

# **Field season 2026**

## **ERC Green2Ice ice core project**

**Prepared by Ice and Climate Group, NBI  
for  
The project responsables and participants and Danish and Greenlandic  
authorities.**



View over the GRIP camp that was established during the summer of 2025. Beautiful pattern of tracks with the skiway and the apron in the background.

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## **Introduction to 2026 field work**

This report provides international partners and Danish and Greenlandic authorities information on field activities in Greenland, and it provides information to the participants on the conditions in Kangerlussuaq and the field camp. It includes a summary of all individual travel dates and information on science programs. It also contains information and rules on environmental issues, work safety and disaster preparedness. All participants are assumed to be familiar with the content of this report.

In addition to general information, the report contains reference information of special interest for the Field Operation Managers and Field Leaders.

The authors wish to express sincere gratitude to the U.S. National Science Foundation and their logistical agent Battelle ARO Polar Field Services (PFS), the New York Air National Guard (109<sup>th</sup>) and the Alfred Wegener Institute for their assistance and their supportive actions over the past many years and in anticipation of the upcoming field campaign in Greenland. Without this assistance, little of what is planned for the 2026 season could be realized.

Copenhagen, April 23rd, 2026

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## The ERC project Green2Ice, [www.green2ice.eu/fieldwork/](http://www.green2ice.eu/fieldwork/)

### **Background**

The ERC synergy project Green2Ice (2023-28), is investigating the deepest and oldest ice and basal sediments drilled from the Greenland Ice Sheet (GrIS). Green2Ice is developing and applying cutting edge dating methods on this unique sample collection to reconstruct the age and the stability of the GrIS. A major achievement of Green2Ice will be to drill a replicate core at GRIP site, from where a deep ice core was retrieved by a European drilling consortium in 1991. At the time, the drilling was terminated close to bedrock. The GRIP replicate drilling will use the existing liquid-filled GRIP borehole to gain access to the deepest part of the ice sheet and re-drill the deepest 200 m section of the ice. Furthermore, the project will aim to ensure retrieval of sediments and rock material from beneath the GrIS summit at the GRIP site.

Principal investigators: Francois Fripiat, Bruxelles; Pierre-Henri Blard, Nancy; Anders M. Svensson and Dorthe Dahl-Jensen, Copenhagen.

In 2025, all camp assets from EastGRIP drilling site (2016-2024) were moved by overland traverse, some 340 km to GRIP in the middle of the Greenland Ice Sheet. Garages and main dome were setup as well as skiway for LC-130 operations. At GRIP, the top of the old borehole was located and a camera sent down to ensure that there is free passage for an ice core drill to be lowered into the borehole.

### **The 2026 Green2Ice field season at GRIP**

The main goals for the for the 2026 Green2Ice field season at the Greenland Ice Core Project (GRIP) site in central Greenland are to establish a drill site, to log the existing bore hole, to drill to bedrock and possibly to drill into the bedrock. The existing GRIP borehole that was drilled between 1988 and 1991 almost reaches bedrock at a depth of 3029 m into the ice sheet. By retrieving ice from the deepest part of the Greenland ice sheet at the GRIP site, we hope to obtain some of the oldest Greenland ice and to learn for how long time the site has been covered by ice.

Besides those major Green2Ice activities, a number of associated scientific projects and several tasks related to camp construction or development are scheduled for the 2026 field season.



*GRIP camp as it looked in July 2025 just before pull-out. In the back is the runway with apron. The black main dome and the two red garages are set at 'main street'. The white drill tent will be moved*

to the drill site next to main dome in 2026. The pattern in the foreground shows the seven snow hills for cargo storage that make up the winter storage 'cargoline'.

### **Scientific plan for 2026 field season**

After the GRIP casing was re-localised and the casing was found intact by video inspection in 2025, the main tasks for the deep drilling operation in 2026 are to log the borehole and to drill through the remaining part of the deep ice sheet to bedrock. When the deep drilling at the GRIP site was terminated in 1991 at 3029 m depth, the deepest retrieved ice had a brownish colour due to a high content of impurities that is typically found in 'basal ice' close to bedrock. The bedrock was, however, not reached at the time. The bedrock temperature is estimated to be approximately  $-8^{\circ}$  to  $-9^{\circ}\text{C}$ , which is below the pressure-melting point. A first goal for this season will be to log the borehole and obtain a temperature profile. A second goal is to reach bedrock by drilling through the remaining basal ice. If successful, attempts will be made to drill into the underlying bedrock or sediment below the ice sheet using a rock drill.



*The happy 'science traverse team' that rediscovered the casing of the GRIP borehole about 4-5 m below the snow surface on June 7, 2025. The GRIP casing was extended to surface.*

The processing of the ice core in the field will be held at a minimum. The ice core will be logged and packed in ice core boxes in 55 cm sections without further processing or analysis. We may choose to/will scrape off water isotope samples from the outside of the core in order to obtain a preliminary climate profile of the deepest ice. The handling of the core from drilling to packing into boxes will be done under 'red light conditions'. This is a necessary measure for potential future OSL (Optically Stimulated Luminescence) dating of the basal ice that cannot be exposed to strong light sources. The full processing of the ice core is planned to happen at AWI or in Copenhagen at a later stage.



*In June 2025, the extended casing seen to the east of Main Dome at a distance of 60 m. The drill site will be constructed around the casing.*

### ***Associated plans for 2026 field season***

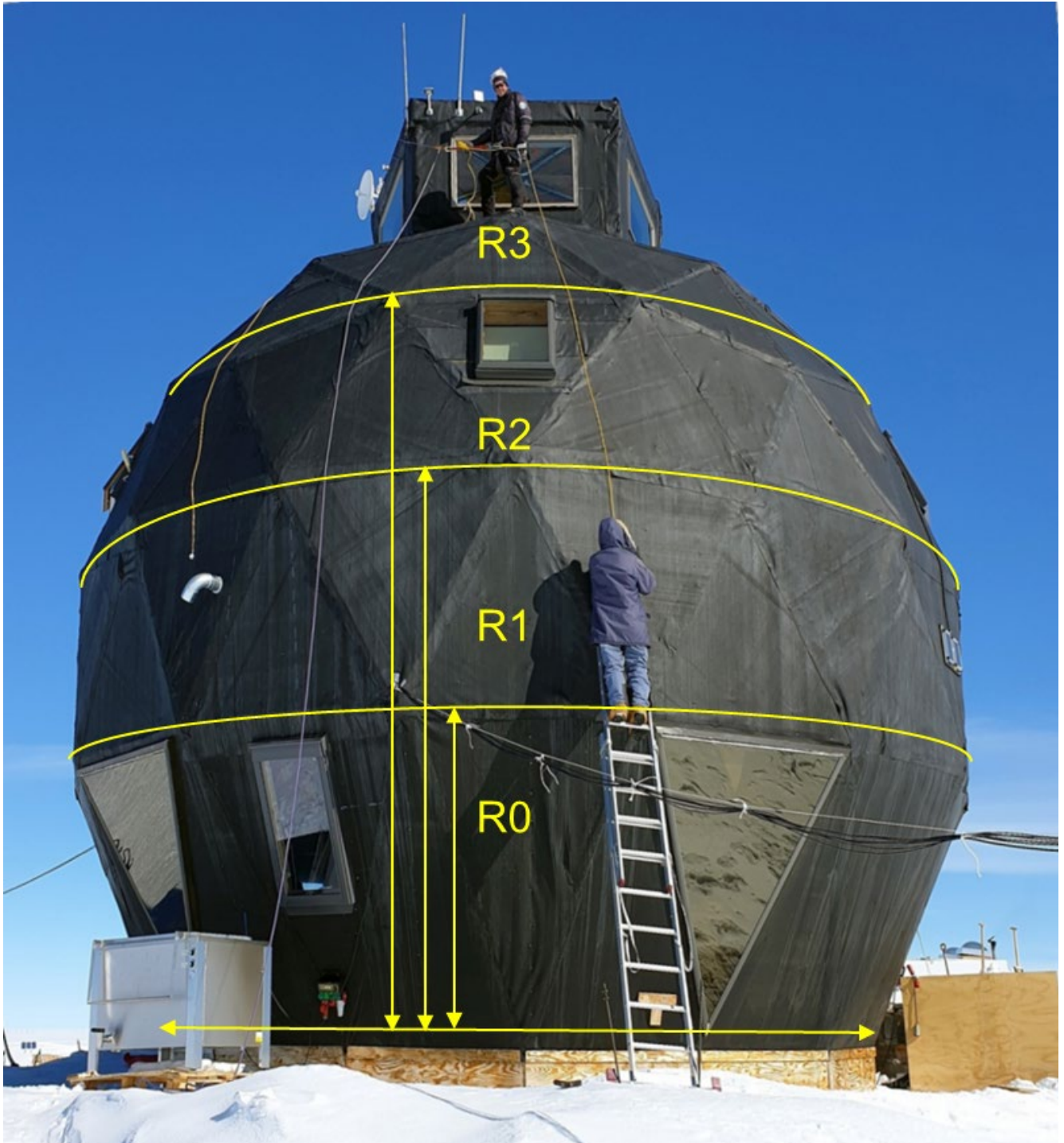
#### **Installing solar power for the main dome (Jørgen Peders Steffensen, UCPH)**

As part of an infrastructure upgrade through the project: Greenland Integrated Observing System (GIOS), we will mount solar power panels on the main dome. After several years of careful recording the 24 hour sunlight, suitable Photo Voltaic (PV) panels have been selected and transported to Greenland. The PV-panels will be mounted on the dome in May and early June. The PV-panels are flexible and will follow the curvature of the dome. A suitable scaffold for mounting is already at GRIP camp.

A solar power DC inverter (power) system will be installed in a new modular Viessman cabin on a short heavy sled. The sled with the unit can be parked next to the dome for electrical hook up. Over winter the unit can be parked on a snow hill or sheltered inside a snow cave. The unit will convert the DC from the PV-panels to 3-phase AC for camp power. A 2.5 tonnes lead battery rack will serve as a power buffer. We will set up the entire power system in late June, allowing for 2-3 weeks of tests and troubleshooting before camp closes mid-July.

When in full operation, the PV system should be able to deliver about 35 kW of power, which is equivalent to our backup generator, and will therefore replace the backup generator during five days of camp opening and five days of camp closure and days with planned small loads. We expect to save approx. 140 liter fuel each day on solar power.

The PV-system will also act as emergency backup in case both large generators fail. The PV-system will be able to power the entire main dome with heating, water generation, cooking and communications.

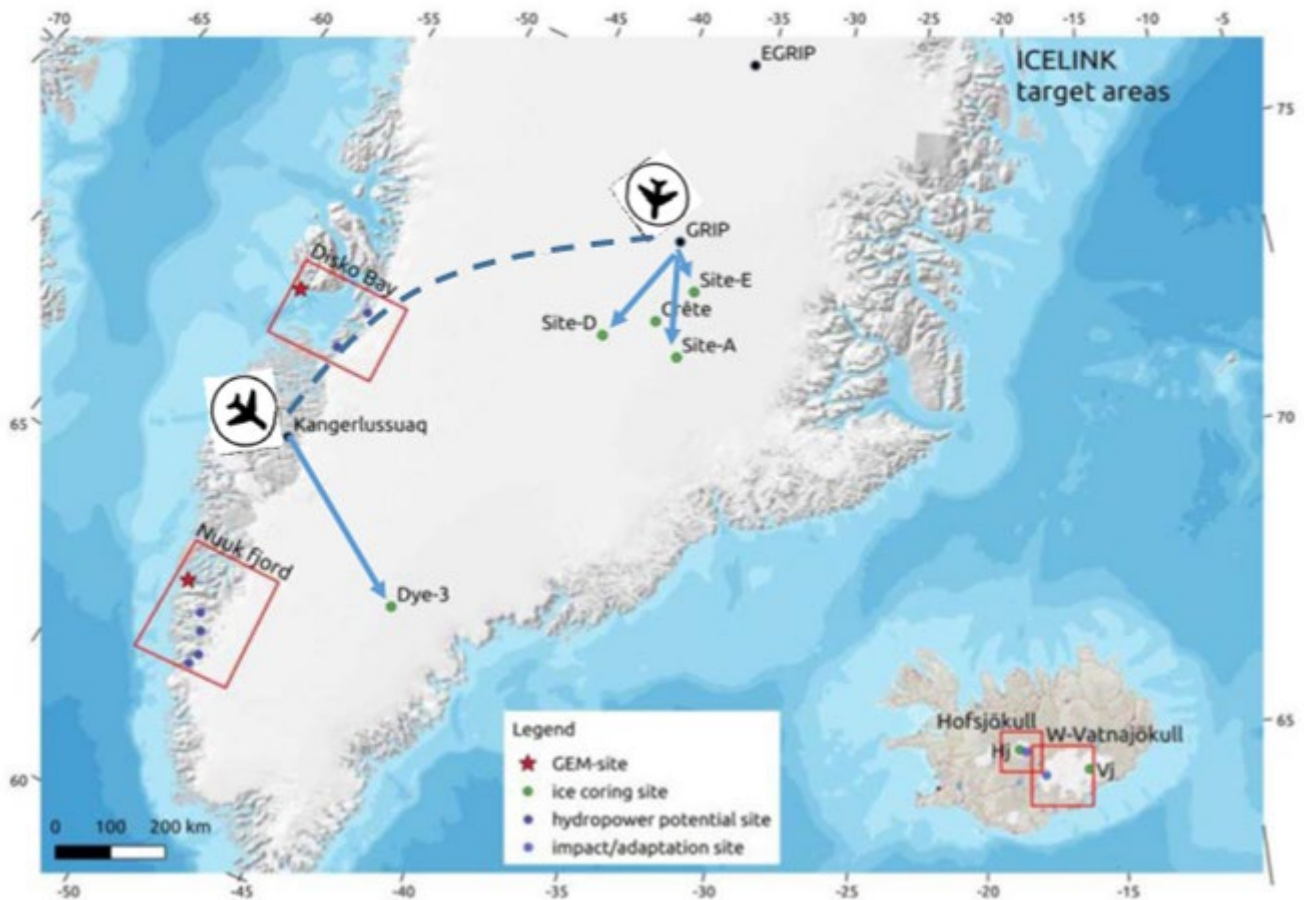


*PV-panels will be mounted 360 degrees around the dome in R1, R2 and R3. As the Sun is up 24/7 in Summer, this will generate around 35 kW power.*

**ICELINK: Shallow drilling (Johannes Freitag, AWI)**

The primary scientific objective is to place current climatic trends—specifically temperature and mass balance - into a robust historical context. The project aims to retrieve in-situ data by drilling shallow firn cores (3-inch cores, 40–50 m depth) at selected historical sites ("Alphabet cores"), up to 200km south of GRIP, and near the Dye-3 deep drilling site in South Greenland. This approach allows newly

acquired data to overlap with and extend existing climate time series and thereby provide long-term records covering the most recent global warming.



Greenland map showing the two bases for flight operations and the suggested routes to selected drill sites.

Site	Lat N	Lon E	Acc (mweq/a)	T <sub>20m</sub> (°C)	Year core drilled
Site A	70.63	-35.81	0.282	-29.41	1985
Site D	70.63	-39.62	0.334	-27.89	1984
Site E	71.76	-35.85	0.206	-30.41	1985
Dye3-4B	65.17	-43.93	0.491	-18.5	1983

Coordinates and weather characteristics at selected drill sites (*T*: borehole temperature at 20m borehole depth measured in 1980s in °C, *Acc*: mean accumulation rates, estimated from core analysis from the 1980s in meters water equivalent per year).

The operational strategy is defined as a highly mobile, airborne field campaign. Utilizing Kangerlussuaq Airport and the GRIP field camp as logistics hubs, the campaign will employ a transportable, sledge-mounted drill (based on the "Hans Tausen" principle) to extract cores within tight 10-hour operational windows. Flight operations are scheduled primarily during nighttime hours

to mitigate the risk of warm temperatures and meltwater interfering with drilling equipment and flight operations.

The ICELINK shallow drilling project is cooperating with GEUS (weather station at Site A) and PFAS (test drilling at the GRIP camp).

The ICELINK field team is a composition of personnel from AWI and UCPH, with previous experience together in shallow drilling.



*Drill camp of the airborne campaign in Northeast Greenland, 2019, with the field team participations. A similar setup is planned for the ICELINK drilling campaign. Left: Drilling rig on a Nansen sled, center: Logging tent, right: Parked Basler/Dornier aircraft.*

Due to the maintenance, repair, and testing of the drilling device, snow sampler, and borehole thermometry equipment, it was deemed essential to establish a transport route to Greenland shortly before the start of the drilling campaign. Otherwise, the envisaged implementation of the drilling campaign in Summer 2026 would not be possible. Therefore, a stopover for the aircraft at the AWI institute location (Bremen, Germany) has been scheduled in the AWI aircraft's work plan prior to the start of the campaign.

The ice cores will be transported to the cold storage facilities in Copenhagen (UCPH) or Bremerhaven (AWI). The transport is coordinated with the sample transport of the NewGRIP samples and will take place either in reefer containers by ship or via airfreight.

**PFAS in snow (Eliza Cook, UCPH)**

The Villum Funded 'PFAS in Snow' project is working in collaboration with the ICELINK shallow drilling campaign to collect three replicate shallow snow/firn cores approximately 15 km SW of GRIP camp from the same location, capturing the last 100 years approximately.

The project plans to drill two replicate cores with the UCPH shallow drill, a couple of meters apart and approximately 35 m in length to capture the last 100 years. The first 35 m core will be used for PFAS analysis, and the second will be used for dating and CFA. Furthermore, we will also obtain a short 10 m core from the same site with a Kovaks hand auger, that has a wider (15 cm) core diameter and will be used for PFAS method development.

Per- and polyfluoroalkyl substances (PFAS) are a group of persistent organofluorine (OF) pollutants; many are known to be toxic and bioaccumulative. They can undergo long-range transport, posing a hazard to human and environmental health worldwide. A key question is: how much PFAS and OF pollutants are being deposited around the world that we don't even know about? Currently about 20 compounds are routinely analysed, yet >10,000 compounds have been commercially produced. Studying PFAS on the remote Greenland ice sheet permits us to understand the background sources that enable global PFAS atmospheric deposition. By drilling and analysing two Greenland ice cores, the aim is to reconstruct the historical deposition of PFAS and evaluate if current international regulation is sufficient. An additional and novel analytical method will be employed, which will allow to see beyond those routinely analysed PFAS and identify all OF pollutants.

**NewGRIP water isotope trench (Hans Christian Steen-Larsen, Uni. Bergen)**

Trenches for the purpose of sampling water stable isotopes have been dug in both Greenland (EastGRIP) and Antarctica (e.g., Kohlen, Dome C, Little Dome C). A trench reveals both a spatial and temporal recording of the stable water isotope signal in the snow. While ice core represents a single location in space and time, a trench provides information on the processes that drives the recording of the climate signal in the ice core. Specifically the role of wind redistribution for generating noise in the record, the role of sublimation for altering the initial precipitation fingerprint, and the role interstitial diffusion on dampening seasonal amplitude. These processes are all playing a role in creating the climate fingerprint found in the ice core record.

A trench will be dug using a Pistenbully to a depth of 3 meters. It is expected that the trench will be 50 meters long. The wall will be cleaned and stratigraphic horizons will be mapped visually. Samples for water isotopes will be collected using liners and sampled in bags in the field. Bags samples will be brought back to the laboratory subsequent isotopic analysis. The process for sampling will be the following:

- 1) Tube is inserted into the snow close to the wall.
- 2) 2) Tube is take out of the wall.
- 3) 3) Snow core is pushed out of tube on cutting table and sampled.

**Seis-Sustain: Vibro-Seismic Truck (Nanna Karlsson, GEUS)**

The Seis-Sustain project aims to create a platform at GRIP for scientific work with a VibroSeis truck. Once fully established, the platform will support seismic investigations of the geology underlying the ice, that are necessary to increase our understanding of the history and dynamic behaviour of the ice sheet, as well as its role in sediment transport to the margins.

The project runs from 2026 through 2029, and during this first season of the project, we plan to move a VibroSeis from Denmark to GRIP and prepare it for operations under the very low temperatures prevalent in the interior of the ice sheet. Technical staff from GEUS and AWI will perform these tasks in June and July. It is our goal that the vehicle will be ready to perform a test data collection in the area between GRIP and Summit Stations before the end of the field season. Finally, the vehicle will be prepared for overwintering at GRIP.



*AWI's VibroSeis truck during a measurement campaign in Antarctica in 2024/2025. Photo credit: Olaf Eisen.*

#### **AWS station system (Greenland Climate Network, former PARCA) maintenance (Nanna Karlsson)**

During the annual maintenance of the Automated Weather Stations in N-Greenland, the GRIP camp will be re-fuelling station and base for the GC team for few days in June. GC team uses a Twin Otter aircraft to visit the weather stations. The plan for the 2026 season is to put up a station at Site A (in collaboration with ICELINK) and visit 3-4 stations for maintenance.

#### ***Drilling plan for 2026 field season***

The GRIP borehole was extended during the 2025 field expedition. Previous field plans and reports can be referenced. The location is: 72.57534 -37.6449

At the beginning of the field season 2026, there is no structure but the casing, extending roughly 0.5m above the snow surface. The casing has been extended with 2x 1m sections and 1x 3m section since finding in 2025.

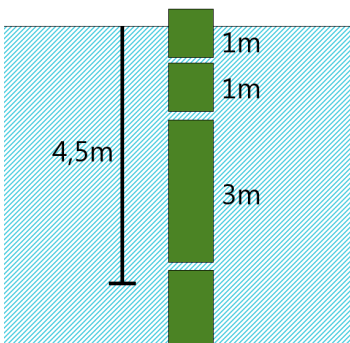
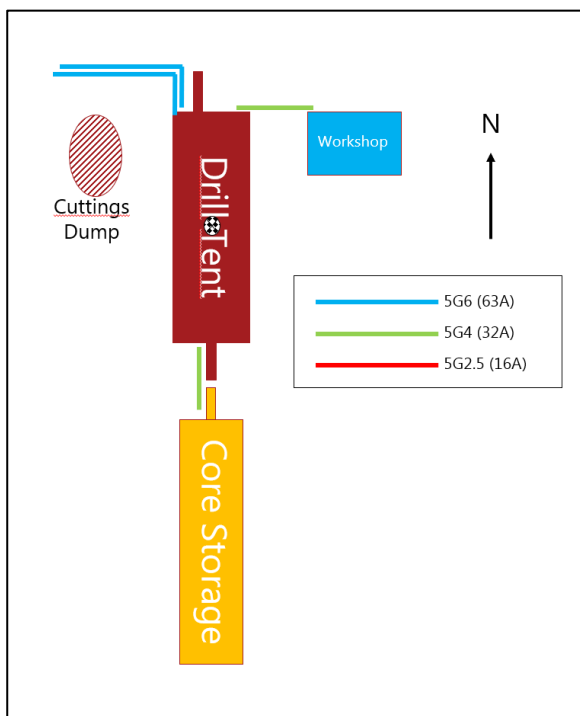


Diagram of the casing joints since finding in 2025.

