedures, and to contribute to a safe work and living space.

The Battelle ARO site supervisor has the responsibility and authority to address behavior issues and may remove from a field location any participant exhibiting unacceptable behavior. This includes but is not limited to harassment, alcohol misuse, unsafe work behavior, and not following the site-specific policies and procedures. For more information on NSF's harassment policy visit: https://www.nsf.gov/pubs/issuances/in144.jsp?org=NSF

Cargo

All cargo destined for Summit Station is routed through Kangerlussuaq prior to shipment to Summit via the 109th New York Air National Guard (ANG). Cargo to Kangerlussuaq can arrive via commercial air from Europe or via the ANG from Scotia, NY. Researchers will be asked to conform to the ANG's schedule. All cargo requirements must be communicated as early as possible to the PM, as space is often very limited.

Refer to the Greenland Guide and/or https://battellearcticgateway.org/ **for details onhow to prepare cargo for transport on the New York Air National Guard 109th flights.**

It is the researcher's responsibility to ensure all inbound and outbound shipments are accurately entered into the Cargo Tracking System.

All hazardous cargo must to be identified to the PM prior to shipment. Researchers are responsible for hazardous cargo arrangements and must provide SDS to the Summit Station site supervisor upon arrival.

At Summit Station, an outdoor cargo line is provided for storing shipping containers, gas cylinders, and spare materials. Indoor heated storage is available for sensitive items that cannot freeze; however, such space is very limited and closely managed. Researchers must work with the PM to identify indoor storage needs during the proposal estimation process.

Researchers are also responsible for return shipping and disposal of hazardous cargo. All hazardous cargo shipped out of the field requires certification: if the research team is not qualified to certify hazardous cargo, Battelle ARO field personnel must be notified upon arrival for arrangements.

Researchers should plan to remove all supplies from Summit Station at the end of their deployment. Only priority items approved by the NSF via the PM can remain over the winter season or beyond the end of the project.

For efficiency in the field, plan return science cargo shipments prior to deployment.

Travel to Summit

Visit the Battelle ARO website at https://battellearcticgateway.org/ and review the *Greenland Guide* prior to travel. It may also be useful for researchers to visit https://geo-summit.org/ for information on current research projects, conditions, and services. For research participants who are not US citizens, consult the US Customs and Border Protection website at http://www.cbp.gov for information on visas.

Contact the PM if there are questions prior to departure or en route.

Travel to Kangerlussuaq

Researchers can travel to Kangerlussuaq on commercial carriers from Copenhagen, Denmark or on the AirNational Guard (ANG) from Scotia, New York, USA, **though travel routing during the pandemic is subject to NSF protocols.** Refer to the *Greenland Guide* found on thehttps://battellearcticgateway.org/ for further details.

Travel from Kangerlussuaq to Summit

Upon arrival in Kangerlussuaq, Battelle ARO staff will provide a briefing on the Kangerlussuaq to Summit Station flight. Schedules are highly dependent on weather and subject to change. It is advisable to regularly check the notice whiteboard located on the first floor of the Kangerlussuaq International Science Support (KISS) building.

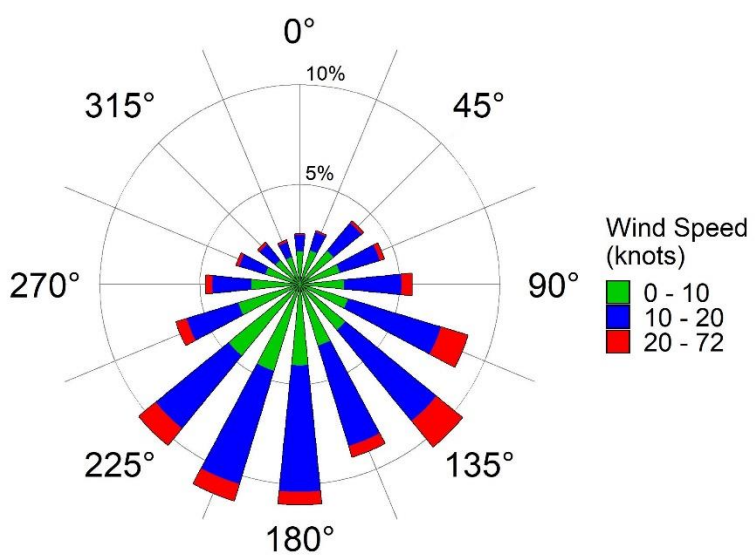
Summer flights to Summit Station occur via ski-equipped LC-130 operated by the ANG. Flight duration is approximately two hours. It is important to dress appropriately, with cold-weather gear at hand, as disembarking passengers will experience outdoor Summit Station weather conditions upon arrival. After exiting the aircraft, passengers will be directed to walk about 200 meters to the central Big House structure where the station site supervisor and station medic will greet arrivals and provide a briefing. With exception of hand-carry items, all baggage and cargo will be offloaded by the Summit Station staff and ANG crew.