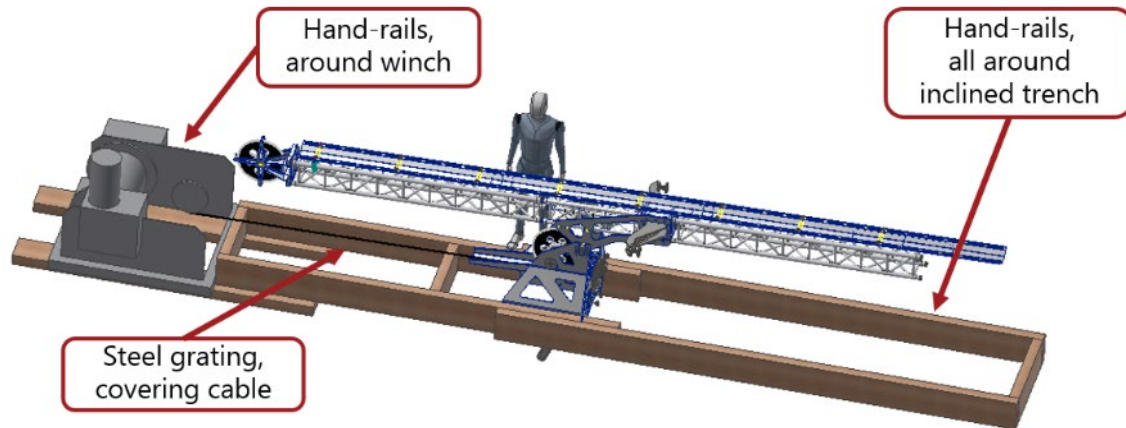
The “Drill Site” consists of the drill tent, core storage cave, and drillers workshop. The drill tent is 4.8m x 19.5m WeatherPort style tent from Alaska Structures and will be constructed on a snow berm to prevent burying between seasons. The core storage cave will be constructed using cast-in inflatable balloons using the techniques developed during the EastGRIP and other expeditions. Final expected dimensions are 2.5m wide x 3.8m tall x 10m(?). The workshop is an insulated, modular structure (freezer panels from Viessmann). Constructed on a sled. Dimensions of the workshop are 3m wide x 6-5m long(?) x 2.4m tall. The drill workshop will be a heated space, for repairs of the drill and other maintenance.



Expected drill tent, storage cave, and workshop location. The workshop is on a movable sled. Electrical cabling connecting the structures also pictured.

The winch (custom design for UCPH by Lebus) and tower (new for this year, it was fabricated and test assembled in CPH, but full integration will first happen at GRIP) are assembled on timber sub-frame.

The frame is recessed into the snow floor and is the rigid base on which the tower and winch mounted. The subframe will also be the mounting anchor for the handrails that protect operators from the inclined trench and winch, as well as the protection for the drill cable as it runs just above the ground.



An inclined trench is required for the lower half of the tower as it tilts.

The control cabin is a heated space, containing the control electronics for the drill and the interface for drill operation. The cabin is constructed from modular insulated panels (intended to be a freezer). The dimensions are 1.5m x 3.0m x 2.4m.

The drill fluid and handling are one of the biggest challenges with this project. The GRIP borehole, at the time of initial drilling, was filled with a combination of D60 and CFC113. The plan for drilling during the Green2Ice project is to add a column of Estisol 240/Coasol to the top of the borehole. We cannot continue to use D60/CFC-113 because CFC-113 is a class 1 ozone depleting material and can no longer be produced or imported.

The scope/season expectations' of the drilling:

Deep Drilling	
Goal	Priority
Setup Deep Tent	P1
Establish Power Distribution	P1
Build Core Storage Cave	P1
Assemble Winch & Tower	P1
Assemble Drill Workshop	P1
Assemble Drill Cabin and Surface Controls	P1
Assemble Fluid Handling Scheme	P1
Cut Inclined Trench, casing lid and drip trays	P1
Deploy (Aarhus) Logger	P2
Deploy Drill (Ice Shelves only)	P2
Deploy Camera	P2
Prepare Core Logging Area (Dark)	P2
Drill into Debris-Rich Ice	P3
Rock Drilling	P3
Replicate Drilling, Testing	P3

## Logistical plan for the 2026 field season

### Camp opening (7-14 May)

Due to new regulations, the 109th are no longer allowed to make an open snow landing, e.g. to land on an unprepared skiway. Therefore, the put-in this year is scheduled to be made via Summit Station located some 28 km west of GRIP. On May 7, the put-in team will go to Summit station (using their prepared skiway) and travel to GRIP by skidoo and sledges brought from SFJ. After opening GRIP station, the crew will prepare the skiway and make ready for the remaining participants to arrive at GRIP by on May 14. First task for the arriving crew will be to pick up cargo at Summit and to set up weather ports for the doctor's clinic, for food storage, and for additional housing.

During this first flight period, camp will receive drill equipment, food supplies, camp/logistical items and the solar panels. It is also required to receive enough fuel to for running the camp and to support the ICELINK AWI Basler plane and the GEUS Twin-Otter plane later in the season. In addition to the May 7 and May 14 LC-130 missions, optional (placeholder) missions are scheduled for fuel and cargo on May 15 and 16.

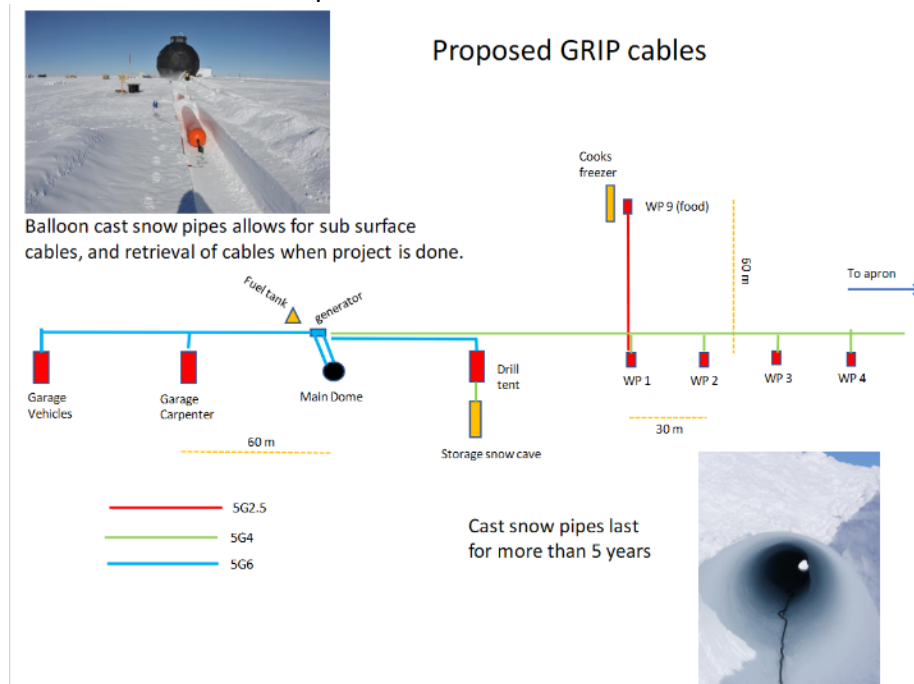
### First half of season (May 7 – June 19)

#### Drill site construction + drill tests + borehole logging

The drill site infrastructure will be constructed. For further details see the section of drilling above.

#### Trenches and power cables

In parallel to the drill site construction, several tasks will be carried out to provide power to camp and to prepare the camp for ice core processing and winter storage. The garages were connected by 5G6 power cables to Main Dome and main generator in 2025. This year, the drill site will be connected to main dome by a 5G6 cable and the Weatherports (WPs) and the apron will be connected by a 5G4 cable. All cables will be placed in 'balloon' tunnels to secure future maintenance and removal.



*Layout of existing and planned GRIP cabling.*

Several snow caves will be prepared also using the balloon technique: A large storage cave (LOCATION DIMENSIONS) will be made for winter storage of vehicles and temperature sensitive equipment. This cave/trench will also be used for logging of ice cores that need to be made in red light conditions. A cook's freezer (DIMENSION) will be made next to the food storage WP.

Mounting of solar panels on the Main Dome and power cables will be made ready to be connected to the battery power station that will be set up during the mid-season exchange week.

During the period 12-17 June camp will be visited by the GEUS/GC-net Twin-Otter aircraft that will do maintenance of automatic weather stations (AWS) at 3 locations on the ice sheet.

**Mid-season flight period (June 19-26)**

Midway in the season, there is a major exchange of personnel and equipment. LC-130 missions with PAX exchange are scheduled for June 19 and 26. Placeholders are scheduled for June 24 (GEUS Vibro-truck put-in) and June 27 (fuel and cargo). Furthermore, in this period the ICELINK Twin-Otter will arrive from Germany/SFJ. Arrival to GRIP is scheduled for June 23/24 and will bring 4x crew + flight crew and the DK shallow drill to be used for the ICELINK project.

Detailed plans for transport of Vibro truck to GRIP and for PFAS drilling are mentioned above in associated projects.

During this period, the battery power station for the solar panels, will be assembled in a Viessmann cabin on a large sledge next to Main Dome, and connected with cables from the solar panels mounted on Main Dome.

Start-up of PFAS project and test of shallow drill after arrival of the Basler.

Any ice cores from the PFAS project or other snow samples taken in the first half of the season, will be flown out with the LC-130 during this period, as cargo is limited for the pull-out period. Likewise, any scientific equipment or heavy items will be shipped out of camp on the LC-130s.

**Second half season (June 26 to July 13)**

Second half of the season will continue with the deep drilling operations (further details in the drilling section above) and the associated projects; ICELINK shallow drilling, PFAS project, snow surface studies by a MegaPit project and the vibro-truck mounting and possible traverse to or towards Summit Station.

**Camp close-down (July 13 to 20)**

Camp close-down and pull-out will be done with the ICELINK AWI Basler. PAX are scheduled to leave camp on July 13, and the pull-out is scheduled for July 20. In addition to those flights, there will be an ice core and ice sample shuttle possibly on July 15. A fourth shuttle is scheduled for transport of drill equipment and other essentials. During this period, the T-O will also be used to drill a shallow core

close to the Dye-3 station in southern Greenland. The camp closing will be made in the expectation of a re-opening in 2027.

Cargo will be stored over winter on snow hills (large sledges) and on lifted pallets similar to the 2025 setup. The new large ice cave will among other things be used for storage of the third PB 300 Polar and the vibro-truck, as well as any temperature sensitive equipment (such as radar equipment). The drill tent may also be used for winter storage.

## Calendar and manning overviews

### 2026 calendar overview

Dates below are for our planning purposes only. We expect deviations from the dates given due to 1) weather, 2) technical issues 3) availability of aircraft.

4/28/2026	Tuesday		FOMs arrive in Kanger
5/1/2026	Friday		Period 1
5/5/2026	Tuesday		First PAX in Kanger
5/7/2026	Thursday		GRIP put-in over Summit Station
5/14/2026	Thursday		GRIP 2nd put-in
5/15/2026	Friday		Placeholder
5/16/2026	Saturday		GRIP cargo/fuel
6/11/2026	Thursday		Period 2
6/12/2026	Friday		GEUS T.O. arrives
6/17/2026	Wednesday		GEUS T.O. departs
6/19/2026	Friday		Mission 2.1
6/23/2026	Tuesday		Basler for IceLink arrives
6/24/2026	Wednesday		Placeholder
6/26/2026	Friday		Mission 2.2
6/27/2026	Saturday		Placeholder
7/12/2026	Sunday		Basler IceLink done
7/13/2026	Monday		Basler shuttles begin
7/20/2026	Monday		Basler shuttles completed
7/20/2026	Monday		Basler to SFJ /GRIP pull-out
7/28/2026	Tuesday		FOMs leave Kangerlussuaq.
8/4/2026	Tuesday		Period 3
8/25/2026	Tuesday		
8/26/2026	Wednesday		

**GRIP Manning 2026 (sorted by name)**

Note: The dates of arrival and departure to and from Kangerlussuaq (SFJ) are dates of reference for booking tickets/flights to and from SFJ only. They are **not** fixed dates for the project.

<b>GRIP 2026 Manning plan, 16. April 2026</b>						
<b>Sorted by name</b>	Name	Country	Latest arrival to SFJ	To GRIP	From GRIP	Earliest departure from SFJ
Field Assistant	Adams, Jonathan Richard	UK/FR	05-maj	07-maj	19-jun	23-jun
Field Assistant	Barrios, Carlos Andrés Ortiz	CO	05-maj	07-maj	19-jun	23-jun
Basler crew	Basler flight attendant?	CA	20-jun	23-jun	07-jul	21-jul
Basler crew	Basler mech	CA	20-jun	23-jun	07-jul	21-jul
Basler crew	Basler pilot	CA	20-jun	23-jun	07-jul	21-jul
Basler crew	Basler pilot	CA	20-jun	23-jun	07-jul	21-jul
FOM	Blunier, Thomas	DK	02-jun			30-jun
Deep Drilling	Boeckmann, Grant	US/DK	12-maj	14-maj	19-jun	23-jun
Field Assistant/PFAS project	Cook, Eliza	UK/DK	16-jun	19-jun	20-jul	21-jul
solar panels mount	Dey, Rahul	IN/DK	12-maj	14-maj	26-jun	30-jun
ICELINK AWI driller	Freitag, Johannes	D	20-jun	23-jun	07-jul	21-jul
Associated (GEUS)	GEUS 3	DK		12-jun	17-jun	
Associated (GEUS)	GEUS 4	DK		12-jun	17-jun	
Deep Drilling	Hansen, Steffen Bo	DK	16-jun	19-jun	13-jul	14-jul
Field Assistant/PFAS project	Hartz, William Frederik	UK/DK/S/N	16-jun	19-jun	26-jun	30-jun
VIBRO TRUCK	Herdal, Anton		23-jun	24-jun	13-jul	14-jul
Field Assistant	Hilmarsson, Sverrir	IS	05-maj	07-maj	14-maj	19-maj
ICELINK snow sampling	Hirsch, Nora	D	20-jun	23-jun	07-jul	21-jul
ICELINK AWI driller/logger	Hörhold, Maria	D	20-jun	23-jun	07-jul	21-jul
MECHANIC	Jacobs, Chris	UK	16-jun	19-jun	20-jul	21-jul
COOK/NURSE	Kalf-Hansen, Anders	DK	05-maj	07-maj	19-jun	23-jun
Associated (GEUS)	Karlsson, Nanna	DK		12-jun	17-jun	
Field Assistant	Kipfstuhl, Sepp	D	05-maj	07-maj	20-jul	21-jul
FOM	Kirk, Marie	DK	28-apr			19-maj
FOM	Kirk, Marie	DK	21-jul			28-jul
FOM	Koldtoft, Iben	DK	16-jun			23-jun
ICELINK UCPH driller	Koldtoft, Iben	DK	23-jun	23-jun	07-jul	21-jul
Deep Drilling	MacPhail, James	UK/NZ	12-maj	14-maj	19-jun	23-jun
solar panels mount	Maistriau, Charlotte	BE/FR	12-maj	14-maj	19-jun	23-jun
Deep Drilling	Nikolaus, Kevin	US/DK	12-maj	14-maj	13-jul	14-jul
Associated (GEUS)	nn 1 (GEUS flt crew)	IS		12-jun	17-jun	

Associated (GEUS)	nn 2 (GEUS flt crew)	IS		12-jun	17-jun	
solar panels power	Nørgaard, Carsten Andersen	DK	16-jun	19-jun	26-jun	30-jun
solar panels power	Olsen, Jørgen	DK	16-jun	19-jun	26-jun	30-jun
ELECTRICAL ENGINEER	Palmelund, Anders	DK	16-jun	19-jun	13-jul	14-jul
FOM	Rasmussen, Sune Olander	DK	16-jun			24-jun
Field Assistant/Groomer	Rasmussen, Sune Olander	DK	24-jun	24-jun	13-jul	14-jul
Deep Drilling	Rathmann, Nicholas	DK	16-jun	19-jun	13-jul	14-jul
MECHANIC	Schenk, Thomas	D	05-maj	07-maj	26-jun	30-jun
Associated (GEUS)	Solgaard, Anne	DK		12-jun	17-jun	
MEGA PIT	Steen-Larsen, Hans Christian	DK/N	23-jun	26-jun	13-jul	14-jul
Field Assistant	Steffensen, Jørgen Peder	DK	05-maj	07-maj	14-maj	19-maj
FOM	Steffensen, Jørgen Peder	DK	30-jun			28-jul
VIBRO TRUCK	Stegmann, Tim		23-jun	24-jun	27-jun	30-jun
FIELD LEADER	Svensson, Anders	DK	16-jun	19-jun	20-jul	21-jul
DOCTOR/FIELD ASSISTANT	Tønnesen, Pia Charlotte	DK	16-jun	19-jun	20-jul	21-jul
FIELD LEADER	Vinther, Bo	DK	05-maj	07-maj	19-jun	23-jun
MEGA PIT	Wahl, Sonja	D/N	23-jun	26-jun	20-jul	21-jul
Deep Drilling	Westhoff, Julien	D/DK	12-maj	14-maj	13-jul	14-jul
COOK	Wright, Shari	CA	16-jun	19-jun	20-jul	21-jul
Deep Drilling	Zeppenfeld, Chantal	D/DK	12-maj	14-maj	13-jul	14-jul
VIBRO TRUCK	Zinck-Jørgensen, Magnus	DK	23-jun	24-jun	20-jul	21-jul

### **Important: Sudden changes in manning plan due to unforeseen issues.**

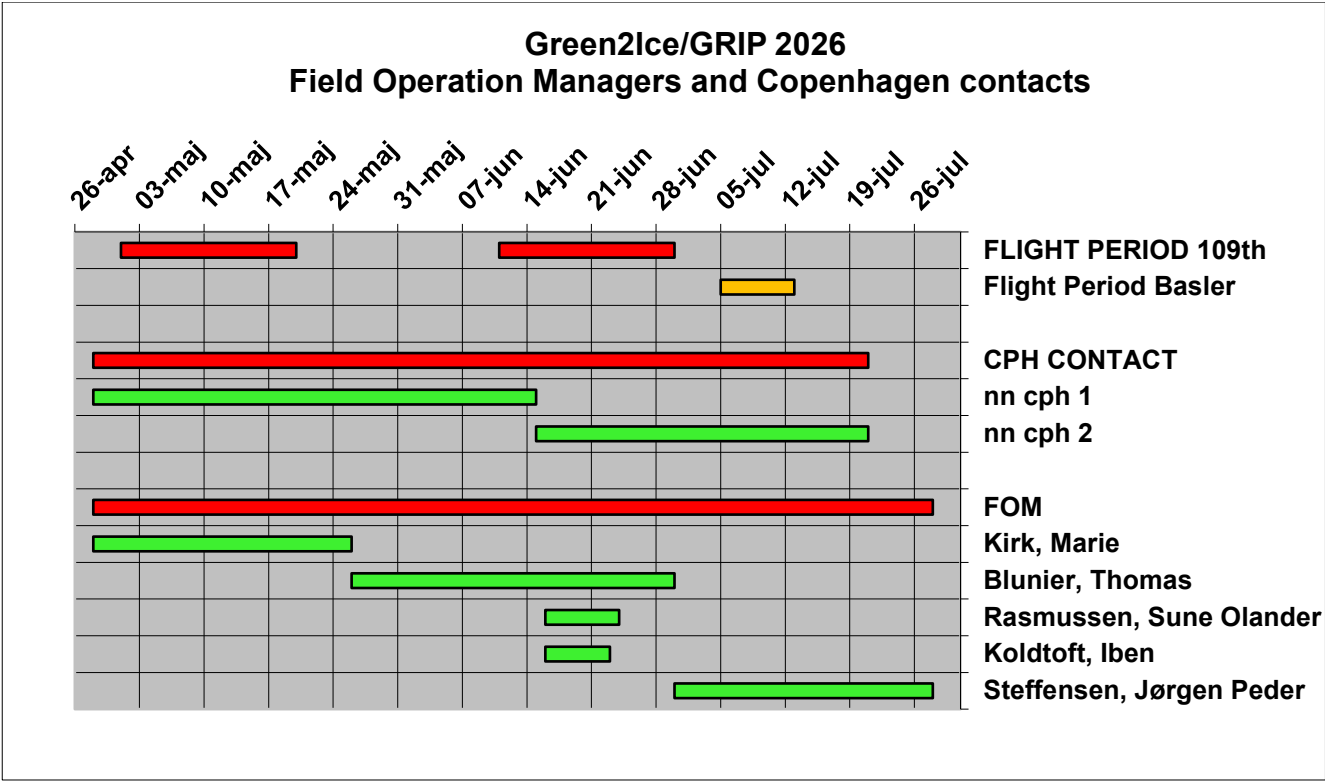
Please keep in mind that being on the manning plan for 2026 is not a guarantee that you will go to the field camp and stay there for the scheduled time. In this line of work, even small incidents may have large consequences. Even though we are scientists, we also share a treat with sea-men – we are superstitious. Therefore, we hesitate to mention specific incidents as it could become self-fulfilling. So, at this time let us just say that a broken vital part with a long delivery time may cause severe delays.

**THEREFORE: PEOPLE WHO APPEAR IN THIS SCHEDULE SHOULD PREPARE THEMSELVES OF THE POSSIBILITY OF EITHER HAVING TO LEAVE CAMP EARLIER THAN PLANNED OR TO HAVE THEIR STAY CANCELLED. PLEASE FOLLOW THE DEVELOPMENTS ON THE Green2Ice HOME PAGE BEFORE YOU LEAVE FOR GREENLAND.**

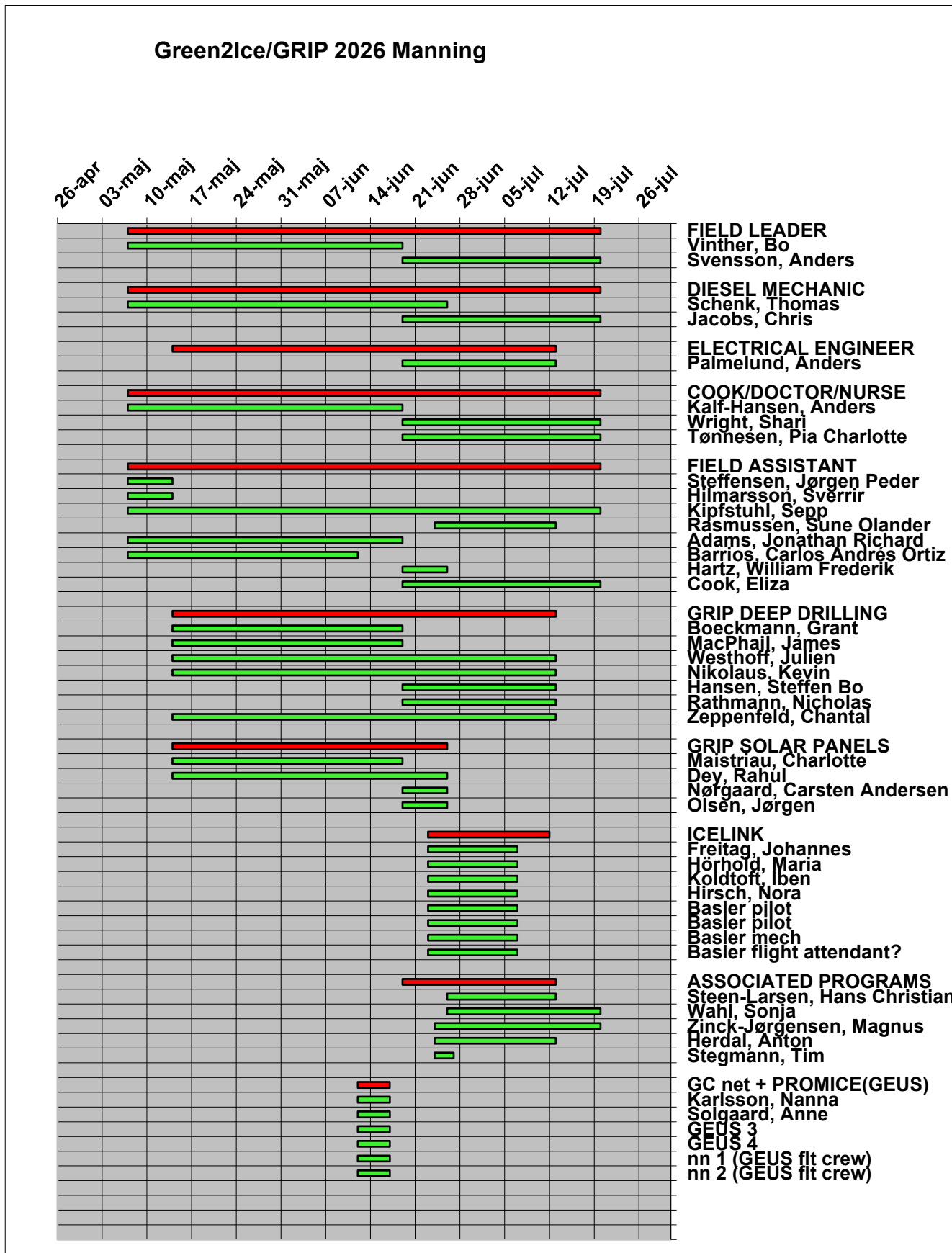
We are sorry for this inconvenience, but in our planning, we have been forced to assume the most optimistic outcome of activity, i.e. the situation where most people are needed in camp. If we had planned for less, a smaller number of people would have been planned for, and we could end up in a situation where activities had to be stopped due to lack of manpower.

Greenland fieldwork GANTT sheets

Kangerlussuaq FOM's

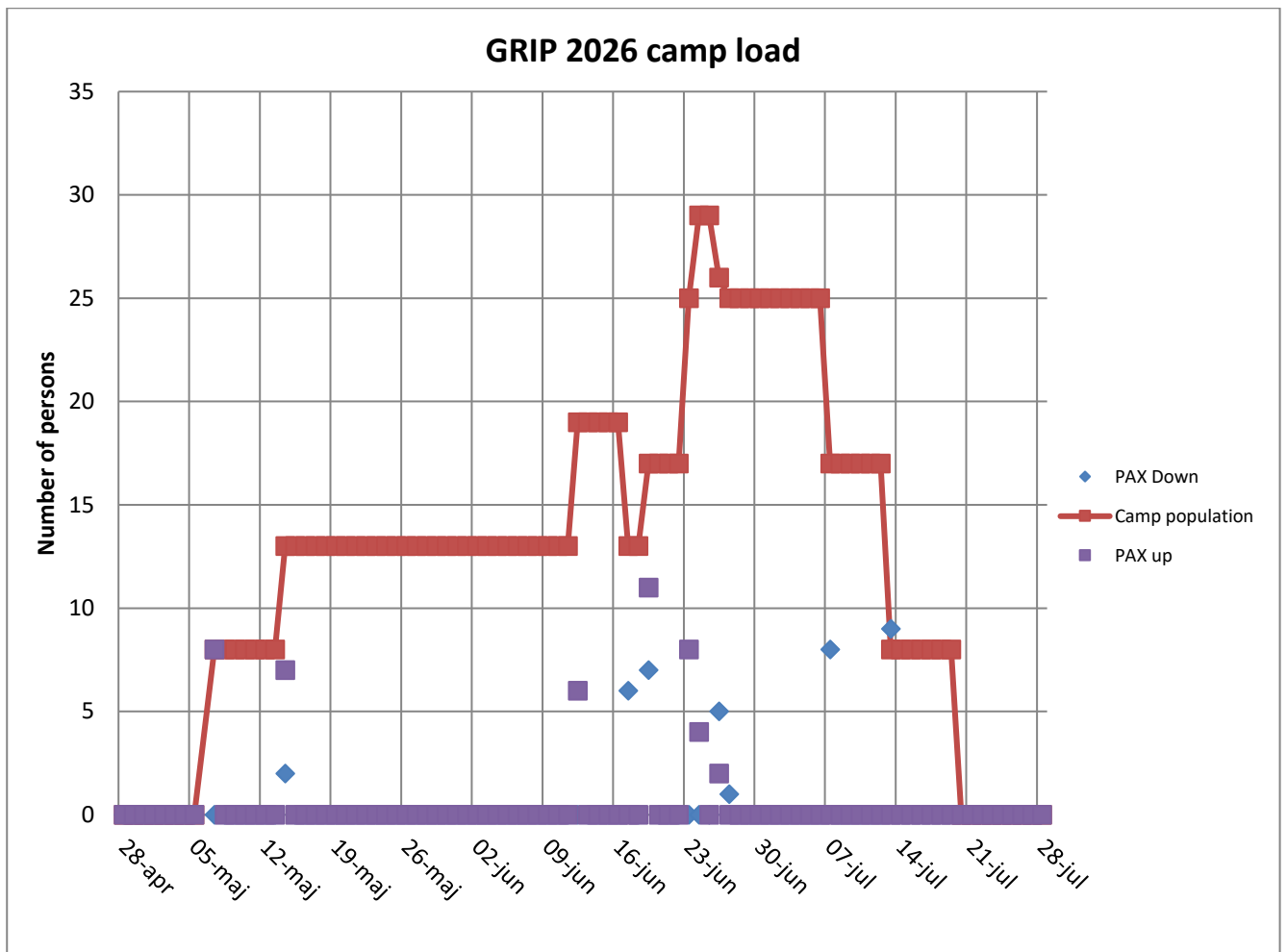


GRIP camp manning



### Camp population

Population at GRIP at put-in: 8  
 Population at GRIP after 2<sup>nd</sup> put-in: 13  
 Population at GRIP at GEUS weather station visit: 19  
 During crew exchange period in June: 17-26  
 After crew exchange when Basler is in camp: 25  
 Population at GRIP when Basler/Ice-Link leaves: 17  
 Population at GRIP at pull-out: 8



## Rules and information on life in camps on the ice sheet

### ***Personnel Transport 2026***

The field participants will deploy to Kangerlussuaq, Greenland mostly via Copenhagen and in a few cases via Nuuk, Greenland. The transport to and from camps on the ice sheet, will be direct from/to Kangerlussuaq with a U.S. air force LC130, or with an AWI Basler.

During the stay in Kangerlussuaq, people will be accommodated in Kangerlussuaq International Science Support (KISS). At KISS, all participants will be provided with bed linen but are responsible for cleaning their room.

**Note, unless arranged otherwise, each nation must take care of tickets and insurances of their own participants. If trouble arises at making ticket reservations we should be notified. Since the opening of the international Nuuk airport, the number of direct flights to/from Kangerlussuaq has reduced dramatically. This might result in long waiting lists, so please make the reservations as early as possible. Marie Kirk and Iben Koldtoft can help you with reservations and/or advice. University of Copenhagen has a general financial guarantee for extraordinary Search and Rescue operations (SAR). Medical Evacuations (MEDEVAC) will be organized and covered up front by University of Copenhagen.**

### ***Personal field equipment***

All participants, except for those who have special arrangements with Green2Ice/Ice-Sustain operations, are expected to provide their own polar field equipment and personal clothing, including normal winter garments, towels, toiletries, soap, facecloth, etc. A typical polar field bag should contain:

#### **Polar Survival Kit**

- 2 Woolen underwear, terry cloth, trousers and jacket
- 1 Fleeced trousers and jacket
- 1 Overall trousers
- 1 Polar boots, including extra liners, preferably 2 pairs.
- 3 thick woolen polar socks
- 1 polar parka coat
- 1 Insulated work leather gloves
- 1 Thin inner gloves
- 1 Insulated leather gloves, or ski type gloves
- 1 Mittens. Optional
- 1 Dark sunglasses
- 1 Sleeping bag, -10 degC or lower
- 1 Fleece liner for sleeping bag
- 1 fleece or woolen cap or hat, preferably of the balaclava type
- 1 Ear gear, fleece or rubber.
- 1 Face mask, *optional, only for those involved in snowmobile traverses.*
- 1 Personal medicine (pls inform the doctor)

**Please bring also**

- 1 Neck Tie or Dress
- 1 Solid hiking boots
- 1 A sturdy cup for coffee or tea
- 1 Your favorite game
- 1 Your favorite instrument - if it allows for transportation – or playlist
- 1 A good portion of good humor

The polar field bag must follow the individual on the flight from Kangerlussuaq to the camp. It is not permitted to board aircraft or engage in traverses without a suitable survival kit. Please expect your luggage to be stowed on a pallet for transportation to camp, and like on commercial airlines, only one small carry-on bag is normally allowed. In special cases, like put-in missions, you will be allowed also to keep ONE sea bag with survival equipment with you in the LC-130.

***Life in camp***

The living conditions on the ice sheet are quite different from those back home, therefore we would like to tell you some simple rules to follow. Some of them are even new for old-timers.

- The ski-way area and apron are **off limits** unless approved by the Field Leader.
- When an airplane is expected, the Field Leader has assigned a person in charge of the apron activities. You are obliged to act as instructed by this person.
- Never leave the camp without informing somebody, the weather can change very quickly. If you go more than 2 km away from camp, the Field Leader should be informed. Remember to bring a PLB (Personal Locator Beacon), a Garmin In-Reach unit and Iridium phone or VHF radio. The Field Leader will hand out PLB, In-Reach, phone and radio.
- The eating hours are (please be on time, making it easy for the cook):
  - Breakfast is individual (normally between 7:00 and 8:00),
  - Lunch is at 13:00 (On Sundays a special brunch is sometimes served),
  - Dinner is at 19:00.

If working in shift, the eating time can deviate from above.  
 If you are not there for eating time, please let the cook know.  
 While eating outside of lunch and dinner hours, make sure that all plates, etc. are cleaned after use.
- Heavy vehicles and snow blowers are only operated by few people assigned by the Field Leader.
- Skidoos –
  - Everybody can use the skidoos when not in specific use, but please follow these rules:
    - Drive slowly in camp and never use 2<sup>nd</sup> gear.
    - Park the scooters with the gear in non-engaged position and plugged into power.
    - Skidoos can only be removed from the camp area after an agreement with the Field Leader.

- When attaching a sledge to a skidoo, always use the hook. Only connect the sledge with a rope if no other option exists and keep the rope as short as possible.
  - Make sure the main drive belt is not frozen by shaking the skidoo from side to side before starting.
  - Skidoos are not toys - only drive skidoos when necessary.
  - Do not drive in the clean zone, South West corner of camp unless permitted by the Field Leader.
- 
- NEVER operate vehicles and machinery under the influence of alcohol. Offenders will immediately be expelled from camp.
  
  - Never leave any cargo or items on the surface without marking it with a bamboo pole, otherwise it may be lost due to snow drift overnight. Roll up cargo straps and put them in designated piles. Collect metal and nylon packing straps as these are dangerous for snowmobile traffic.
  
  - If you remove marked items on the snow, then also remove the bamboo marker in order to avoid disorder and digging for nothing.
  
  - Drinking water originates from a marked area. So never drive or walk through this area or contaminate it with any bodily fluid. Just keep out of the marked area.
  
  - Drinking water will be produced in the cook's snow melter. To keep a steady water supply in the camp, refill it with snow from the marked area when there is room in the pot.
  
  - In order to keep the camp clean there are only a few bamboo poles where you are allowed to take a leak. The poles are close to the outhouse tents.
  
  - During blizzards visibility goes down. If visibility becomes so poor, that you cannot see adjacent tents or buildings from where you are, there is a serious risk of getting lost. **Stay inside where you are until you are picked up by a team member from the main dome.**

### ***Booze and Drugs***

Please find the newest version of what tobacco and alcohol you are allowed to bring to Greenland on the Greenlandic government website: <https://grl-rep.dk/en/pas/import>.

People can bring their own prescription medicine. If prescription medicine is needed, make sure the camp physician is informed. In case of illness, necessary drugs will be supplied by the camp physician. Greenland law forbids any import and consumption of drugs, such as cannabis, morphine and designer drugs. Any person who attempts to bring in or use illegal drugs in Greenland will be expelled from camp immediately and FOMs and Field Leader will contact Greenland police.

## ***Policy for use and handling of pictures/recordings***

*Final version adopted by the EGRIP SC October 2016 (Modified for Green2Ice).*

All persons, including visitors, going to Greenland as part of the GRIP field campaign implicitly give their consent to the following use of pictures/recordings by accepting to participate in the field campaign. Additional rules or limitations may be enforced by the field leader in special cases.

### **Participants appearing on pictures and in recordings:**

The GRIP field work participant approves use of digital and analogue pictures, filmed material, and sound recordings made during the GRIP campaign (defined here as the period from arrival in Greenland until departure from Greenland) in which the participant appears.

The approved use comprises, but is not limited to; use on the internet, in print, in television broadcasts, but only applies to material depicting field participants during work and daily life situations.

Any field member may withdraw this consent for any given photo or film sequence without further explanation.

Pictures/recordings depicting participants in situations not mentioned above should never be made public without explicit consent from all recognizable persons on the pictures/recordings. Field members taking pictures or making film and/or sound recordings must accept to delete pictures/recordings if requested to do so by a participant that appears in the material.

### **Rights of use**

When material is shared with other field participants or uploaded to field computers, the photographer by doing so gives permission for the material to be used by the GRIP project. Photographers wanting personal acknowledgment must make sure that their pictures are named with the photographer's name as the last part of the file name, e.g. "GRIP-main-dome-4-July-2026-John-Doe.jpg".

Material produced as part of the field campaign or obtained from participants can be used by all collaborators crediting the Green2Ice project as a community: " Photo/Source: Green2Ice, green2ice.eu" For media files containing the name of the photographer, use the credit line with the name of the photographer included, e.g. "Photo/Source: John-Doe, Green2Ice, www.green2ice.eu".

The original photographer retains the rights to any other use of the material, including any commercial use.

### ***Declaration of liability release for GRIP field participants***

The GRIP drilling project aims to have a medical doctor/physician in camp at all times and is prepared to arrange medical evacuation to a medical facility on the Greenlandic coast of a field participant or visitor if deemed necessary by the doctor and field leader. However, participation in the field work or visits to the camp is at the participant's (and/or their institution's) own risk, and each participant (or his/her institution) is responsible for medical and proper insurance cover.

Each institution should be prepared to contribute to costs related to evacuation of their participants from camp to a medical facility at the coast, and particularly each participant (or their institution) is responsible for securing cover of costs of medical treatment and repatriation (and/or for taking out insurance against these costs).

In extreme cases, a Search and Rescue operation (SAR) may be necessary. Once initiated, a SAR is carried out by the Joint Rescue Coordination Centre (JRCC) Denmark and is out of the hands of the GRIP drilling project. The JRCC staff collects and distributes essential information concerning a distress situation, arranges the dispatch of rescue assets to aircraft or ships in distress and coordinates the efforts of all responding resources. Each nation is responsible for covering SAR costs for their participants (and/or for taking out insurance against this cost).

All field participants are required to sign a liability waiver accepting these terms before boarding a plane to the camp on the ice sheet.

*By joining the fieldwork, each participant waives any rights to hold University of Copenhagen, the GRIP camp, or any project staff members liable for any non-deliberate injury or damage caused e.g. by accidents, failure of equipment, or during medical treatment.*

*By signing the participant declares that he/she understands that it is the responsibility of himself/herself or his/her home institution to arrange appropriate insurance cover for personal injury or liability.*

*By signing the declaration, each participant also expresses understanding that it is the responsibility of himself/herself or his/her home institution to secure cover of costs of medical treatment and repatriation (and/or for taking out insurance against these costs).*

*By signature, each participant also confirms that he/she will follow the safety guidelines outlined in the field plan and follow instructions given by the field operations manager, the field leader, and flight crews.*

The declaration is signed before deployment to GRIP camp. For field participants for longer stay the declaration is uploaded in the medical system, while shorter stay field participants and guests will sign the declaration in Kangerlussuaq. The declaration will be kept in the field operations office in Kangerlussuaq.

## ***Policy on handling cases of workplace accidents, safety issues, mobbing, harassment and sexual harassment at GRIP drilling camp and Kangerlussuaq***

In accordance with the law on physical and psychical working environment at Danish/Greenlandic workplaces, and the Arctic safety manual for University of Copenhagen, the Field Leader at GRIP is the project appointed safety officer. All work-related incidents should be reported to the Field Leader or to the Field Operation Manager in Kangerlussuaq.

In case of sensitive issues such as harassment or sexual harassment, incidents may be reported to one of two NAMED PERSONS (one male, one female) who will then inform the Field Leader about the issues in an anonymized version. The Field Leader or the camp physician may also be approached directly about such issues. The Field leader shall post the two NAMED PERSONS on a note on the board next to the bathroom entrance.

### ***Assigned Duties***

Everybody in camp will be assigned extra duties on a rotary basis. These duties include:

**Cooking.** Although there will be a cook, Saturday night dinners are prepared by the camp crew. All mornings are self-service. If you skip meals, please inform the cook(s) in advance.

The field Leader will make a roster with rotating duties on the following:

**Dishwashing.** Although one person is assigned, we expect all to help to keep dishwashing an easy duty.

**Snow melter.** Although one person is assigned, everybody has the duty to keep the snow melters full. Check the water level before and after you have taken a shower and after doing laundry.

#### **Drinking water snow melter.**

Each day one person is assigned to be responsible for keeping the drinking water snow melter full. Use ONLY the assigned buckets and shovels and take ONLY snow at the assigned spot. Hygiene is very important.

#### **House mouse duty.**

One or two people will be assigned to keep toilets and common areas in the main dome clean.

### ***Terms of reference for the GRIP 2026 Field Season (formal control and command)***

During the field season Bo Møllesøe Vinther and Anders Svensson will be Field Leaders at GRIP camp, having formal command and responsibility of operations in camp. All field participants must follow all instructions from the Field Leaders (The Field Leader role is similar to the role of a captain of a ship at sea).

In Kangerlussuaq, Marie Kirk, Iben Koldtoft, Thomas Blunier, and Jørgen Peder Steffensen will be field Operations Managers (FOMs). There will be FOM assistants as well. The FOM is the official spokesperson for Green2Ice/Ice-Sustain and the FOM has control of all Green2Ice/ Ice-Sustain assets in Kangerlussuaq, such as the office, cars, bicycles etc. The FOM is the formal liaison between GRIP and U.S. logistics (Battelle ARO), New York Air National Guard and Greenland authorities. The FOM has final say on composition of cargo and on passenger lists for all LC-130 flights to and from camps on the ice sheet.

### ***Dangerous goods (HAZMAT) Lithium batteries***

All modern electronics: Cell phones, GPS, laptops, cameras etc. contain lithium batteries. As there have been a series of incidents involving fires on aircraft from shorted lithium batteries, most airlines deny checked in lithium batteries or equipment with lithium batteries. Furthermore, it has become almost impossible to ship any type of lithium equipment/batteries by airfreight.

However, “Lithium ion batteries exceeding a watt-hour rating of 100 Wh but not exceeding 160 Wh may often be carried as spare batteries in carry on baggage, or in equipment. So always check the airline webpage before travelling.

The same regulations apply when flying with the 109<sup>th</sup> to and from GRIP. This means that all PAX must keep all batteries in their carry on. Do not put spare batteries in your luggage (suitcase or duffel bag).

If approved by the FL or FOM in Kangerlussuaq, the team can arrange a zarges box with lithium equipment to be transported as packed on the AF pallet (note this means paperwork by a certified person) or as carry on.

### ***Personal Locator Beacon (PLB) and Garmin In-Reach***

A personal locator beacon, PLB, will be issued to everyone who has to leave camp. It is a unit with the size of a hand held radio. The unit is registered at the radio authority of Greenland. When activated, the unit contacts a satellite with a distress signal. The unit transmits its identity code and GPS position (it has a built in GPS). The radio authority will contact the FOM in Kangerlussuaq with specifics of identity and position. **The PLB is a last resort emergency device.**

GRIP camp will have a number of Garmin In-Reach devices to give to people working away from camp. The In-Reach will be set up so that the Field Leader receives position updates on remote field teams. If you're interested, it is possible to buy these devices on the web. The device can be set to transmit your position at a fixed time each day by e-mail to your family and friends.

### ***Accidents and Illness***

There will be a doctor/nurse during the GRIP camp field work. The doctor/nurse will have a hot line to doctors in Denmark and the health care system in Greenland. In case of illness, the camp will be able to treat a patient with a wide selection of drugs. In case of accidents, the patients will first be given

First Aid and if evacuation is needed an airplane will be called in from Kangerlussuaq, East Greenland, Thule, Summit Station, Station Nord, etc. to transport the patient(s) to a suitable emergency site/hospital.

Good communication (Satellite broad band, Iridium handheld, Iridium OpenPort, Radio, Personal Locator Beacons) and navigation equipment (GPS, InReach) should ensure fast evacuation if needed. Under most circumstances, we can move a patient to a hospital within 24 hours.

### ***Handling of Waste and environmentally hazardous chemicals***

As GRIP camp is located in a pristine area of the Greenland Ice Sheet and is inside the NE-Greenland National Park, the camp is constructed to reduce the environmental impact as much as possible, e.g. by using wood and snow as primary construction materials and by using temporary tent structures to maximum extent.

In GRIP camp strict guidelines of waste management will be enforced.

LITTERING IS NOT ALLOWED. It is the duty of everybody to pick up any litter encountered. Any traffic outside the general camp area has to be sanctioned by the Field Leader.