Site Context and Climatology

Summit Station is named for its proximity to the apex of the Greenland ice sheet. Located in the dry snow region, approximately 400 km from the east and west coastlines, Summit Station experiences ~0.7 m snow accumulation per year. As Summit Station is co-located with the GISP2 borehole, it both benefits from and enhances the interpretation of a ~110,000-year reconstructed climate record. Due to its high latitude and high altitude, Summit Station offers access to free tropospheric air. Summit Station is within the North-East Greenland National Park at N 72.6° W 38.5° and 3,250 m (10,530 ft) AMSL.

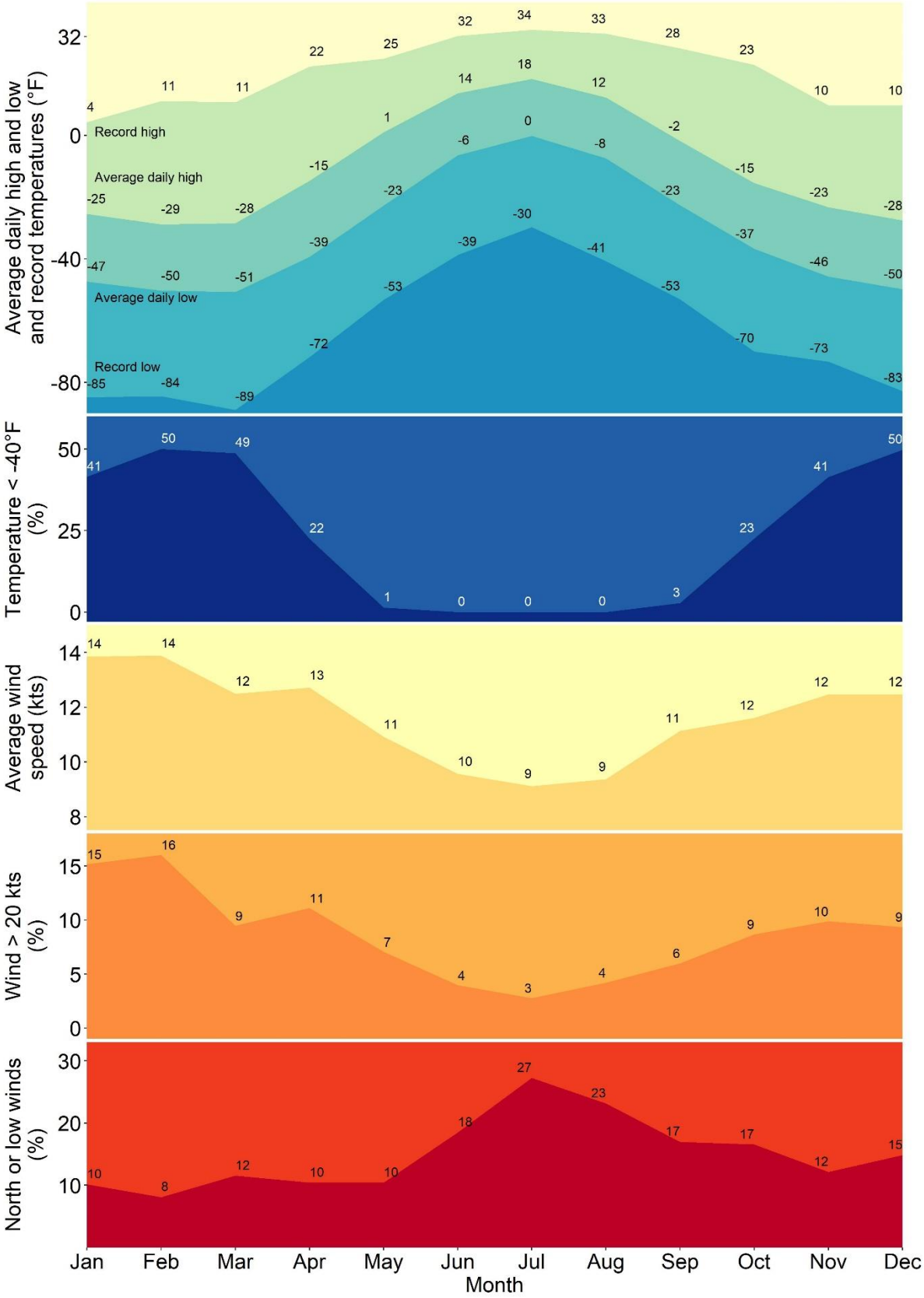
The pressure altitude at Summit Station ranges from about 10,000 to 12,500 ft. Recorded temperature extremes since 2009 range from -89°F in the winter to 34°F in the summer. Summertime winds average 10.2 knots but can exceed 40 knots during storm events. Wintertime winds are often stronger; sustained speeds of over 71 knots were recorded in February 2018.