All waste will have to be sorted into the following categories:

- Natural combustible (e.g. wood, card board).

- Kitchen Waste.

- Glassware.

- Metal (e.g. cans, nails and screws).

- Hazardous solids (e.g. batteries, PVC).

- Hazardous fluids (e.g. fuel, hydraulic fluid, drill fluid).

All glassware, metal and hazardous material and kitchen waste will be retrograded to Kangerlussuaq for further processing.

To limit possible spills of fuel, only authorized personnel are allowed to operate pumps for fuel transfer.

All spills of hazardous fluids to the snow have to be excavated and the polluted snow has to be deposited in a salvage drum.

Use only designated toilets. Urination is only allowed at designated spots (pee-poles).

Special rules apply for fuel handlers, heavy vehicle operators and mechanics: A daily check on fuel tanks, pump system, hydraulics and hazardous chemical storage are necessary to ensure no leakage to the environment.

### **Fluid Handling**

The drill fluid and handling is one of the biggest challenges with this project.

The GRIP borehole, at the time of initial drilling, was filled with a combination of D60 and CFC113.

The plan for drilling during the Green2Ice project is to add a column of Estisol 240/Coasol to the top of the borehole.

We cannot continue to use D60/CFC-113 because CFC-113 is a class 1 ozone depleting material and can no longer be produced or imported.

Challenge	Description	Mitigation
Fluid Compatibility	The combination of D60/CFC-113 with E240/Coasol has not been attempted before. The resulting properties of the fluid are unknown	Before any E240/Coasol is introduced to the borehole, a bench test will be conducted
CFC-113 Containment	CFC-113 is a regulated class 1 ozone depleting material. Containment of release and documentation is required	Described below, fluid recycled to the borehole with minimum possible release.
Health Considerations	Exposure to the drill fluid has some adverse health affects.	High level of air ventilation with exposure measurements, PPE, passive fluid containment

### Health Precautions and Mitigation

Below are the exposure limits per the SDS for each of the 4 drill fluids:

*Table 0.1. Hazards and mitigations of drilling fluids. Sources:*

<sup>1</sup> Danish Ministry of the Environment, Environmental Project No. 1567, 2014

<sup>2</sup> SDS CFC-113

<sup>3</sup>Exxsol D60 SDS

<sup>4</sup>Estisol240 SDS

<sup>5</sup>Drilling operations for the South Pole Ice Core (SPICEcore) project

<sup>6</sup>Coasol MSDS

Drill Liquid Component	Hazard Classification	Suggested PPE	Exposure Limits
CFC-113	<sup>2</sup> Eye Irritation, 2A	<sup>2</sup> Ensure that eyewash stations and safety showers are close to the workstation location.  Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts  Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times	<sup>1</sup> 500ppm <sup>3</sup> 3800mg/m <sup>3</sup>
Exxsol D60	<sup>3</sup> Harmful: may cause lung damage if swallowed.	<sup>3</sup> Adequate ventilation should be provided so that exposure limits are not exceeded. Use explosion-proof ventilation equipment.	<sup>3</sup> 184ppm <sup>3</sup> 1200mg/m <sup>3</sup>

	Repeated exposure may cause skin dryness or cracking. May be irritating to the eyes, nose, throat, and lungs.	<p>If prolonged or repeated contact is likely, chemical-resistant gloves are recommended. If contact with forearms is likely, wear gauntlet-style gloves. Nitrile</p> <p>If contact is likely, safety glasses with side shields are recommended.0</p> <p>If prolonged or repeated contact is likely, chemical, and oil resistant clothing is recommended.</p>	
Estisol 240	<sup>4</sup> The product is not classified, according to the CLP regulation.	<p>General protective and hygienic measures: The usual precautionary measures are to be adhered to when handling chemicals.</p> <p>Respiratory protection: Not required.</p> <p>Hand protection Selection of the glove material on consideration of the penetration times, rates of diffusion and the Degradation. Material of gloves: Neoprene gloves Nitrile rubber, NBR</p>	<p><sup>5</sup>Derived No Effect Level (DNEL) of 20.4ppm for acute exposure and 10.2 ppm for long-term exposure</p> <p><i>(For Estisol 140)</i></p>
Coasol	Not classified	<p>The use of local exhaust ventilation is recommended to control process emissions near the source. Laboratory samples should be handled in a lab hood. Provide mechanical ventilation of confined spaces.</p> <p>When handling this product, it is recommended to wear chemical resistant gloves. The choice of suitable protective gloves depends on work conditions and what chemicals are handled, but there is positive experience with gloves made of PVC or Nitrile. Gloves should be replaced immediately if signs of degradation</p>	<p><sup>6</sup>Contains no substances with occupational exposure limits</p> <p>Long term exposure, systemic effects: Inhalation 4.2 mg/m<sup>3</sup></p>

		<p>are observed.</p> <p><u>Other notes:</u>          Negligible inhalation hazard at ambient temperature (-18 to 38oC) or recommended blending          Temperature</p> <p>Vapors or aerosols which may be formed at elevated temperatures may be irritating to respiratory tract Avoid breathing vapors or mists.</p> <p>Frequent or prolonged contact may cause mild skin discomfort.</p> <p>May cause slight eye discomfort, but will not injure eye tissue.</p> <p>Low toxicity if swallowed; however swallowing larger amounts may cause injury</p>	
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All personnel working with the drill fluid will be supplied with appropriate chemical resistant boots, suits, and gloves. Personnel will also be supplied with safety glasses.

There are eye washing facilities in the drill workshop and main dome. Handwashing is also done in the bathroom (separate from food) in the dome.

This year, an energy recovery ventilation (ERV) system will be implemented in all heated and enclosed work areas that will contain drill fluid (drill workshop and control cabin). The ventilators circulate air up to 130m<sup>3</sup>/h. This is a complete air change in 5 minutes in the cabin and 15/20 min in the drill workshop.

Concentration of VOC (D60) in the drillers workshop will be monitored (beginning in the 2027 field season) with a handheld measurement device: Tiger LT from GasDetect (PN IOPTLSLBMR-0000). This device cannot measure CFC.

For the 2026 field season, personal O<sub>2</sub> monitors (Senko SGT O<sub>2</sub>) will be worn or placed in areas with the highest CFC concentration (whenever entering the inclined slot, in the drillers' cabin, and the workshop). The primary risk from CFC is that it displaces oxygen, causing asphyxiation. The O<sub>2</sub> monitor mitigates that risk.

Environmental Hazards and Mitigations

CFC-113 is class 1 regulated ozone depleting substance per REGULATION (EU) 2024/590. Therefore, we are obligated to treat the substance according to the regulations. This is existing equipment (no new imports or production), so the project must follow the laws of recovery and destruction in Article 20:

**Recovery and destruction of used ozone-depleting substances**

...

5. Ozone-depleting substances contained in products and equipment other than those referred to in paragraphs 1 to 4 shall, if technically and economically feasible, be recovered for destruction, recycling or reclamation, or shall be destroyed without prior recovery, unless such recovery is regulated under other Union legal acts.

6. Ozone-depleting substances listed in Annex I, and products and equipment containing such substances, shall be destroyed only by destruction technology that has been approved by the Parties to the Protocol. Other ozone-depleting substances for which the destruction technology has not been approved shall be destroyed only by destruction technology that complies with Union and national law on waste and where additional requirements under such law are met.

7. The Commission is empowered to adopt delegated acts in accordance with Article 29 to supplement this Regulation by establishing a list of products and equipment for which the recovery of ozone-depleting substances or destruction of products and equipment without prior recovery of ozone-depleting substances shall be considered technically and economically feasible, specifying, if appropriate, the technology to be applied.

8. Member States shall promote the recovery, recycling, reclamation and destruction of ozone-depleting substances listed in Annex I and shall establish the minimum qualification requirements for the personnel involved.

The reading of article 20, section 5, requires that we will take steps to recycle all the CFC-113 possible and reuse it in the borehole. There are several technologies implemented to retain and recycle the drill fluid. As a general note, CFC-113 has a relatively high vapor pressure so we avoid any heating or vacuum techniques that will vaporize the CFC-113 – resulting in the reclamation becoming technically not feasible at our remote site.

Technology	Description
Estisol240/ Coasol Buffer	By adding a layer of drill fluid that does not contain CFC-113 at the top of the borehole. This fluid will act like a rinse, to prevent CFC-113 from coming up on the drill and cable. It will mix overtime, but the dilution effect will still reduce overall CFC-113 lifted from the borehole
Floating Cable Wiper	This is a mechanical wiper that squeegees fluid from the cable as it comes out of the drill fluid. This has potential to keep liters of drill fluid in the borehole during each run. The device is still a prototype, effectiveness will be tested this year
Drip Trays	The drill tower, inclined trench, and chip press will be contained in drip trays that drain directly back to the borehole.
Chip Press	A hydraulic fruit press is repurposed to mechanically squeeze as much fluid from the ice chips. This was chosen over melting or centrifugal options used by other projects to prevent aerosolizing the CFC-113.

In total, the project expects to release 10-30kg of CFC-113. A majority will be trapped in the ice cuttings that come to the surface with the drill. The rest is a result of handling the fluid and

evaporation. The expected losses are based on internal calculations and extrapolation of the loss of drill fluid from previous projects.

Some physical waste, contaminated with drill fluid, will be generated during the drilling process. For example, the cores will be dried with paper towels before being packed for transportation. Two options were evaluated for disposal of this waste:

1. Collect the waste and transport back to Copenhagen for hazardous waste disposal.
2. Collect the waste and contain it in the drill site. For example, with ice chips that already contain a small percentage of cfc-113 contamination.

The logistics at the end of 2026 are very limited, so there is no capacity to fly waste out of camp in 2026. Therefore, this option would be to contain the chips in appropriate enclosures and transport them to Denmark during the 2027 field season. The specific requirements for flying the waste out of camp and shipping to Denmark will need to be discussed with KU's chemical waste specialist and the waste disposal contractor. This will likely be very costly (financially and leave a large environmental impact due to CO2 emissions from flights).

Leaving the waste in the already contaminated site, but contained, is the alternative. The expected majority of the waste will be paper products (paper towel), that have a small environmental impact. Therefore, the cost (financial and environmental) of transporting the waste home would be eliminated at a small cost in CFC-113 released.

During the 2026 season, the waste will be collected and stored for further evaluation. The quantity of CFC-113 will also be quantified during the 2026 season. The quantity of contaminants in the chips after processing will be measured, as well as the quantity remaining on the waste. This can be done by placing a known mass of chips/waste in a sealed garbage bag and allowing the CFC to vaporize. Measuring the volume of the bag after evaporation will tell us what the original volume of the CFC-113, roughly.

### ***Fire hazards***

Camp structures are spaced so that an accidental fire will not spread to other structures. Carbon dioxide extinguishers and fire blankets will be placed at all locations where fuel is handled, at GRIP in the kitchen and on the first floor of the main dome.

Only one of the three main fuel tanks will be in camp at any time. The other two tanks will be at the apron or at the cargo line.

**An emergency response plan for spills and fire has been made for GRIP camp. This plan is available in the main dome kitchen (Evacuation Zone A) and the Field Leader office and in the carpenter's garage (Evacuation Zone B). Camp personnel should know the contents of this plan.**

### ***Power Supply***

Within all operations, 230 Volts, 50Hz will be the standard supply. The camp will be powered by diesel generators. For projects away from camp, such as shallow coring and radar surveys, we have both gasoline diesel generators available.

GRIP:

**Diesel**

1 – Iveco	125KVA	3 x 230V (400V/50Hz)	Main generator
1 – SDMO	40KVA	3 x 230V (400V/50Hz)	Backup generator
1 – SDMO	10KVA	3 x 230V (400V/50Hz)	traverse power

**MoGas**

1 – Honda	4.5KVA	1 x 230V / 50Hz	shallow drilling
1 – Robin	4KVA	1 x 230V / 50Hz	

Reserves in Kangerlussuaq:

**Diesel**

1 – Hatz	5 KVA	1 x 230V / 50Hz	available
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**MoGas (i.e. petrol/benzin)**

1 – Honda	4KVA	1 x 230V / 50Hz	
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Please help to conserve fuel by conserving power.

**GRIP/Ice-Sustain 2026 – Address and useful numbers**

Official address: Green2Ice/ EGRIP 2026 / NBI  
 KISS 208  
 DK-3910 Kangerlussuaq  
 Greenland  
 Phone +299 52 41 25  
 e-mail: [fom@egrip.camp](mailto:fom@egrip.camp)

This is the address of the Field Operations Manager (FOM) office in Kangerlussuaq which is located in the KISS building room 208.

During the 2026 season, we will use Iridium OpenPort and OneWeb for internet connection. Within camp and when moving within the 20 x 20 km<sup>2</sup> allocated area, we communicate by VHF radio, by In-Reach and handheld Iridium phones. We will also deploy the polar bear Doppler radar in 2026. The radar that can detect movement in a 3 km radius of camp. We will continue to use our ceilometer for reporting clouds to improve weather reporting and reduce the risk of aborted flights.

During the field season contact with the participants on the ice sheet can be made as described below.

## ***Camp Internet Connection – OneWeb***

At GRIP, we will use our new satellite communication system OneWeb for the first time. It will replace our old Iridium OpenPort system.

### ***Camp Iridium OpenPort system***

GRIP camp will utilize the Iridium OpenPort system in the first week, and then the system will act as backup in case the other satellite systems go off-line. This system consists of an array of antennae and receivers that multiplex to obtain two in-going phone lines and internet connection. This system has been reliable in previous years. At GRIP there are one complete OpenPort system in the main dome. While the Field Leader has unrestricted access to telephones and the internet via OpenPort, camp personnel are in general restricted from access to the internet.

#### **When camp is communicating via OpenPort, please note:**

Using the internet over Iridium OpenPort is paid per Mbyte (price is about 14 USD per Mb). If unlimited, unnecessary uploads & downloads of software updates, large email attachments, images, movies, etc. by GRIP participants will very quickly cost the Green2Ice/Ice-Sustain budget a fortune! Please, turn off all automatic downloads/updates and all banners and pictures on your browser before connecting. Communication costs for NEEM 2010: 360,000 DKK

#### **Iridium OpenPort telephone to GRIP Camp**

This number is not yet fixed. Please be aware that calling camp on Iridium can be as expensive as **6 USD per minute**. Please ask the Field Operations Manager which number is current.

Only some of the Iridium numbers will be available at any given time. Please ask the Field Operations Manager (FOM) which number is current.

Initially **NO** external bell will be connected to the phones so arriving calls are not always heard.

Good times to call are during

Lunch	14:00 – 15:00 GMT
Evening dinner	21:00 – 22:00 GMT

The Iridium system OpenPort will be operational 24 hours.

## ***Camp Cell phones – Satellite network***

If the OneWeb connection is available, participants can make international calls from their phones, and the outside world can call into camp. The system will not be operational in the first week.

GRIP Field Leader will have ext. 401, EGRIP FOM will have ext. 301, public phone in EGRIP Dome will be ext. 402.

Details on when the system is online will be posted in the SITREP.

## **EMAIL**

The Field Operations Manager will check arriving E-mail at least once a day on the following email: [fom@egrip.camp](mailto:fom@egrip.camp) (Don't forward large attached files).

For Field leader at EGRIP: [fl@egrip.camp](mailto:fl@egrip.camp)

On the ice, when we use the Iridium OpenPort system to send and receive e-mails, we will still be able to send & receive any e-mail via the above address; BUT at a high cost! PLEASE Remember to avoid attaching image files with your e-mails. The Field Leader will send images for the field diary on the Green2Ice and IceLink home pages every day on behalf of everybody.

## **GRIP official communications**

### **SITREP**

Field Leader and FOM will Sunday night prepare a **SITuation REPort "SITREP"**, i.e. a report on the preceding week's field activity. This report will be transmitted by e-mail to the FOM Copenhagen office. It will be put on the Green2Ice home page for download and for the relevant Greenlandic and Danish authorities.

The Sitrep follows the following format:

1. Number, date and time
2. Passenger movements
3. Cargo movements
4. Camp activities
5. Sub programs
6. Drill depth and time
7. Status for drilling
8. Other info
9. Signature of the Field Operations Manager

**Daily reports on the web ([www.green2ice.eu](http://www.green2ice.eu) & [www.icelink-project.eu/fieldblog/](http://www.icelink-project.eu/fieldblog/)) and SITREPs on [www.green2ice.eu](http://www.green2ice.eu)**

Daily, a short "What we have done today" report and stories from camp will be placed on the web. Information will be sent from the GRIP camp to the Field Operations Manager office in Kangerlussuaq who, in turn, will take care of the home page together with the logistical team in Copenhagen ([logistics@egrip.camp](mailto:logistics@egrip.camp)). The Field Operations Manager ([fom@egrip.camp](mailto:fom@egrip.camp)) will coordinate this activity.

## Description of GRIP camp

After arrival to the GRIP site in 2025, the crew started to lay out and construct new camp infrastructure. The entire layout will be anchored on two main considerations: The old GRIP drill hole casing should be in the middle of the future drilling tent, and the new skiway run 180-360 true. By choosing this N-S skiway orientation, we will keep approaching airplanes as far as possible from the air space over the U.S. Summit camp, 28 km to the west. Also, although wind directions at GRIP vary a lot, there is a statistical main air flow from the South, with least amount of cross winds at 180-360 degrees.

### ***GRIP quartering and buildings***

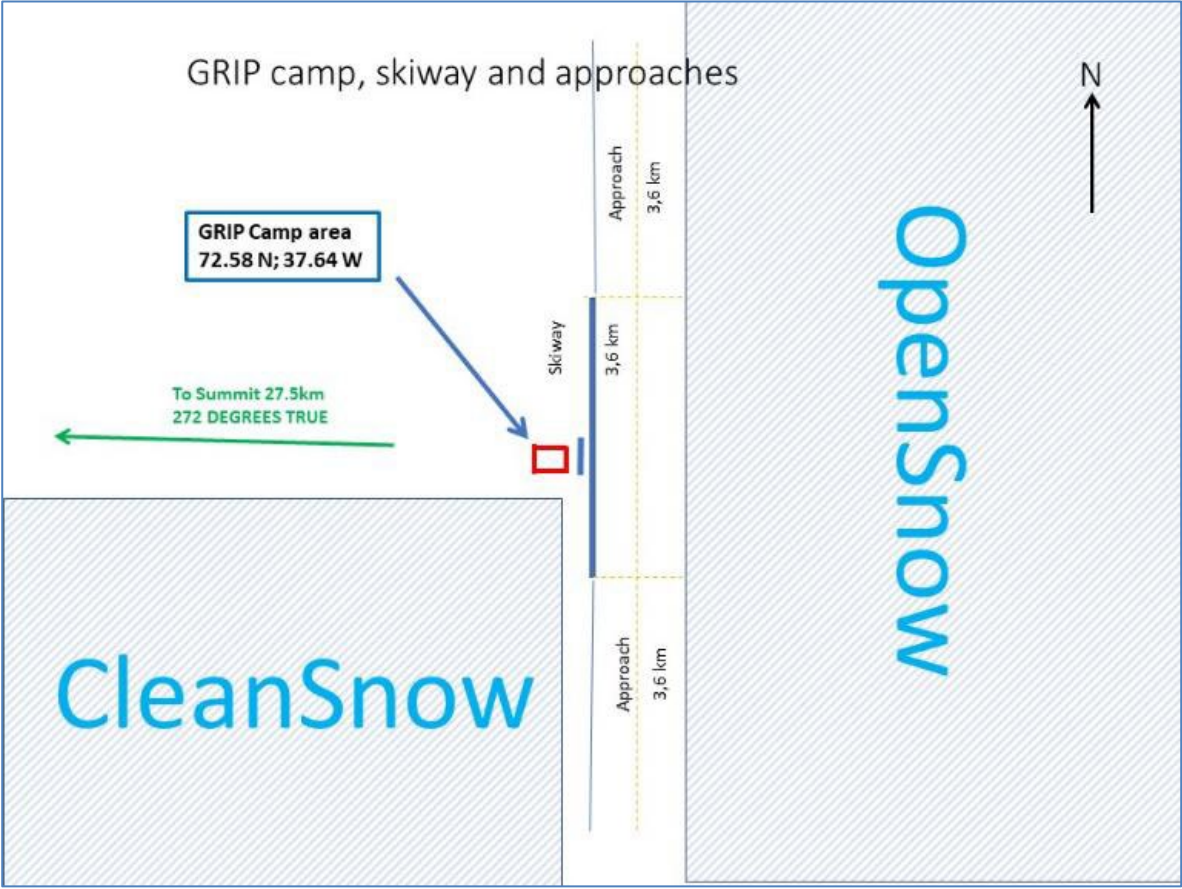
GRIP after Put-in:

	PAX	
	Normal(max)	
Kitchen/office	5(10)	40' wooden dome
Big tomato	1(2)	Fiberglass hut
Small tomato	1(1)	Fiberglass hut
Pistenbully no2	1(1)	Cabin
Pistenbully no3	1(2)	Cabin
Garage, mechanic		26' x 40' Weatherport
Garage, carpenter		26' x 40' Weatherport
Garage, storage		24' x 28' Weatherport
Quarter (WP 1)	2(4)	10' x 15' Weatherport
Quarter (WP 2)	2(4)	10' x 15' Weatherport
Quarter (WP 3)	3(6)	12' x 20' Weatherport
New quarter (WP 4)	3(6)	12' x 20' Weatherport
Freshie shack (WP food)	-	12' x 20' Weatherport
Quarter (WP)*		10' x 10' Weatherport
New quarter (WP-clinic)*		12' x 10' Weatherport
Total	19(36)	

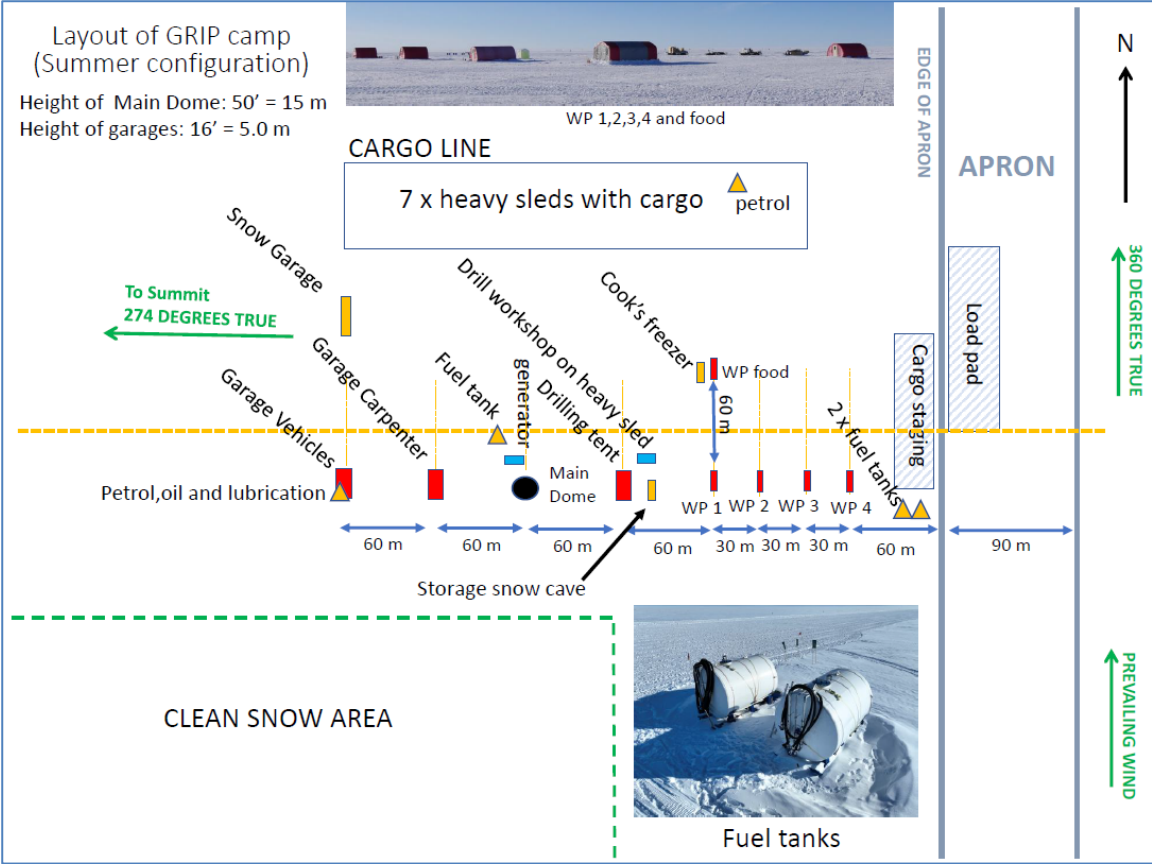
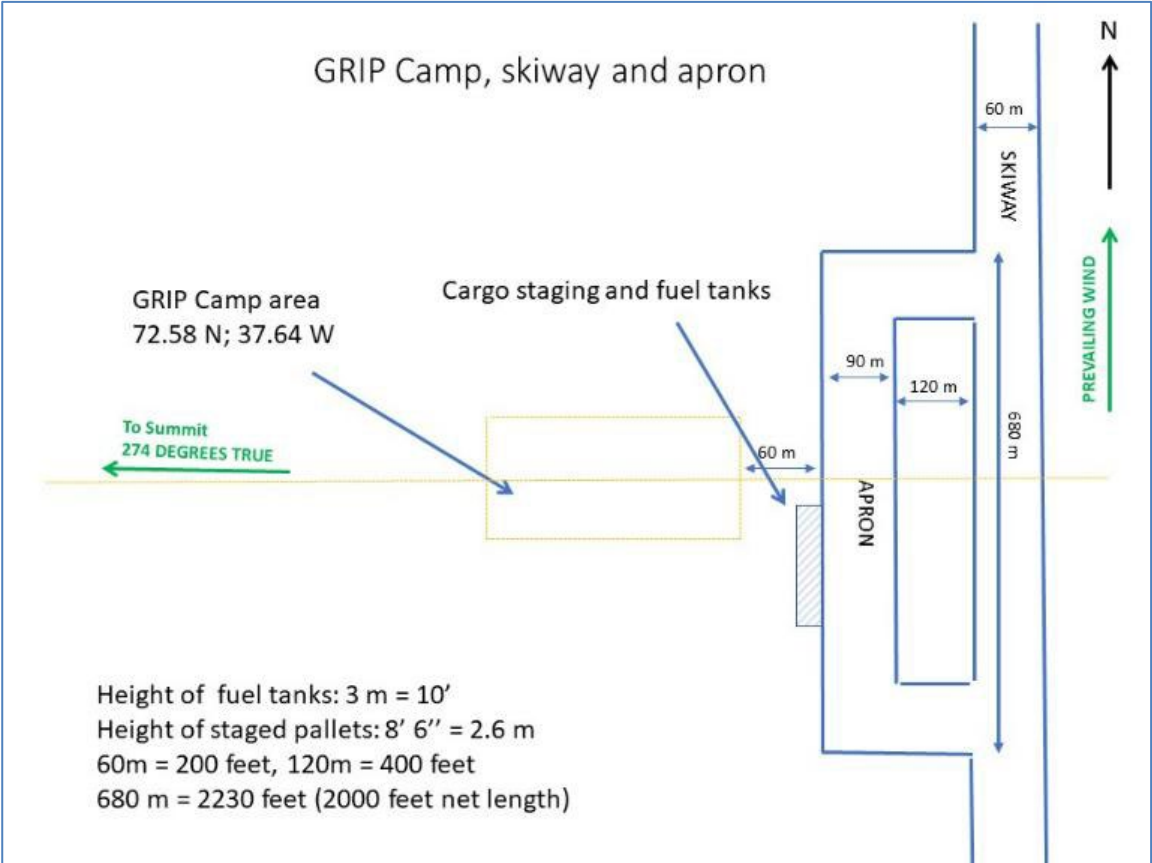
Structures marked with "\*" are not planned for the 2026 season.

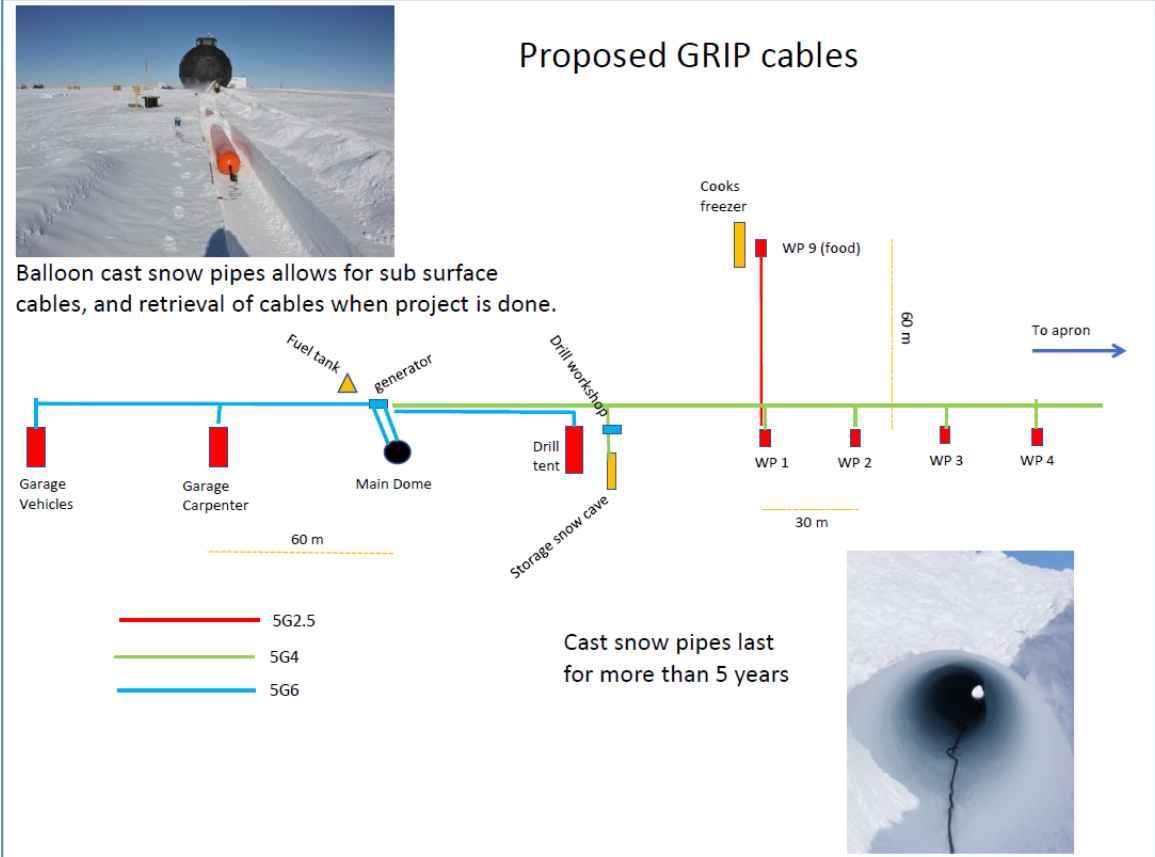
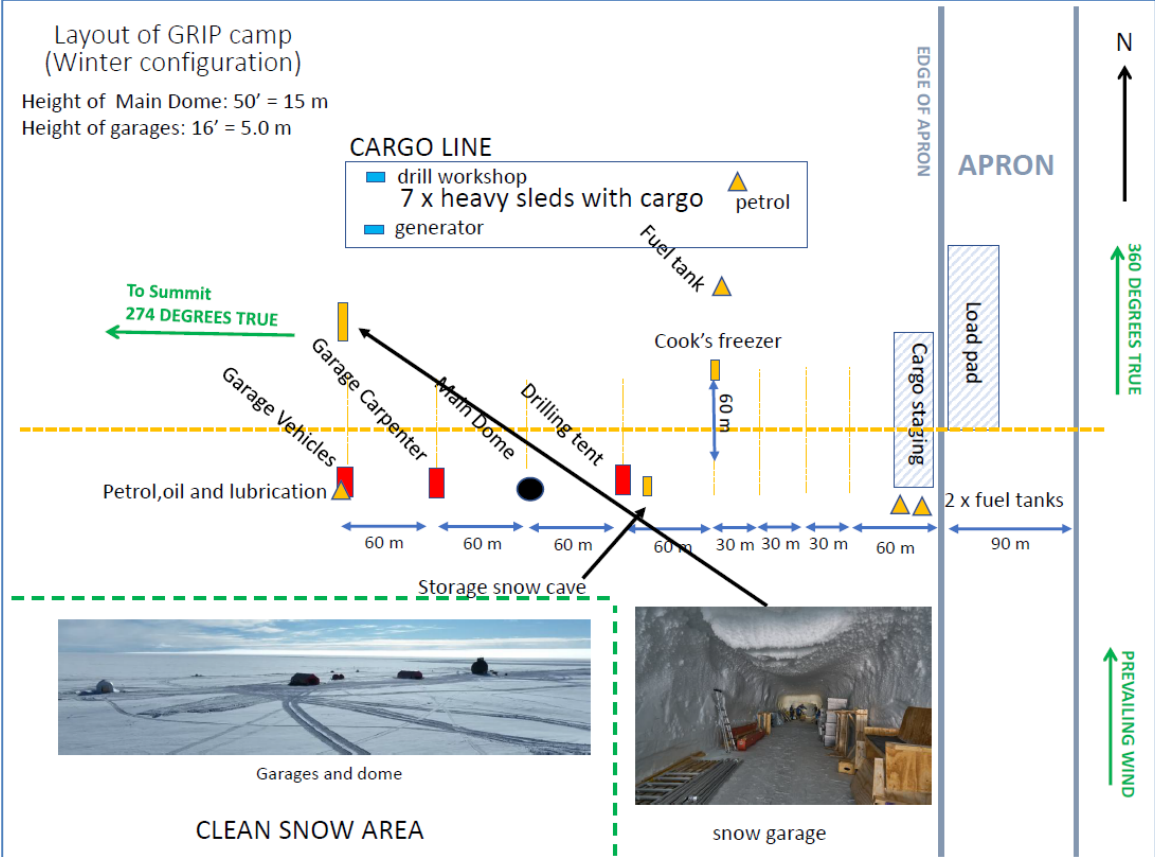
For those individuals who prefer to sleep in small tents, GRIP has a few tents to lend out.

Maps of the GRIP camp area



Planned skiway will be 12,000 feet long and 200 feet wide.





## Description of Kangerlussuaq and Surrounding Area



Google earth

miles  
km



In terms of complexity, Kangerlussuaq (Søndre Strømfjord or SFJ) is unique. Originally there was no native village. The first settlement was the US base Blue West Eight during World War II. The base was closed October 1, 1992, and all facilities handed over to the Greenland Airport Administration. Due to its US origin, the main electrical supply in Kangerlussuaq is 60 Hz, and you may encounter both 115V and 208V US type sockets, as well as 230V Danish sockets.

Since the opening of a new international airport in Nuuk in November 2024, most flights between Greenland and Denmark are out of Nuuk. However, sometimes when weather is really bad in Nuuk, Kangerlussuaq is used as alternate. In Summer of 2026 approx. one flight per week has a planned direct connection between Kangerlussuaq and Copenhagen. The fact remains that Kangerlussuaq is not the dominating hub for flights to/from Greenland anymore and traffic and overall activity has been reduced significantly. The population has shrunk from approximately 450 to about 250. The terminal area still has some businesses: Air Greenland, local supermarket “Pilersuisoq” and some souvenir shops. However, Air Greenland cargo terminal has closed. The terminal side includes private housing, a combination of Air Greenland terminal and Hotel Kangerlussuaq, which also houses the Air Greenland offices and an ATM in DK Kroner. There are also buildings to the west of the terminal which house the Airport Administration.

On the South side of the runway is the old U.S. Base. Here GRIP/Ice-Sustain office and quarters will be in KISS (Building 662). The project warehouse is building 442 which in 2022 was purchased from Greenland Airports by University of Copenhagen.



Google earth

feet 5000  
km 1



Weather: The climate is continental and dry with an annual precipitation averaging 120mm; winter temperatures reach down to  $-50^{\circ}\text{C}$  and the summer temperature increases to above  $+20^{\circ}\text{C}$ . In project planning for fieldwork in or around Kangerlussuaq, it is always best to prepare for the worst. The weather in Kangerlussuaq can be cold in May, and snow is always a possibility. June, July and August are normally fairly temperate with temperatures ranging from  $5\text{-}21^{\circ}\text{C}$ . Rain used to be rare in these months, but in July 2023, it was raining most of the time and the soil around Kangerlussuaq became really boggy.

Field clothing should include windbreaker, rain wear, work boots, warm hats and gloves, woollen shirts, sweaters and trousers. Given the wide range of temperatures during summer months, the use of layered clothing offers the greatest flexibility.

Be aware that cell phones cease to work 5 km from Kangerlussuaq. If you go on a walk, please tell the FOM where you are going and when you expect to be home. The FOM can lend you a satellite phone for emergencies.

Another important consideration is the insect season, normally from first week of June to late July. During this period, large, voracious Arctic mosquitoes are abundant.

In the past 5 years there have been 4 polar bear sightings in the Kangerlussuaq area.

In Kangerlussuaq you can buy regular, canned or freeze-dried foods, fuels (jet fuel/kerosene, gasoline, and field stove alcohol). There is also a gym center with swimming pool, a tennis-, badminton-, racket ball- and soft ball court, a golf course - and also a small museum with exhibitions about the history of Kangerlussuaq. Ask the FOM for more information.

There are a few alternative dining and drinking establishments in Kangerlussuaq. Dining is available at the terminal. There is a cafeteria where the price of a typical meal is DK Kr. 120, and a restaurant. In summertime restaurant "Roklubben" is mostly open for the public. This lakeside restaurant, some 5 km from Kangerlussuaq, offers a splendid view while dining on Greenland specialties.

### ***Base for Science***

Kangerlussuaq has a long tradition as an important base for field geophysical and glaciological research projects, but so far, the region has had only limited activities within the disciplines of life science. The area lies at the edge of the Polar Cap Zone and the Aurora Zone. It is therefore of particular interest to science studies related to the ionosphere and the magnetosphere as well as to the lower and upper atmosphere.

The Kangerlussuaq region is within the low Arctic eco zone with diverse habitats like salt lakes, dune systems, mountain tundra and steppes with caribou and musk ox populations etc. Reindeer are indigenous but muskoxen were introduced from Northeast Greenland **forty** years ago. Muskox and reindeer are hunted and in season meat can be purchased at authorized butchers.

The plant growing season is long, featuring 150 days without snow cover, 80 continuously frost-free days, and 150 consecutive days with maximum air temperature continuously above freezing; (the numbers given are average values). The climate is very stable and with low rate of rainy days. The monthly mean is 241 sun hours in May through August.

The Kangerlussuaq region is a well exposed high grade basement terrain forming the southern border zone of the Nagssugtoqidian orogen. The region has a glacial landscape dating back 8,000 years. The town is sitting on uplifted fjord sediments that popped up due to isostatic rebound after the last glacial. You may find proto-fossilized fish in the sediments west of town. **Please note: It has become illegal to take large amount of fossils and rocks out of Greenland. As a rule of thumb, you are allowed to take out what you can have in a closed fist.**

The proximity of the Inland Ice has a significant effect on the climatic regime for the living resources and further it presents unique logistic opportunities for studies on the Ice Sheet proper, the edge zone, and periglacial geomorphology.

### ***The KISS (Kangerlussuaq International Science Support) facility***

Scientists and students who plan to work in Greenland have facilities available in Kangerlussuaq. KISS offers an array of modern facilities and possibilities to rent equipment and goods for use in the field or in the labs of the KISS building.

KISS (bldg. 662 in the map) is owned by Greenland Airports and operated by the Kangerlussuaq Airport Management. The use of KISS is reserved exclusively for researchers and research projects registered by the Greenland Authorities after submission of project plans.

It is important to realize that KISS is a year-round facility and that the Kangerlussuaq region offers obvious research opportunities and potentials during the 8 winter months. This applies both to projects in biology and geophysics and the presence of KISS now greatly improves the logistics for performing field operations during wintertime.

The KISS facility, and the other facilities in Kangerlussuaq offer unique possibilities for performing science based at Kangerlussuaq. Please contact the GRIP/Ice-Sustain FOM office for more information.

### **Green2Ice/Ice-Sustain 2026 Responsibles**

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Basler mech		
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Basler pilot		
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Tønnesen, Pia	DK	<a href="mailto:pia@tonnesen.dk">pia@tonnesen.dk</a>
Vinther, Bo	DK	<a href="mailto:bvinther@nbi.ku.dk">bvinther@nbi.ku.dk</a>
Wahl, Sonja	N/D	<a href="mailto:Sonja.Wahl@uib.no">Sonja.Wahl@uib.no</a>
Westhoff, Julien	DK/D	<a href="mailto:julien.Westhoff@nbi.ku.dk">julien.Westhoff@nbi.ku.dk</a>
Wright, Shari	CA	<a href="mailto:shari@churchillwild.com">shari@churchillwild.com</a>
Zeppenfeld, Chantal	DK/D	<a href="mailto:chantal.zeppenfeld@nbi.ku.dk">chantal.zeppenfeld@nbi.ku.dk</a>
Zinck-Jørgensen, Magnus	DK	<a href="mailto:magnuszinck04@gmail.com">magnuszinck04@gmail.com</a>

## Phone numbers & contact information

Contacts to Ice and Climate group, NBI

Iben Koldtoft	+45 30 45 01 28	e-mail: <a href="mailto:koldtoft@nbi.ku.dk">koldtoft@nbi.ku.dk</a>
Marie Kirk	+45 35 33 13 20	e-mail: <a href="mailto:m.kirk@nbi.ku.dk">m.kirk@nbi.ku.dk</a>

Green2Ice/Ice-Sustain FOM (Field Operations Manager) telephone +299 52 41 25

FOM satellite phone (will appear in the SITREP)  
e-mail [fom@egrip.camp](mailto:fom@egrip.camp)

### Iridium Satellite handheld telephones to GRIP camp

Only some of the telephones will be available at any given time. Please ask the Field Operations Manager (FOM) which numbers are current.

### Iridium OpenPort system

Please ask the Field Operations Manager (FOM) which number is current. Numbers will be published in the Situation report (SITREP).

### Kangerlussuaq

While participants are in Kangerlussuaq, they can be reached through the internet, as the Ice-Sustain/Green2Ice offers WIFI services in KISS also by their own cell phones.

Ice-Sustain/Green2Ice FOM phone: +299 52 41 25

Battelle ARO POLAR FIELD SERVICES, Kangerlussuaq

Office:	+299 84 15 98
Fax	+299 84 15 99
Mobile:	+299 52 42 18 (primary)
	+299 52 42 81 (secondary)

E-mail: ARO-KangerOps@polarfield.com

Air Greenland Cargo +299 52 43 98

Tickets +299 70 12 12

NYANG (109<sup>th</sup>) +299 84 13 89

e-mail: [139ravenops@gmail.com](mailto:139ravenops@gmail.com)

109<sup>th</sup> address:

109<sup>th</sup> Airlift Group

New York Air National Guard

Stratton Air National Guard Base,

1 Air National Guard Rd.

Scotia, New York 12302-9752

FIC: telephone: +299 36 33 53 (sector north)

FIC e-mail: [fic@naviair.dk](mailto:fic@naviair.dk)

Notam & com centre +299 36 33 04

Rescue and Coordination Centre (RCC) +299 36 33 18

e-mail: [rcc@naviair.dk](mailto:rcc@naviair.dk)

KISS manager +299 52 45 33

email: [sciencesupport@mit.gl](mailto:sciencesupport@mit.gl)

#### **MEDICAL ADVISORY GROUP**

GRIP medical team in Denmark [medicals@egrip.camp](mailto:medicals@egrip.camp)

### **Cargo shipments to Greenland**

GRIP will have a Field Operations Manager in Kangerlussuaq all the time this season. It is essential that all shipments are labelled correctly, and that the FOM is informed about every shipment. In addition, we can expect delays in the Air Greenland transport from Copenhagen to Kangerlussuaq since there is no directly air transport of cargo.

Cargo to Kangerlussuaq should be labelled:

EGRIP / NBI 2026

KISS 208

DK-3910 Kangerlussuaq

Greenland

Phone +299 52 41 25

The international designation of Kangerlussuaq is **SFJ** (Søndre Strømfjord)

We would like following information about each cll.:

**Weight**

**Dimensions**

**Volume**

**Value**

**HS code(s)**

Additional information and labeling

Non Freeze

Hold in Kangerlussuaq

Hazardous Material, including UN number and Proper shipping name.

Information on shipments and **Air Way Bill # (AWB)** should be emailed to:

[fom@egrip.camp](mailto:fom@egrip.camp) and [logistics@egrip.camp](mailto:logistics@egrip.camp)

We urge people to ship cargo as early as possible. Relevant information and documents in connection to cargo for the fieldwork can be found on the Green2Ice website:

<https://www.green2ice.eu/shipping/>.

### ***Shipping to GRIP from the United States***

**Battelle ARO POLAR FIELD SERVICES** and the GRIP FOM must be notified of all cargo shipments, including commercial air in order to arrange for the receipt and transportation of cargo to the appropriate location in Greenland.