Summit Station Wind Speed and Direction



Summit Station, Greenland

Annual climatology



Source data NOAA ESRL 1-minute averages, July 2008 to Sept 2021

Station Layout

Summit Station is a remote research station that exists solely to support science. The station houses a variety of structures designed to support a highly variable population that ranges from a minimum of four staff members during the winter to a maximum of over 50 staff, researchers, and visitors during the summer.

The Big House is an elevated building that serves as the center of station activity. It contains the kitchen, dining area, staff office, communications equipment, one bathroom, laundry, and a lounge.

The Berthing Module and Clinic structure is made from connected modules. It contains a medical clinic, emergency food supply, communications equipment, five bedrooms, and one bathroom.

Diesel generating sets in the Summit Mobile Garage (SMG) power the station. The SMG also houses mechanic workspace and scientific balloon preparation equipment. A standalone snow-melter structure supplies water to the station.

The two main science structures at Summit Station are the Atmospheric Watch Observatory (AWO) and the Mobile Science Facility (MSF). The AWO is located within the Clean Air Sector, a limited-access science zone 700 meters south of the main station structures. The MSF is located 200 meters east of the Big House.

Services, People and Living

Accommodations

All researcher berthing is within communal, hard-sided structures. Participants should expect to have a roommate. Participants are provided with sleeping pads and elevated bunks or cots but are responsible for providing their own sleeping bags. As most researcher berthing is passively heated, Arctic-grade winter sleeping bags are required. Both passively heated outhouses and indoor bathrooms are available.

Food

Summit Station is staffed with a chef, who prepares lunch and dinner meals six days a week. Breakfast and snacks are self-serve, with a range of food items available at any hour. On Sunday, staff and researchers are asked to prepare their own meals or to serve themselves from leftovers. The site supervisor will assign ‘house mouse’ duty on a rotating schedule to both staff and researchers. Those assigned as ‘house mouse’ are expected to dedicate a significant portion of the day to chores, cleaning, and kitchen assistance.

Phone

Phone connections from Summit Station to offsite locations are enabled via VoIP, VSAT, and Iridium technologies. For non-emergency use, Battelle ARO requests that researchers only use the VoIP phones, as these are the most economical. Phones are available at several locations around Summit Station. Both researchers and staff are asked to limit personal phone usage, as the phones are primarily intended for priority science and business needs.

Computers and Internet

Summit Station is equipped with a satellite network connection, and wireless access points are available in many buildings. This connection is available for researcher use. However, the system capacity is intended to accommodate limited offsite communications and cannot support intensive demands. The following guidelines are in place for network usage at Summit Station:

- Bandwidth is very limited. Science and work activities take priority over personal use.
- Discuss any data transfers (> 250 MB/day) in advance with the PM.
- Disable auto-update features, cloud services, data synchronizing applications, podcast subscriptions, and other passive bandwidth uses on all computers and devices.
- Place devices on 'airplane mode' when not in use to reduce background usage.
- If possible, schedule network activities during periods of low usage.
- If overtaxed, the system becomes unusable for all parties, and critical science functions are impacted. If this occurs, Battelle ARO can institute strict policies to regulate usage.

Money

The Danish Kroner currency is used throughout Greenland. However, no currency of any type is required at Summit Station, as no goods are available for sale. See the *Greenland Guide* for further information regarding currency use in Greenland.