Please send the following info:

**Weight**

**Dimensions**

**Volume**

**Date of arrival in NewYork**

To GRIP FOM's: [fom@egrip.camp](mailto:fom@egrip.camp), [logistics@egrip.camp](mailto:logistics@egrip.camp),

Battelle ARO: Tracy Sheeley ([sheeley@polarfield.com](mailto:sheeley@polarfield.com)) and Kyli Cospers ([kyli@polarfield.com](mailto:kyli@polarfield.com))

PLEASE NOTE: Be sure to mark your cargo with "GRIP 2026" to avoid your cargo ending up at Summit!

**Useful tables for planners, Field Leaders, Field Operation Managers, drillers and other interested parties**

***Positions of GRIP, NGRIP and EGRIP camps***

EGRIP position: 75.63N, 36.00W (decimal degrees), 2708 m a.s.l. (8885 feet)

GRIP position: 72.5779 N, 37.6366 W (decimal degrees), 3232 m a.s.l. (10,694 feet)

NGRIP position: 75.10 N, 42.30 W (decimal degrees), 2918 m a.s.l. (9573 feet)

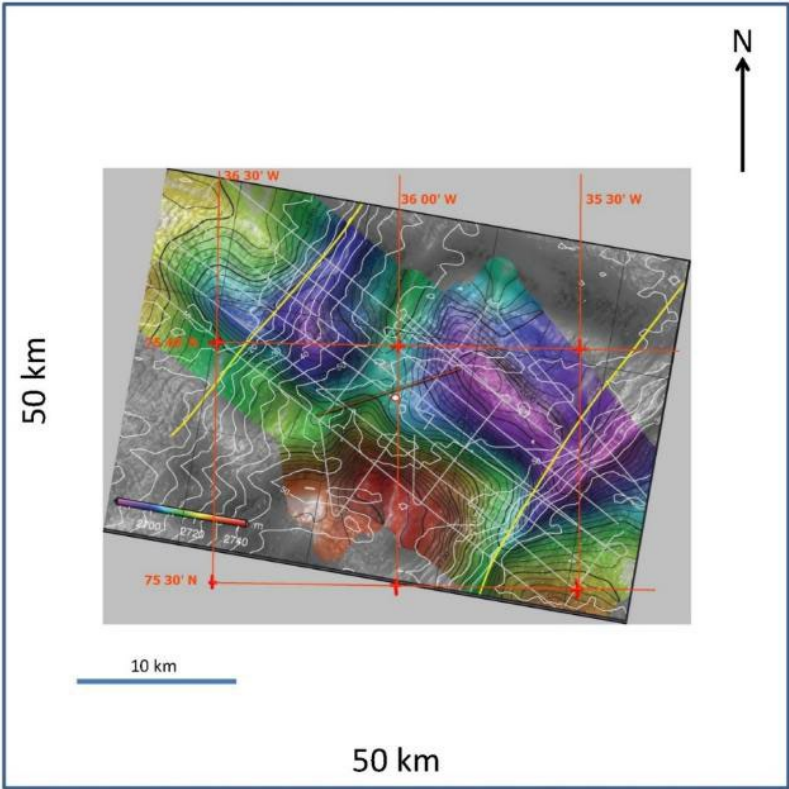
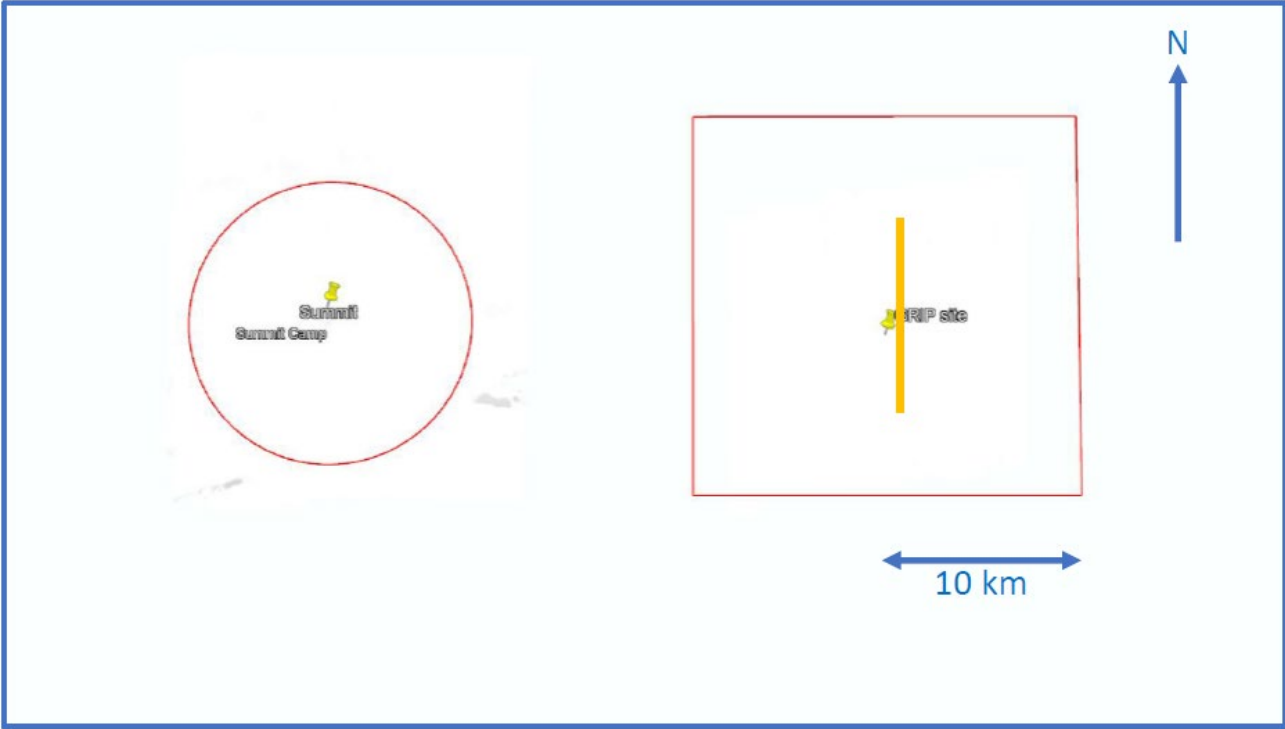
***Positions of EGRIP skiway (July 2025)***

NorthEast end: 75 38' 46.18''N; 35 56' 08.09''W ELEVATION: 8871 feet (2704 m)

SouthWest end: 75 37' 47.10''N; 36 03' 02.84''W ELEVATION: 8898 feet (2712m)

Skiways runs 240 30' and 060 30' degrees true.

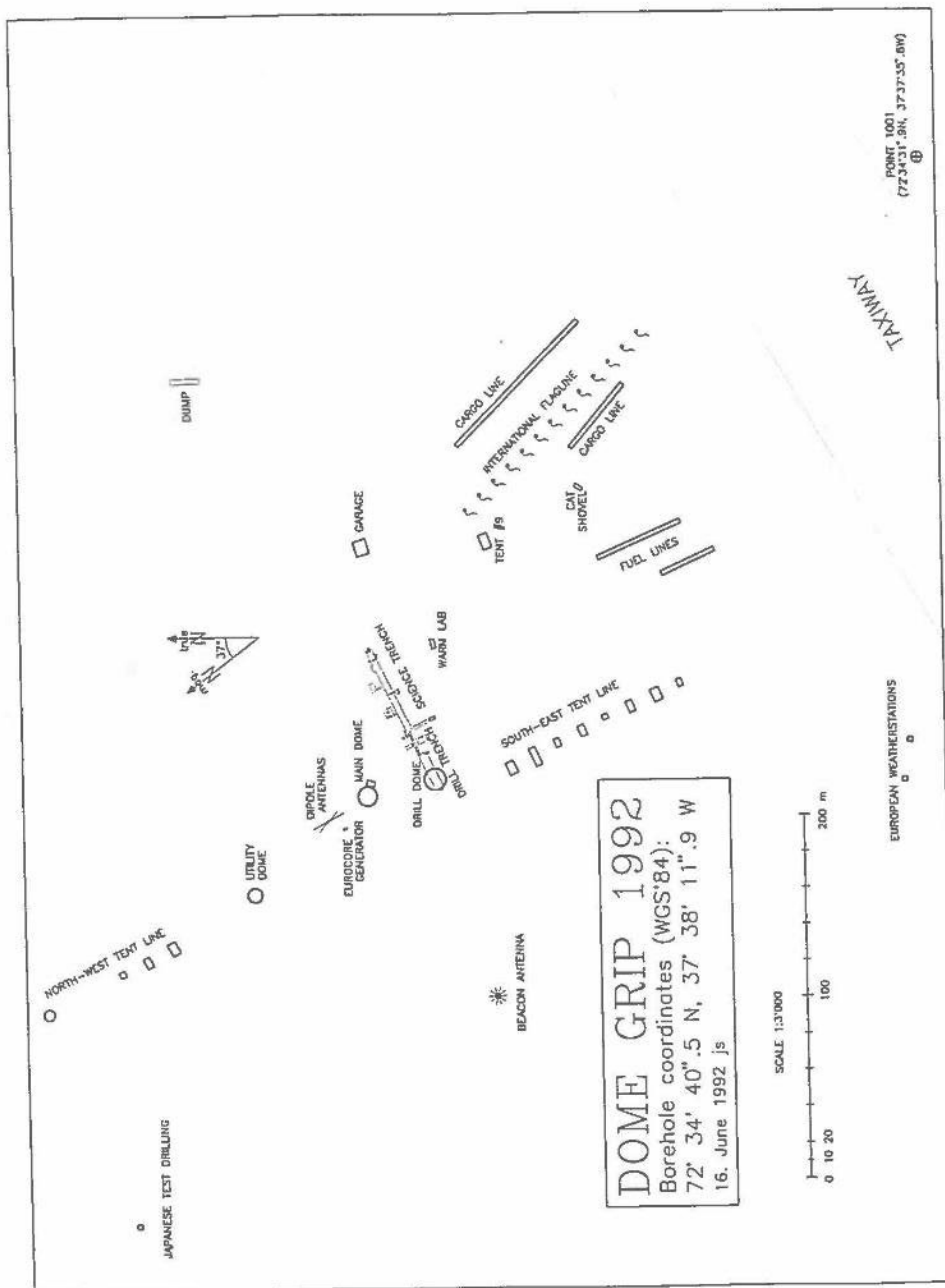
Official (109<sup>th</sup>) altitude: 8,885 ft, Slope 0.22 degrees, down vs 060.



Map on the vicinity of EGRIP camp with camp and skiway (240 degrees true). Data has been compiled by Knut Christiansson, Penn. State. The entire frame is 50 km by 50 km and represents the area allotment requested for EGRIP at Greenland authorities.

Map of the GRIP camp from 1992

84



***Skiway official survey document***

July 3, 2025 survey

**SURVEYOR:** Jorgen Peder Steffensen (Document updated July 2025).

**NOTE:**

1. ALL ELEVATIONS REFERENCE MEAN SEA LEVEL IN FEET (METRIC)
2. LATITUDES/LONGITUDES AND AZIMUTHS EXPRESSED IN DEGRESS-MINUTES-SECONDS FORMAT
3. ALL DISTANCES IN FEET (METRIC)
4. NO SIGNIFICANT ICE FLOW AT GRIP.

**GRIP CAMP (BGGP?)**

**AIRFIELD REFERENCE POINT (ARP):** CENTERLINE STATION 1475 (450 meter)

LATITUDE: 72-34-41.48 N LONGITUDE: 37-37-30.47 W

ELEVATION: 10630 (3240 meter)

DISTANCE SKIWAY CENTERLINE POINT TO THRESHOLD:

APPROACH: 6000

DEPARTURE: 6000

**MAIN SKIWAY (200 ft. x 12000 ft.)**

**APPROACH (18)                      180 DEGREES TRUE**

LATITUDE: 72-35-40.74 N                      LONGITUDE: 37-37-30.47 W

ELEVATION: 10626 (3238.9 meter)

**DEPARTURE (36)                      360 DEGREES TRUE**

LATITUDE: 72-33-42.23 N                      LONGITUDE: 37-37-30.47 W

ELEVATION: 10633 (3240.8 meter)

MAIN SKIWAY GRADIENT: 0.06%

**SKIWAY AZIMUTHS from Approach True 18**

True: 180 00' (2025).

**MAIN DOME (HIGHEST STRUCTURE)**

LATITUDE: 72-34-40.66 N                      LONGITUDE: 37-38-19.50 W

ELEVATION: 10669 (top of structure) (3252 meter)

**AGL:**

DISTANCE TO SKIWAY CENTERLINE: 1475 (450 m)

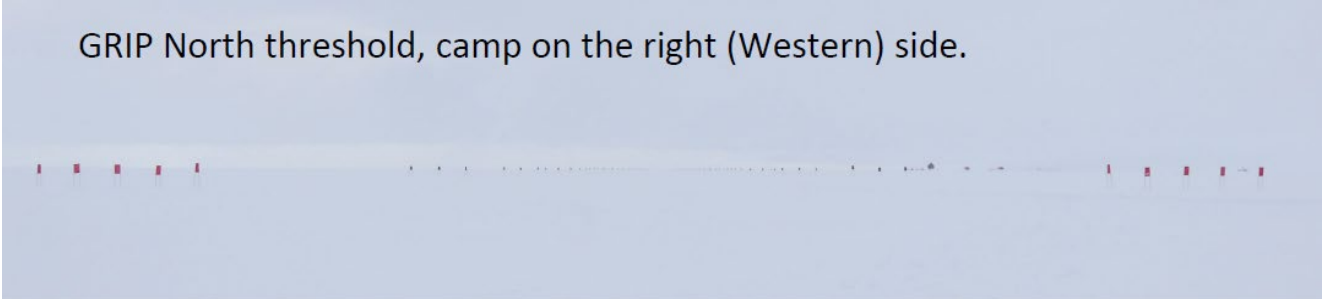
DISTANCE SKIWAY CENTERLINE POINT TO THRESHOLD:

APPROACH 24 : 6000 (1829 meter)

DEPARTURE 06 : 6000 (1829 meter)

***Skiway pictures 2025***

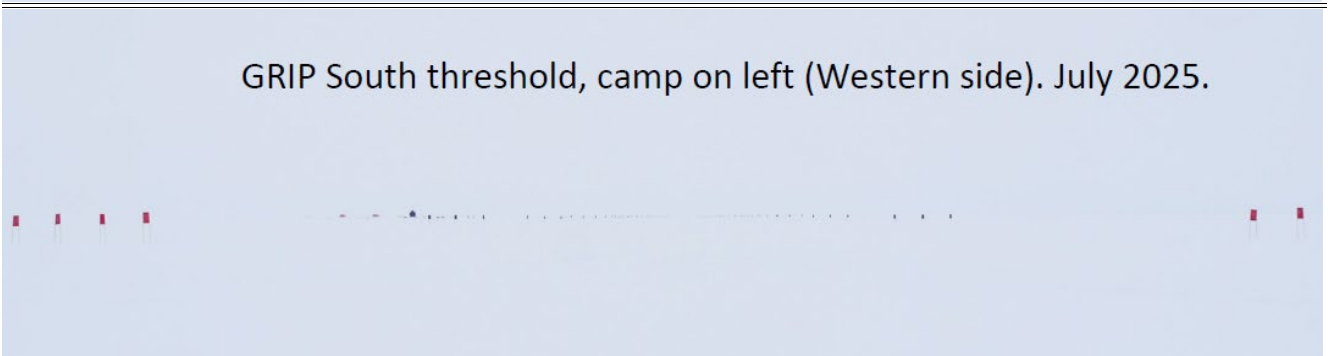
GRIP North threshold, camp on the right (Western) side.



GRIP Northern lead-in, seen from the South at North threshold.



GRIP South threshold, camp on left (Western side). July 2025.



GRIP Southern lead-in, seen from the North at South threshold.

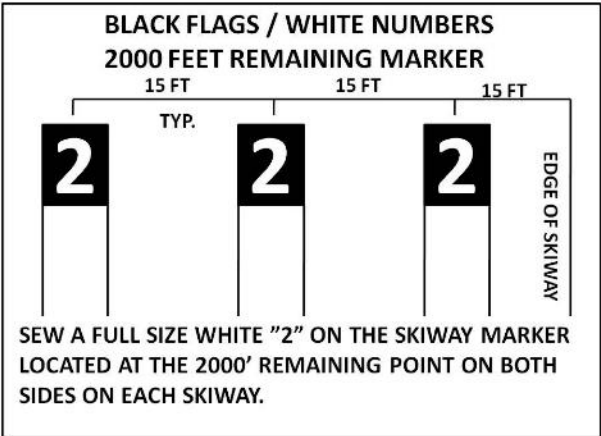
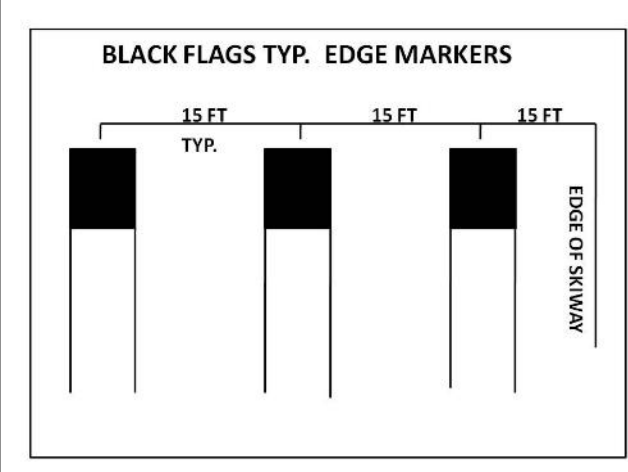
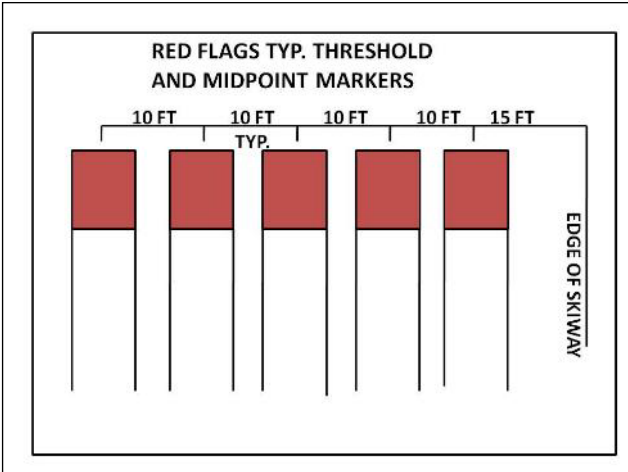
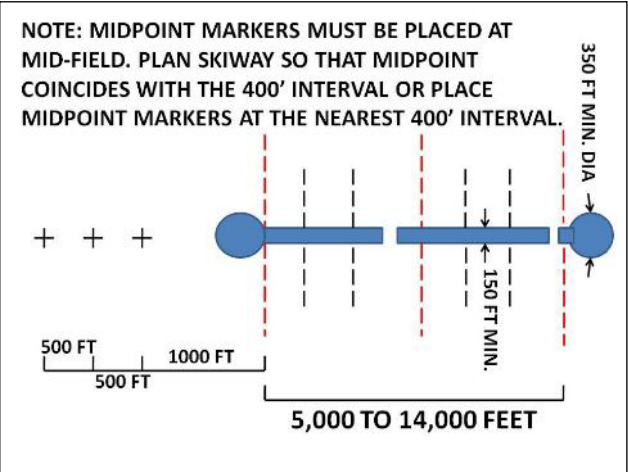
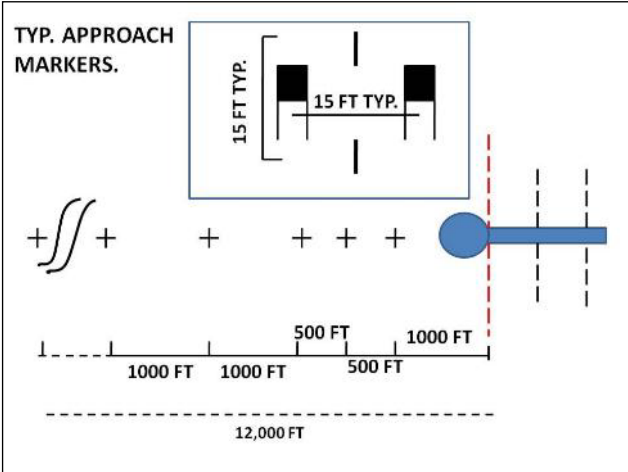


## GRIP Southern 2000 feet markers



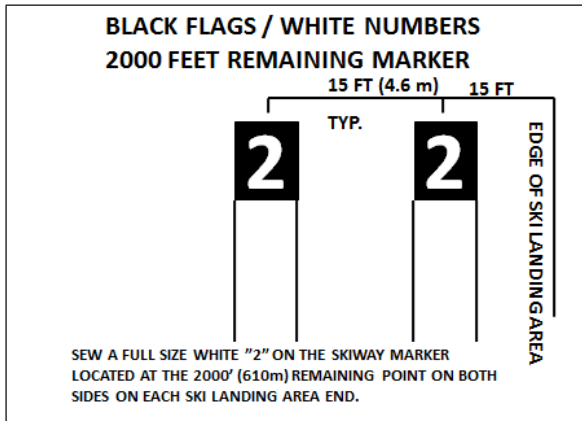
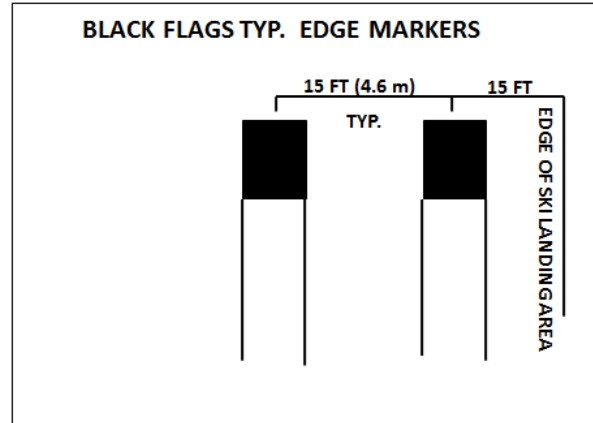
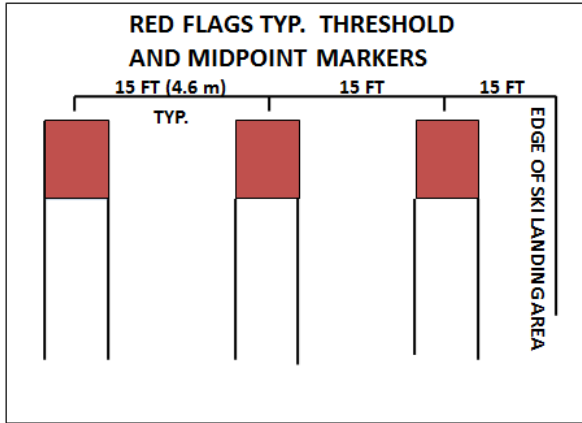
### Skiway Marking

GRIP skiway is 200' x 12,000' (Feet) – (choice of length 5,000' – 16,000', width 150' – 400') Skiway design from AFI 13 – 217, 10.MAY 2007

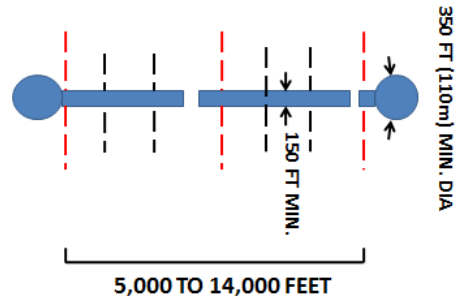


**Ski Landing Area Marking (temporary skiway, last used at NEEM)**

A ski landing area can be 200' x 12,000' (Feet) – (choice of length 5,000' – 16,000', width 150' – 400').  
Landing Area design from AFI 13 – 217, 10.MAY 2007



NOTE: MIDPOINT MARKERS MUST BE PLACED AT MID-FIELD. PLAN SKI LANDING AREA SO THAT MIDPOINT COINCIDES WITH THE 500' (152.4m) INTERVAL OR PLACE MIDPOINT MARKERS AT THE NEAREST 500' INTERVAL. NO APPROACH MARKERS NEEDED

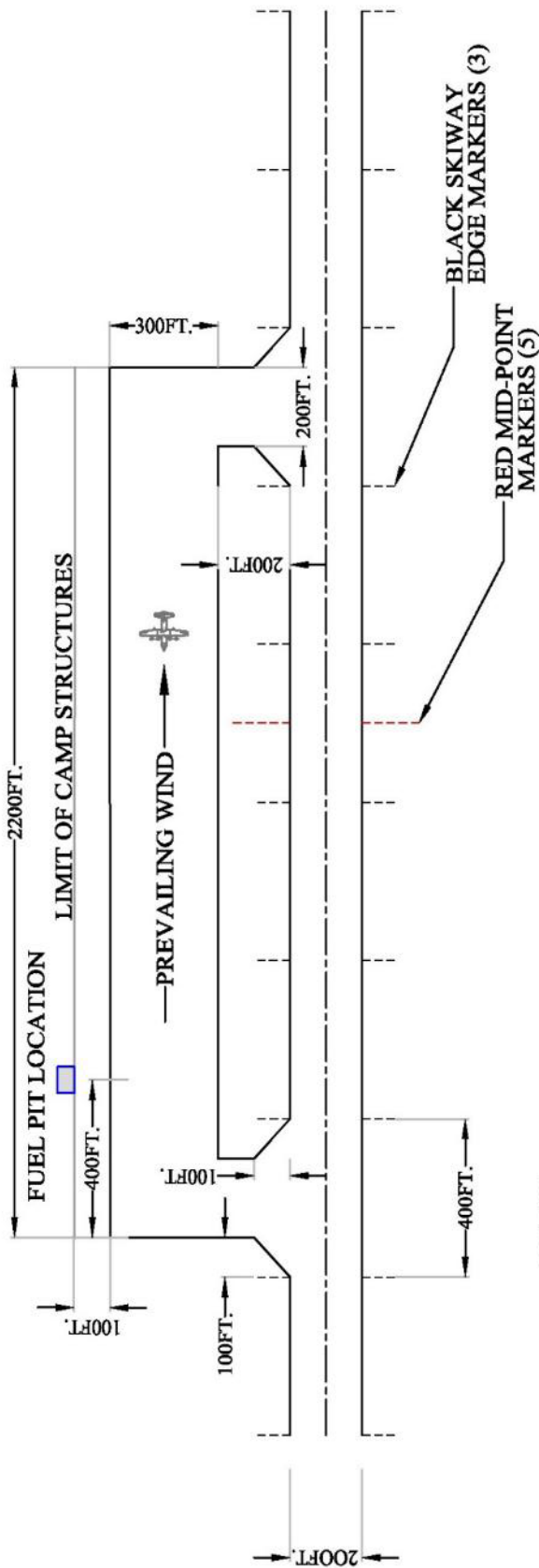


**TYPICAL DIMENSIONS FOR MARKER BAMBOO:**  
2.4 m (94") x 2.5 cm (1 ")DIAMETER

**SKIWAY:**  
**NO OF MARKERS NEEDED (12,000 FEET X 200 FEET) (3660 m X 61 m):**  
30 RED AND 12 BLACK WITH "2" AND 268 BLACK (INCLUDING APPROACHES).  
APRON AND TAXIWAYS: 30 GREEN.

**SKI LANDING AREA :**  
**NO OF MARKERS NEEDED (12,000 FEET X 200 FEET):**  
18 RED AND 8 BLACK WITH "2" AND 80 BLACK  
APRON AND TAXIWAYS: 30 GREEN.

# SKIWAY APRON LAYOUT (CARGO OFFLOAD / ONLOAD AREA)



- NOTES:**
1. DIMENSIONS AS NOTED.
  2. ACTUAL LOCATION OF SKIWAY APRON IN RELATIONSHIP TO SKIWAY MAY CHANGE DEPENDING ON CAMP LOCATION.
  3. MARK APRON CORNERS WITH DOUBLE GREEN FLAGS, APRON LIMITS WITH SINGLE GREEN FLAGS.
  4. MARKERS ENLARGED FOR CLARITY.

**LC-130 AIRPLANE DESCRIPTION**  
 WINGSPAN...132' 7"  
 LENGTH...97' 9"  
 HEIGHT...38' 6"

### ***Shipping boxes***

The type of shipping box is very critical for both the protection of the cargo, and for efficient air transport. In Kangerlussuaq, the boxes will be stored on the cargo line which is exposed to snow, rain, sand and wind. On the ice, drifting snow will creep through any openings. The off loading from the aircraft at Summit is in the form of drifting cargo: The pallets are slid down the rear ramp of the aircraft while the aircraft is taxiing. In order to obtain the full payload and prevent the aircraft from cubing out before reaching maximum weight, the boxes should be stackable on an Air Force pallet. Also, wooden boxes with nails sticking out are dangerous to handle. By experience, we have found the following series of boxes to satisfy all the requirements:

Zarges aluminium box, type K-470. The following sizes are preferred:

order no	Internal dimens (L*W*H)	Outside dimens	Weight
40678	550*350*310	600*400*340	5,0
40564	550*350*380	600*400*410	5,3
40565	750*550*380	800*600*410	10,0
40566	750*550*580	800*600*610	12,0
40580	1150*750*480	1200*800*510	20,0

The boxes should be lined with a shock absorbing layer. We have found a 27mm layer of Dow Chemical EDPM foam, 35kg/m<sup>3</sup>, to provide the needed protection for even fragile material. Finally, in order to seal the box, all seams (bottom inside and outside, two vertical seams) should be sealed with Loctite 290 penetrating sealing compound.

*We propose that, whenever possible, all participants use these or compatible boxes for their cargo. In order to be compatible, a box should have the same outside dimensions, and the same type of inter-box locking mechanism. The boxes should be equipped with handles and clearly labelling on each side.*

**Typical specifications for Twin Otter and Basler**

Actual specs depend on the aircraft used, its equipment, fuel type etc.

**De Havilland DHC-6, Twin Otter:****Basler (modern DC-3), Polar 6:**

Weight empty [kg]	3456	8900
Max take off weight [kg]	5682	13068
Weight of ski	250	544
Empty weight with ski	3706	9444
Max load [kg]	1976	4008
Fuel consumption [kg/hr]	270( 330l/hr)	470 (570l/hour)
Speed without ski [km/hr]	250(135 kn)	380 (205 kn)
Speed with ski [km/hr]	230 (125 kn)	300 (160kn)
Max range [km]	556	3225
Max altitude [ft]	30,000	25,000
With pax	10,000	25,000
Fuel load [kg]	1100	4008
Loading data:		
Cargo hatch [m*m]	2.0*1.9	2.15 *(1.9 front – 1.6 rear)
Cargo compartment		
Length, incl rear cabin etc [m]	8.1	12.85
Width 1,1m, max	1.2	2.34
Height 1,3m, max	1.4	2.0
Pay load		
Normal with full fuel load [kg]	990	2500 (with fuel for 3 hours)
Maximum	1260	1500 (with fuel for 5 hours)

**Twin Otter:**

In order for the cargo to fit through the cargo door, if the cargo is:

- 5.5m long, it must not be more than 0.2m thick
- 4.0m long, it must not be more than 0.35m thick
- 2.5m long, it must not be more than 0.65m thick
- 1.3m long, it must not be more than 1.2m thick

**Basler:**

In order for the cargo to fit through the cargo door, if the cargo is:

- 6.0m long, it must not be more than 0.6 m thick

**Typical LC-130 specifications**

(all specs for info only, depends on aircraft etc)

An empty LC-130 is [lbs]	91000
Tank capacity [lbs]	61000
Max touch down weight open snow [lbs]	125000
Max take off weight [lbs]	155000
Max landing weight [lbs]	155000
Max landing weight on prepared skiway [lbs]	135000
Fuel capacity [lbs]	62000
Fuel consumption [lbs/hr]	5000
Nominal speed [kn]	290
Flight time SFJ-NGRIP-SFJ (1020 nm)	4.4 hours
Flight time SFJ-NEEM-SFJ (1260 nm)	5.4 hours
Range with max payload [miles]	2364
Max air hours [h]	10
Cargo room max 41*10.3*9' [m]	12.50*3.14*2.74
Physical door width 116" [m]	2.94
Cargo deck to ceiling 9' 1" [m]	2.76
Max weight for one pallet, pos 1-4 [lbs]	10000
Max weight of one pallet, pos 5 [lbs]	8500
Max weight of ramp pallet [lbs]	4664
Nominal empty weight of pallet and nets [lbs]	355
Max weight multplie pallet for combat offload [lbs]	12000
Pallet outside dimensions 88"*108" [m]	2.23*2.75
Pallet inside dimensions 84"*104"*2.25" [m]	2.13*2.64
Max height normal pallet, 96" [m]	2.44
Normal height of pallet, snow and combat [m]	2.28
Max height ramp pallet for combat offload [m]	1.75
Max height dual or tripple pallet [m]	1.75
Max vol per pallet [m <sup>3</sup> ]	13.7
Max vol ramp pallet [m <sup>3</sup> ]	8.75
Width wheel well area 123" [m]	3.12
Width ramp without rails 114" [m]	2.89
Width outboard rails 105 5/8" [m]	2.68
Ramp height 44" to 49" [m]	1.12 to 1.25
Ramp length 10' [m]	3.05
No of pax without using pallet space	4
1 pallet equals [pax]	8
2 pallet equals [pax]	14

Note: Pallet heights are measured from top of pallet.  
Max weight for pallet on 931B forks is 2200 lbs

**Small table of values and conversions**

1 foot =	0.3048 m
1 lbs =	0.4536 kg
1 US gallon =	3.7854 l
1 knot =	0.514 m/s

Max dimension of cabin luggage	55*40*23 cm, 8 kg
Density of Jet A1	805 kg/m <sup>3</sup>
Density of mogas	720 kg/m <sup>3</sup>
200 l drum of JET A1 or D60	178 kg
Empty standard drum	15 kg
Jet A-1 weight vs. volume	0.52 liter per lbs.
Firn density for stop of water flow	720 kg/m <sup>3</sup>

**CINA equation for the relation between pressure and altitude:**

$$p[hPa] = p_0 \left( \frac{288 - 6.5 \cdot 10^{-3} \cdot h [m]}{288} \right)^{5.256}$$

where  $p_0=1013.25$  hPa, 288K standard air temperature at sea level (15 °C) and  $6.5 \cdot 10^{-3}$  the standard lapse rate in the troposphere [°C/m]. Use this equation to obtain the sea level pressure when the altitude is known, i.e. for aviation weather reports.

**Chill temperature:**

This is the formula used for calculating wind-chill-temperatures (t temperature in C, v windspeed in m/s):

$$t_{\text{chill}} [^{\circ}\text{C}] = \left( \frac{10.45 + 10\sqrt{v} - v}{22.034} \right) \cdot (t - 33) + 33 [^{\circ}\text{C}; \text{m/s}]$$

**Current capability of electrical cables:**

Area [mm <sup>2</sup> ]	Resistance [Ohm,/100m]	Nom load [A]	Max load [A]
0,7	2.3	6	10
1,5	1.16	15	25
2,5	0.69	20	35
4,0	0.43	25	45
6,0	0.29	40	60
10	0.175	60	80
16	0.11	80	110
25	0.07	100	135

*Connections to 5-conductor cable:*

**Old system**

Yellow/green:	Protective ground
Blue	Neutral (0)
Black	L1
Brown	L2
Black	L3

**New system**

yellow/green
blue
brown
black
grey

## ***Coordination of LC-130 in Kangerlussuaq***

Note regarding the coordination of Polarfield/GRIP  
and 109'th TAG activities in Kangerlussuaq.

This note is written to make the field coordination between Polarfield/Batelle ARO, GRIP camp and 109'th TAG as smooth and easy as possible by ensuring efficient ways of exchanging firsthand information between the responsible Field Operations Managers (FOM's) for CPS and GRIP and 109'th TAG personnel during periods with flights for the GISP and GRIP programs.

The outline of this paper should be presented to each Deployment Commander(DC) in a briefing and each mission crew should be briefed on the contents before scheduling a flight to/from GRIP. This will ensure that the FOM's and the 109'th personnel will operate along the same outlines throughout each period of deployment.

In the following it is assumed that prior to the field activities of Polarfield and GRIP in Greenland, plans and agreements have already been made between Polarfield/GRIP and 109'th TAG regarding times of deployment in Kangerlussuaq, expected number of missions throughout the season, total cargo estimates, estimates on cargo straps, nets and pallets needed, ski-way marking, ski-way preparation, off load areas, radio frequencies etc.

### Flight period:

After arrival of 109'th to Kangerlussuaq a meeting should be held between 109'th DC, 109'th cargo responsables (Load masters and Aerial port) and the FOM's of Polarfield and GRIP. Both FOM's need to be there since U.S. NSF activities and GRIP project are independent and each FOM carries the financial responsibility regarding 109'th operations. At this meeting the FOM's will provide information on:

- Planned flights,
- Amount of cargo,
- Hazardous cargo,
- Number of PAX to be transported,
- Ski-way conditions in camp.
- Ski-way, taxiway and off-load area outlines relative to the camps,
- Updates on radio frequencies,
- Current weather and
- Communication radio frequencies & phone numbers.

The DC will provide information on the exact duration of the deployment, ground crew availability, aircraft availability and options in case of bad weather. The meeting will result in an operation schedule for the flight period in question. Both FOM's and the DC should consult each other in case of changes in this schedule.

### Day to day operations:

The FOM's will normally organize that all cargo is palletized, strapped down and weighed. In cases of doubt the FOM's will consult the Aerial Port regarding palletizing. The FOM's will always consult the Aerial Port when married pallets are being built and when load vehicle (k-loader) is needed. The

FOM's will list the weight and height of the pallets. The FOM's will indicate to Aerial Port which pallets are going on each flight and will indicate the position of any hazardous cargo on the pallets. Normally, transportation of pallets from the staging area to the planes and vice versa will be handled by Aerial Port using the Articulated front loaders (ATs) or other load vehicles. However, the FOM's will assist in the on- and off-loading of aircraft whenever needed using the GRIP forklifts and trucks.

Cargo manifests, passenger manifests and shippers declarations of hazardous material will be prepared by each FOM office and delivered to Skier operations on the day before departure. In case of last minute changes (e.g. changes in passengers) the changes to the manifests will be passed on to Skier operations no later than two hours before departure. The FOM's will get aviation weather observations from the field camps on a one hour basis, starting at least 3 hours prior to scheduled departure. The FOM will ensure that the Field Leader also sends three consecutive Aviation weather reports to the DMI office, so DMI may work out an aviation weather report for the 109th pilots.

Since each FOM is economical responsible to his/her program, the FOM and DC either in person or by telephone will agree on whether a flight will depart or not. The FOM should be present at the AC at departure to provide last minute briefing with the departing crew.

During missions Telephone, Iridium phones, OpenPort phones and e-mail will be monitored for updates on weather and mission progress from plane crews and field camps. NOTE: Both GRIP camp and FOM office will have phone lines open 24 hours a day. The FOM office will relay information on mission progress to Skier OPS. The FOM keeps a record of departure times and reported arrival times.

End of flight period:

At the end of deployment, before departure of the 109'th to the U.S. or, when there is a change of DC, a meeting should be held between the 109'th and the CPS and GRIP FOM's in order for the FOMs and DC to sign the mission sheet, which includes the number of flight hours assigned to the different programs.

## AVIATION WEATHER REPORTS

The aviation weather reports should report the following in the sequence shown:

1. Time [local, here SFJ hours], use 24 hour format.
2. Ceiling Height to cloud base[100 feet, estimated or observed]. Type [SKC, FEW, SCT, BRK, OVC]
3. Visibility [nautical miles or fractions there off]
4. Temperature (Celsius). State centigrade.
5. Wind, Direction[10 deg resolution], State "true" or "magnetic" . And speed in knots
6. Pressure [hPa], reduced to zero elevation using **10700'** for **GRIP**, 10600' for GISP, 9700' for NGRIP, 8140' for NEEM and 8924' for EGRIP. This is called the **QNH** value.
7. Horizontal definition [good, fair, poor, nil]
8. Surface definition [good, fair, poor, nil]
9. Comments.

Example: 0630 local, Scattered, 2500 feet estimated, vis. 2 miles, temp: -15 degC, Wind 290 mag at 12 knots, QNH 1013 hPa, horizon: good, surface: fair, "skiway clear, fogbank SE of ski-way."

**Visibility:** Nautical miles or fractions of miles. Any visibility problems less than 6 miles state obscuring phenomenon. Choices: Haze, snow, ice fog, ground fog, blowing snow, white out. Max visibility stated "unrestricted".

**Pressure:** Local pressure converted to sea level according to international aviation CINA standard atmosphere. State hPa. Note, that the elevation used is the agreed upon, canonized elevation in feet, not the actual elevation. hPa (or millibar; 1 hPa = 1 mb)

**Ceiling type:** **SKY CLEAR** (SKC, no cloud at all), **FEW** (a small cloud here and there <25 %), **SCATTERED** (SCT. Even coverage of clearly separated small clouds. 25% -60%), **BROKEN** (BRK, Even coverage of clear blue patches of sky between clouds. 60 % – 85 %). **OVERCAST** (OVC, even cloud cover, 100%). With OVC always state cloud base height.

**Horizon definition:**

<b>Good:</b> Sharp horizon	<b>Fair:</b> Identifiable
<b>Poor:</b> Barely discernable	<b>Nil:</b> No horizon

### Surface definition

**GOOD:** Snow surface features are easily identified by shadow. (Sun in obscured)

**FAIR:** Snow surface can be identified by contrast. No definite shadow exist. (Sun obscured).

**POOR:** Snow surface cannot be identified except close up. (Sun totally obscured).

**NIL:** Snow surface features cannot be identified. No shadow or contrast. Dark coloured objects seem to "float" in the air. Glare is equally bright from all directions.

**Whiteout** NIL surface, NIL horizon

**Comments:** Plain language comments, trends, changes : «Fog bank north», "Visibility decreasing." "Winds variable". "Barometer rising".

**Conversion:**

1mB	= 1 hPa	=	0.0295300 in.Hg.
1 foot	= 0.3048 meter,		
1 nau.miles	= 1853 meter.		
1 m/s	= 1.943 knots		



## **Communication plan**

### **Typical radio communication plan**

The major part of the communication is performed using a satellite link, Iridium OpenPort and Iridium satellite communication. However, flight related communication close to camp is performed on VHF radio.

Call signs (Site Names): Polarfield Sonde, Summit Radio, GRIP, GOC Sonde.

### **VHF radio**

Camp communication with air craft is performed on Air band **122.8MHz** FM, in camp radios will operate on Maritime Channel 8 (156.400 MHz). Maritime VHF is also used to support SAR operations.

If aircrafts are expected, weather reporting from camp starts 3 hours prior to estimated take off time on a one hour basis unless otherwise arranged. Reporting primarily on e-mail with telephone and radio as backup unless agreed otherwise. Weather observations should be reported to the FOM office, weather office in Kangerlussuaq (DMI) and the 109<sup>th</sup>. DMI needs at least three observations from camp to issue a local area forecast to the flight crews.

### **Summary of frequencies used in Greenland**

<b>VHF radio air band</b>	118.1	CNP AFIS
	118.3	SFJ Approach
	121.3	NUUK FIC
	121.5	<b>Call, Emergency</b>
	122.8	Air to ground, EGRIP or Summit
	126.2	SFJ Tower
	123.45	Open Mic. Flight chat line
<b>VHF marine band</b>	Ch 8	GRIP talk channel
	Ch 12	GRIP talk channel
	Ch 16	International call and distress channel (156.8 mHz)

## ***Phonetic alphabet***

A special way of saying letters and numbers that makes them less likely to be misunderstood when they are transmitted over radios.

A	Alpha	N	November	1	Wun
B	Bravo	O	Oscar	2	Too
C	Charley	P	Papa	3	Tree
D	Delta	Q	Quebec	4	Fower
E	Echo	R	Romeo	5	Fiwer
F	Foxtrot	S	Sierra	6	Six
G	Golf	T	Tango	7	Seven
H	Hotel	U	Uniform	8	Aight
I	India	V	Victor	9	Niner
J	Juliet	W	Whiskey	0	Zeeroh
K	Kilo	X	Xray		
L	Lima	Y	Yankee		
M	Mike	Z	Zulu		

In addition, numbers are usually spoken as individual digits. For example, 123 would be read as “wun too tree”.

## ***Useful abbreviations for de-cyphering pilot talk on flight plans***

AC: Air craft.

ACL: Air Craft Load = Total weight of aircraft (in kg or pounds)

GC: Centre of gravity For balancing the Air Craft

FL: Flight Level level of flight in nearest 100 feet

POB: Persons on board = total number of souls (PAX and crew)

Endurance or FOB = Total time of flight with current fuel load.

1000z = 10.00 GMT (0800 AM West Greenland summer time)

Flightplan:

IDENT: C-GHGF TYPE: DC3T VFR M SHG/S

DEPART BGNM@1200 FL125 N0205

ROUTE: BGSF

EET 0330 FOB 0600 POB 5

For PIC E BENGTSOON

J.P.Steffensen, FL EGRIP Camp

+8816 777 15686

Identity: Charlie-Golf Hotel Golf Foxtrot. Type: Turbo DC3 (Basler), Flying Visual Flight Rules. Safety equipment "M SHG/S" Departs EGRIP at 1200z , flying at flight level 12500 feet, route to Sondrestrom, Estimated flight time 03.30 hours, Fuel on board 06.00 hours. 5 Souls on board. Pilot in Charge: E Bengtsson.