Medical

During the summer months, Summit Station is staffed with a full-time, on-site medic. Emergency and non-emergency telephone-medicine consultation is also available. The station clinic is stocked with a full field medical kit. In addition to these services, typically several staff members at the station have a Wilderness First Responder certification.

Upon arrival in Kangerlussuaq, anyone experiencing symptoms of illness should be evaluated prior to departure for Summit Station. The Kangerlussuaq Battelle ARO staff must be alerted of any developing medical condition that could compromise travel to Summit Station. Even a moderate cold can greatly diminish tolerance to altitude.

Upon arrival at Summit Station, the station medic will provide a medical information questionnaire. Be sure to bring a sufficient supply of prescribed medications, with the awareness that departure flights are often delayed, and that limited medications are available at Summit Station.

Altitude Sickness

The pressure altitude at Summit Station typically ranges from 10,000 to 12,500 ft. Altitude sickness is a serious medical concern and can result in evacuation. For that reason, Battelle ARO recommends that all participants consult with their physician regarding prescription medications for preventing altitude sickness. As past experiences at altitude are not always predictive, repeat Summit Station visitors are encouraged to take precautions against altitude illness.

There is no opportunity to acclimatize before arriving at Summit Station. Follow these suggestions to minimize the risk of altitude sickness:

- Avoid alcohol for several days before and after arrival.
- Avoid fatty or greasy foods.
- Eat large quantities of carbohydrates for a few days before arrival.
- Drink plentiful hydrating liquid for a few days before arrival.
- Get adequate rest prior to and during travel.
- Plan for minimal physical labor during initial days of acclimatization after arrival

Conservation

Resources at Summit are precious. Participants are expected to be mindful and conserve when possible. Electrical power is produced by diesel generators using fuel supplied via aircraft. Electrically efficient instrument designs will reduce local combustion emissions and resulting science impacts, as well as reduce project support costs. Water is produced from snowmelt, in a power and labor-intensive process. Limit laundry to no more than one load per week: bring clothing adequate to last for eight days. Limit showers to a maximum of once every four days. Hand soap and laundry detergent are supplied.

Recreation

Basic recreational facilities and materials are available at Summit Station, including exercise equipment, a video library, and books. Skiing, walking, or snow biking on the skiway or on approved flagged routes are also popular activities. A check-out policy applies to recreational travel; consult the site supervisor for information.

Drugs and Alcohol

Battelle ARO does not tolerate drug or alcohol abuse. Staff or researchers over the age of 21 may consume alcohol and are expected to drink responsibly. Anyone using illegal drugs or abusing alcohol will be sent from Summit Station on the next available flight.

All staff and researchers must abide by Government of Greenland policy for importation of alcohol into Greenland. The policy is subject to change, and in past years importation of alcohol has been restricted or illegal. Participants are responsible for being aware of and complying with Government of Greenland customs requirements and restrictions. Illegal import of alcohol is not tolerated.

Vehicle Use and Travel

For safety reasons, locations in the Summit Station vicinity have been classified as either "in-station" or "out-of-station." Different travel requirements apply to these locations. Travel requirements details are explained in the *Summit Station Travel Policy*, which the site supervisor will review with participants upon arrival. Contact the PM for information regarding project support in accordance with the policy.

At Summit Station a "pedestrian culture" is encouraged. Most areas can be reached by foot, and it is critical for the ongoing success of clean-air science to minimize emissions whenever possible. Small sleds are available to facilitate transporting loads by foot.

Battelle ARO maintains a small pool of snowmobiles for use by staff and researchers. Snowmobile use must be approved by the site supervisor. Projects requiring snowmobiles must coordinate in advance with their PM to ensure that an appropriate machine is available and permissible in their project site. All snowmobile operators must receive training annually, and operators and passengers must wear helmets. Unauthorized or recreational use of snowmobiles is forbidden.

Operation of equipment in the clean air and other science sectors is strictly controlled, and requests must be approved by the PM and the SCO. Details and guidelines for access to the clean air sector are outlined in the *Clean Air Management Plan*, available from the PM.

About this Guide

This guide is intended to offer an overview of what to expect at Summit Station and the steps needed to initiate the planning process. It is not exhaustive and cannot provide all the information necessary for a safe and productive season at Summit Station. It does not substitute for a Battelle ARO-developed season plan.

This guide is updated annually, and suggestions or comments are welcome.

Contact the Battelle ARO Science Project Manager Sam Dorsi at sam@polarfield.com with questions.