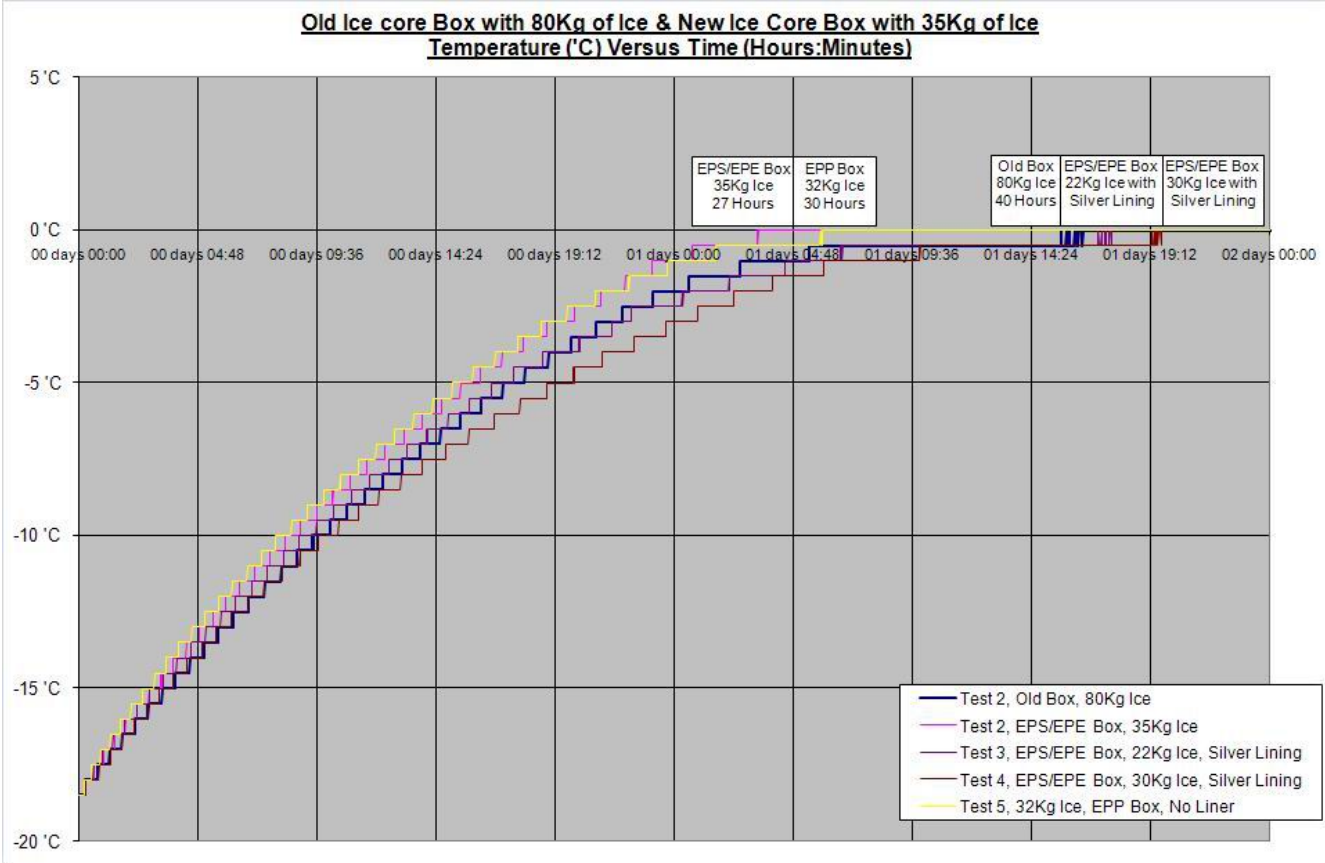
**Positions in Greenland**

<b>Positions in Greenland</b>				
<b>Site</b>	<b>N, deg</b>	<b>W, deg</b>	<b>N, deg, min</b>	<b>W, deg,min</b>
Aasiaat, BGAA	68,7219	52,7847	68 43 19	52 47 05
Akureyri, AEY	65,65	18		
AWI 1995 depot	76,63	46,37	76 38	46 22
Camp Century, tower	77,1797	61,10975	77 10 46	61 06 35
Camp Century,upstream	77,22122	60,80012	77 13 16	60 48 00
Constable Point, BGCO	70,7417	22,6583	70 44 30	22 39 30
Danmarkshavn, DMH	76,79	18,65		
Dye-2	66,485	46,298	66 29 06	46 17 54
Dye-3	65,15139	43,81722	65 09.05	43 49.02
EGRIP	75,63541	36,00025	75 38 07	36 00 01
GISP 2 (Summit)	72,58833	38,4575	72 34.78	38 27.27
<b>GRIP</b>	<b>72,58722</b>	<b>37,64222</b>	<b>72 34.74</b>	<b>37 37.92</b>
Hans Tausen, 95 Drill site	82,50556	37,47222	82 29.8	37 28.2
Jakobshavn, BGJN	69,2444	51,0622	69 14 40	51 03 44
Kangerlussuaq, BGSF	67,0111	50,725	67 00 40	50 43 30
Kulusuk, BGKK	65,5736	37,1236	65 34 25	37 07 25
Longyearbyen	78,25	15,5		
Narsarsuaq,BGBW	61,1611	45,42780	61 09 40	45 25 40
NEEM	77.4486	51.0556	77 26 54.93	51 03 19.89
NGRIP	75,1	42,30000	75 06	42 20
NGT23, B20	78,83333	36,50000	78 50 00.0	36 30 00.0
NGT27, B21	79,99925	41,13744	79 59 57.3	41 08 14.8
NGT30, B22	79,34142	45,91156	79 20 29.1	45 54 41.6
NGT33, B23	78,00000	44,00000	78 00 00.0	44 00 00.0
NGT37	77,25000	49,21667	77 15	49 13
NGT39	76,65000	46,48333	76 39	46 29
NGT42	76,00000	43,50000	76 00	43 30
NGT45	75,00000	42,00000	75 00	42 00
Nuuk, BGGH	64,1944	51,6806	64 11 40	51 40 50
Saddle North	66,43333	43,33333	66 26	43 20
Station Nord (STANOR)	81,6	16,650	81 36	16 39
Storstroemmen			77	22
T53. JJ			71 21.24	33 27.34
T61	72,2	32,3	72 12	32 18
Thule AB	76,53	68,7	76 32 00	68 42 00
Uummannaq, BGUQ	70,7342	52,6961	70 44 03	52 41 46

**Relevant distances**

<b>From</b>	<b>To</b>	<b>km</b>
AEY	NOR	1780
AEY	CNP	600
CNP	THU	1532
CNP	DMH	686
CNP	RENLAND	161
DMH	NGT33	627
DMH	NOR	539
EGRIP	GRIP	344
EGRIP	CNP	695
EGRIP	SUMMIT	350
EGRIP	NEEM	440
EGRIP	NGRIP	190
MST	CNP	170
MST	RENLAND	141
NEEM	SFJ	1180
NEEM	THU	480
NEEM	UPERNAVIK	600
NEEM	NGRIP	365
NGRIP	CNP	799
NGRIP	GRIP	315
NOR	Longyearb	717
NOR	HT	335
SFJ	THU	1224
SFJ	JAV	245
SFJ	EGRIP	1088
SFJ	GRIP	796
THU	CC	205
THU	HT	887
THU	NGT33	625
THU	GRIP	1005
THU	NOR	1182

Ice core boxes, temperature measurements



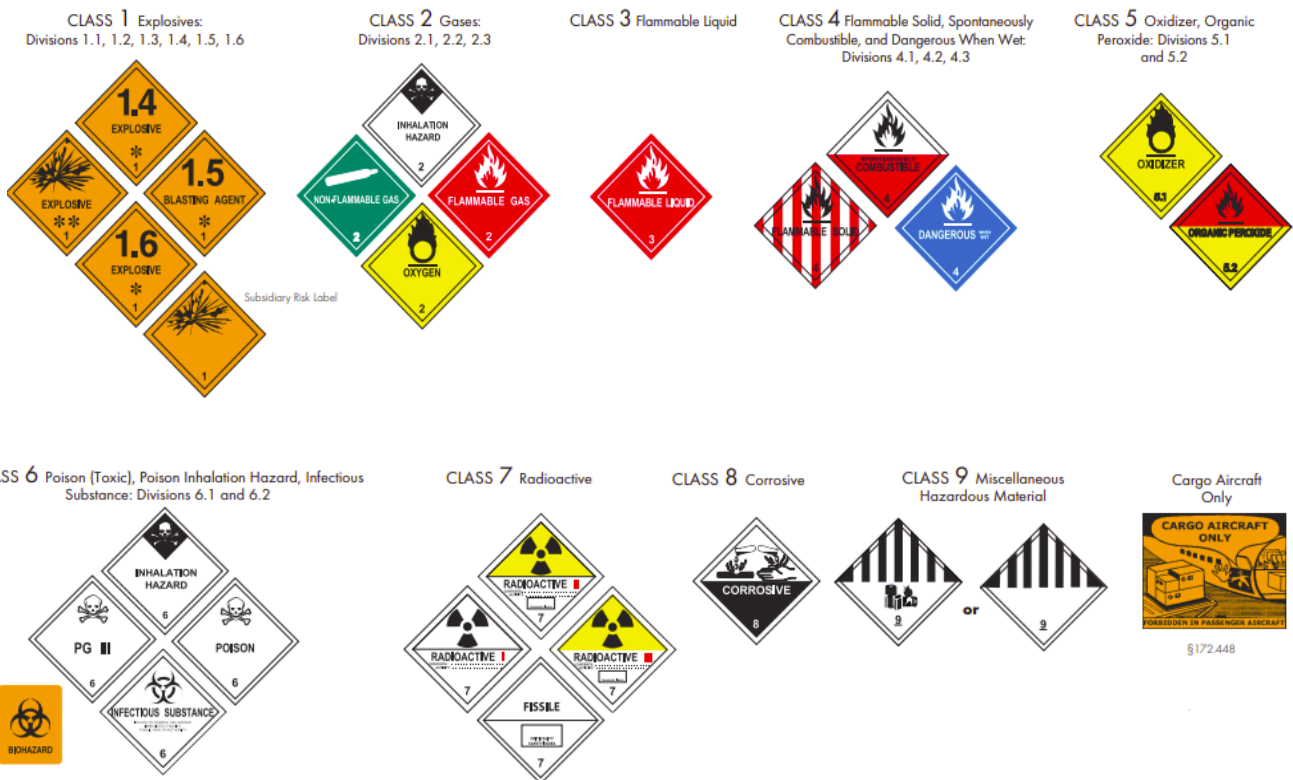
## HAZMAT / DGR Information

### What to be aware of when shipping Dangerous Goods DGR (EU) / HAZMAT (US)

Dangerous goods include explosives, gases, flammable liquids, toxic substances, infectious substances, radioactive substances, corrosive substances, lithium batteries and more, which can be a hazard to people, animals or the environment if not properly handled in use or in transport.

There are heavy regulations regarding shipping anything listed as DGR/HAZMAT and if not following these regulations, we can get in real trouble and heavily fined. Therefore, when you plan to ship cargo by Road, Rail, Ship or Air, it is important that you check your cargo for any of the left or similar danger symbols.

Another thing you should look out for are the below shipping labels (divided by the UN Model Regulations classification of danger).



If your goods or cargo is marked with any of these or any other hazardous labels, then you need to handle and ship them as DGR/HAZMAT. Which means that the packaging, labelling and paperwork, must be, handled by certified personnel e.g. the shipping agency that you plan to use, the logistical department at your institution, or the EastGRIP logistical group.

**Important info:** If you have found an old box with any of the shipping labels above, and you want to re-use it for shipping something else not hazardous, then you MUST remove the old labels, as the box will otherwise be considered as containing hazardous materials. Which can end up giving you a penalty.

It is very good to know that it is allowed to re-use undamaged shipping boxes. DGR/HAZMAT boxes are expensive.

### Lithium Batteries

Lithium batteries have become very restricted to ship by AIR due to, a series of incidents involving fires on aircraft from shorted lithium batteries. All modern electronics, such as cell phones, laptops, cameras etc. contain lithium batteries.

#### IATA distinguishes between “lithium ion batteries” and “lithium metal batteries”

“lithium ion batteries” are a type of secondary (rechargeable) battery commonly used in consumer electronics. Also included within the category of lithium-ion batteries are lithium polymer batteries. **Generally found in mobile telephones, laptop computers, etc.**



“lithium metal batteries” are generally primary (non-rechargeable) batteries that have lithium metal or lithium compounds as an anode. **Generally used to power devices such as watches, calculators, cameras, temperature data loggers.**



#### Lithium batteries are classified in Class 9 – Miscellaneous dangerous goods as:

**Loose batteries:** UN 3090, Lithium metal batteries, or UN 3480, Lithium ion batteries **(forbidden for transport as cargo on passenger aircraft IATA).**

**Or, if inside a piece of equipment or packed separately with a piece of equipment to power that equipment as:** UN 3091, Lithium metal batteries contained in equipment, UN 3091, Lithium metal batteries packed with equipment, UN 3481, Lithium ion batteries contained in equipment, or UN 3481, Lithium ion batteries packed with equipment **(less restricted IATA).**



#### So what does that mean for us?

- 1). Find the MSDS (Manufacturers Safety Data Sheet) or SDS (not old version) and see under **Section 14: Transport information**, if/how your lithium batteries can be, shipped.
- 2). As UN 3090, Lithium metal batteries and UN 3480, Lithium ion batteries are, forbidden for transport as cargo on passenger aircraft. Always consider to ship as packed in /or with equipment. However even this has become complicated.
- 3). Consider to send by Ship (IMDG less restricted), or carry as hand luggage (see next page).

**Example of lithium batteries packed with equipment, in the original packaging.**

#### Packaging of the lithium batteries

It is important to remember, that one of the major risks associated with the transport of lithium batteries and battery-powered equipment is short-circuit of the battery as, a result of the battery terminals coming into contact, with other batteries, metal objects, or conductive surfaces.

- Packaged batteries or cells must, be separated in a way to prevent short circuits and damage to terminals.
- Cover the poles with tape.
- Must be packed in a strong outer packaging (preferable the original packaging) or contained in equipment (in preferable the original packaging).



**To carry lithium batteries in your carry on hand luggage**



To carry lithium batteries as carry on hand luggage is often easier than to ship them as cargo. However, here is also a few things to be aware off. One thing is that the different Airlines, have different regulations, so check their homepage before you travel with the lithium batteries.

A thing they all agree about; “it is safer to have lithium batteries in your carry on hand luggage, than in your checked in luggage.”



Therefore, you will also find that you can actually carry quite a lot of lithium batteries with you on the plane.

<https://www.easa.europa.eu/en/domain/dangerous-goods>

IATA distinguishes between small (up to 100 Wh), medium (up to 160 Wh) and large lithium batteries (more than 160 Wh):

Wh rating or lithium metal content	Configuration	Carry-on baggage	Checked baggage	Operator approval
≤ 100 Wh / 2g	In equipment (PED or PMED)	Yes (max 15 PED/PMED <sup>1</sup> )	Yes	No <sup>1</sup>
	Spare battery(ies)	Yes (max 20 spare batteries <sup>2</sup> )	No	No <sup>2</sup>
>100 to ≤160Wh	In equipment (PED or PMED)	Yes	Yes	Yes
	Spare battery(ies)	Yes (max 2 spare batteries)	No	Yes
>160Wh	Must be prepared and carried as cargo in accordance with the IATA Dangerous Goods Regulations			
> 2g ≤ 8g	In equipment (PMED only)	Yes	Yes	Yes
	Spare batteries for PMED	Yes (max 2 spare batteries)	No	Yes

1. Each person is limited to a maximum of 15 PED. The operator may approve the carriage of more than 15 PED.  
 2. Each person is limited to a maximum of 20 spare batteries of any type. The operator may approve the carriage of more than 20 batteries.

Watt-hour rating, expressed in Watt-hours (Wh), the Watt-hour rating of a lithium cell or battery is calculated by multiplying the rated capacity in ampere-hours by the nominal voltage.

[www.iata.org/contentassets/6fea26dd84d24b26a7a1fd5788561d6e/passenger-lithium-battery.pdf](http://www.iata.org/contentassets/6fea26dd84d24b26a7a1fd5788561d6e/passenger-lithium-battery.pdf)

**Help:** Marie Kirk has IATA, IMDG, DOT (49 CFR) and U.S. Air Force certification (AFMAN 24-604), and can help you with any questions that you might have. However, it is important to stress that Marie cannot certify cargo from your country of origin to Denmark/Greenland, as she needs to be able to physically inspect the cargo.

**Sun glasses**

It is recommended to use sunglasses with UV-protection (Polaroid) to protect eyes from excessive ultraviolet radiation, primarily to avoid snow-blindness, but also to reduce long-term ocular damage such as cataracts. Be careful to wear glasses that also block the sunrays around the edges of the lenses.

Standards for sunglasses – see labelling on inside of the frame

**Europe CE (EN 1836:2005)**

0	insufficient UV protection
1	sufficient UV protection
2	good UV protection
3	full UV protection

**US (ANSI Z80.3-1972)**

A compliant lens should have a UVB (280 to 315nm) transmittance of no more than one per cent and a UVA (315 to 380nm) transmittance of no more than 0.5 times of the visual light transmittance.

**Australia (AS 1067)**

0	some UV protection
1	.
2	.
3	.
4	high level of UV protection

## ***Acute mountain sickness - AMS***

Symptoms/signs of acute mountain sickness:

- Headache
- Fatigue/nausea
- Difficulty in breathing
- Sleep disturbances (insomnia)

Symptoms of AMS usually start 6 to 8 hours after a rapid ascent and reach their greatest severity within 24 hours, subsiding over 72 hours. Rapid ascent, exercise, and continuing to ascent to higher altitudes greatly increases the chances of suffering from AMS and its symptoms.

Best way to reduce risk of AMS is to **avoid excessive alcohol consumption the night before flying into camp** and to keep well hydrated on water.

AMS is rarely serious and is usually self-limiting, but may lead to more serious high altitude cerebral edema or high altitude pulmonary edema.

## ***How to operate the Gamow bag***

The purpose of the Gamow bag is to provide temporary first aid treatment to victims suffering from varying degrees of acute mountain sickness (AMS) on location and on an emergency basis.

1. Place victim inside bag.
2. Pull the zipper close.
3. Pump the foot operated air pump to begin inflation.
4. Check to make sure that the nylon web retaining straps are not twisted and that they are in their proper locations
5. Inflate the Gamow bag to the desired pressure – see below.
6. A pump per minute rate of 10 to 20 must be maintained at all times to ensure adequate victim protection from excessive carbon dioxide concentrations. An electric oil free air-compressor with an output of at least 1 cubic foot per minute (cfm) may be used to pressurize the Gamow bag (use chrome inlet).
7. Do not connect the bag to oxygen.

<b>Ambient conditions</b>			<b>Inside Gamow bag when pressurized to 2 psi (103 mmHg)</b>		
Meters	Feet	mmHg	Meters	Feet	mmHg
2400	7874	562	1054	3458	665
2700	8859	541	1310	4298	645
3000	9843	522	1555	5102	626
3300	10827	503	1805	5922	607

3600

11812

484

2053

6736

588

The Gamow bag should only be used on a temporary or emergency basis. The bag is not intended as a cure for AMS.

Treatment with oxygen greatly outweighs the use of the Gamow bag, but must be maintained at a flow of 6-8 liters per minutes.

### ***How to monitor blood pressure using the Omron electronic monitor***

1. The subject sits down and rests their arm on a table so the brachial artery is level with the heart. Alternatively lie on your back and rest the arm across your stomach. This is important when monitoring blood pressure, as pressure is proportional to height. For example, if one measures the blood pressure at head height, the systolic/diastolic pressure readings will be approximately 35mmHg less compared to readings taken at heart level, whereas at ground height the pressure readings will be 100mmHg greater.
2. Wrap the sphygmomanometer cuff around the upper arm, just above the elbow. Place the tubings on the hollow of your elbow.
3. Press the **ON** button.
4. Press **START**.
5. The blood pressure monitor will automatically measure the blood pressure.
6. **NOTE:** Do not move the arm during monitoring.
7. Monitor displays the systolic blood pressure (the high value) and diastolic blood pressure (the low value) and heart rate.

<b>Blood pressure</b>	<b>Interpretation</b>	<b>Action</b>
SBT>180 mmHg or DBT>110 mmHG	Severe hypertension	Repeat the test; Contact physician
SBT>160 mmHg or DBT>100 mmHG	Moderate hypertension	Repeat the test; Contact physician
SBT>140 mmHg or DBT>90 mmHG	Mild/borderline	
SBT≈120 mmHg and DBT≈80 mmHG	Optimal	
SBT<90 mmHg and DBT<60 mmHG	Hypotension	

SBP= Systolic blood pressure

DBP= Diastolic blood pressure

### How to monitor blood glucose

1. Wash your hands.

2. Prepare your lancing device.
3. Remove the test strip from its foil packet.
4. Insert the three black lines at the end of the test strip into the strip port.
5. Push the test strip in until it stops. The monitor turns on automatically.
6. Wait until the monitor displays the “Apply Blood message”, which tells you that the monitor is ready for you to apply blood to the blood glucose test strip.
7. Use your lancing device to obtain a blood drop either from a finger or an ear lobe.
8. Before you obtain a blood sample from the fingertip or ear lobe, make sure the sample site is clean, dry, and warm. Avoid squeezing the puncture site.
9. Apply the blood sample to the test strip immediately.
10. Touch the blood drop to the white area at the end of the test strip. The blood is drawn into the test strip.
11. If the monitor shuts off before you apply blood to the test strip, remove the test strip from the monitor and try again.
12. Continue to touch the blood drop to the end of the test strip until the monitor begins the test. The monitor begins the test when you hear the beeper and/or the display window shows the status bar.
13. Then the display window shows the countdown. **Note: Do not** remove the test strip from the monitor or disturb the test strip during the countdown.

#### Result of blood glucose monitoring

Blood glucose	Interpretation	Action
LO = low (<1.1 mmol/L or 20 mg/dL)	Extremely low	Repeat the test; Contact physician
<2.8 mmol/L (50 mg/dL)	Moderately low	Repeat the test; Contact physician
4.1-5.9 mmol/L (74-106 mg/dL)	Normal	
>11 mmol/L (200 mg/dL)	Moderately high	Repeat the test; Contact physician
HI = High (>27.8 mmol/L or 500 mf/dL)	Extremely high	Repeat the test; Contact physician

#### Error messages:

Error no 105 or 705: take out batteries, wait five seconds, insert batteries, and try again.

#### Calibration of new test strip lot:

Insert calibration strip into strip port. Wait until the monitor displays the lot number. Check number against packet.