Field season 2018

East GReenland Ice core Project (EGRIP) 2015-2020: Second year of EGRIP deep drilling.

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

Picture 1: Picture from the science trench at EGRIP. May 2017.

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Copenhagen, 200418

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EGRIP 2018 introduction

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 CH2MHill Polar Services and to the New York Air National Guard (109th) for their assistance and their supportive actions in 2017 in anticipation of the upcoming EGRIP field campaign. Without this assistance, little of what is planned for the 2018 season could be realized.

Copenhagen, April 6th, 2018

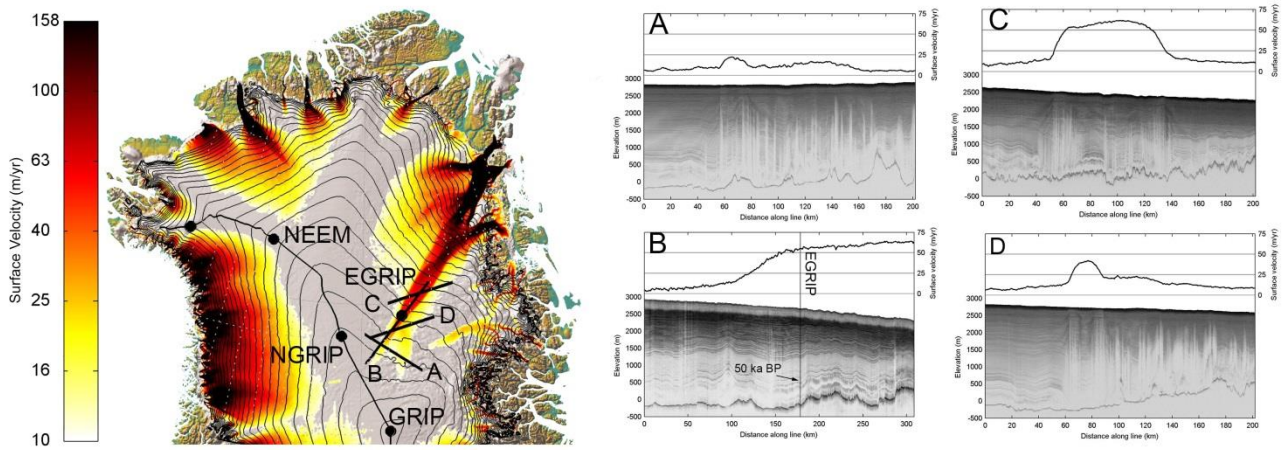
Lars Berg Larsen, Trevor Popp, Dorthe Dahl-Jensen, Marie Kirk and J.P.Steffensen

The East Greenland Ice drilling Project (EGRIP)

EGRIP 2015-2020: Season 2018

Background:

The behavior of the fast flowing ice, ice streams through the Greenland ice sheet, is not well understood. The ice streams discharge ice into the ocean that accounts for half the loss of mass from the Greenland ice sheet and many ice streams have doubled their velocities during the last decade. There is a need to understand the processes of the ice streams before they properly can be included in ice sheet models which will enable predictions of future loss of mass from the ice streams and thus improve estimates of future sea level rise.



Map of Greenland and the North East Greenland Ice Stream (NEGIS). Velocities from RADARSAT synthetic aperture radar data are shown in color (Joughin, Journal of Glaciology, 2010) The deep drill sites and the main ice ridge are marked as well as the profiles (A-D) where radio echo sounding profiles have been recorded by aeroplane and surface velocities have been extracted from the map to the left. (B) Profile from University of Kansas 1999 (19990525_01_09, 19990525_01_10, 1990525_01_16) *showing that the ice thickness at the drill site, EGRIP, is 2550 m and that climatic undisturbed layers are detected to 50.000 years before present. The surface velocity is 51 m/yr at the drill site, EGRIP. (A,C,D) Profile from NASA Operation IceBridge 2013 using the University of Kansas depth penetrating radar across the ice stream clearly showing the margins disturbed by shear deformation (*profiles from 20120404_01_16 to 20120404_01_19 (A); *20130402_01_24 to 20130402_01_27 (C); 20130423_01_3 to 20130423_01_6 (D)) (figure produced by D.Dahl-Jensen)*

In North East Greenland, the largest ice stream in Greenland begins right at the central ice divide and cuts through the ice sheet in a wedge shape to feed into the ocean through three large ice streams (Nioghalvfjerds isstrømmen, Zachariae isbræ and Storstrømmen). The onset of the ice stream on the ice divide is believed to be caused by strong melting at the base and the ice reaches velocities over 100 m/yr 200 km from the ice divide, but still 500 km from the coast where the ice is heavily crevassed. It is possible to find a site without crevasses, where the ice is flowing as an ice stream. Drilling an ice core through the 2550 m of ice reaching to the bedrock would allow us to reach the following goals:

-study the dynamics of the ice flow in an ice stream by ice rheology and deformation studies of the ice core.

-study the dynamics of the ice flow by borehole observations of basal sliding, borehole deformation, and basal water processes.

Besides from the ice dynamic goals the internal radio echos sounding layers traces layers that are more than 50.000 years old. The layers have been traced back to other deep ice cores in Greenland (P.Vallelonga et al.: Preliminary glaciochemical and geophysical study of the Northeast Greenland Ice Stream (NEGIS), Cryosphere). Climatic studies of this period and especially the present interglacial (the last 11.000 years), a period where records of high resolution chemistry and greenhouse gasses are not available from other Greenland ice cores is an important goal for the project:

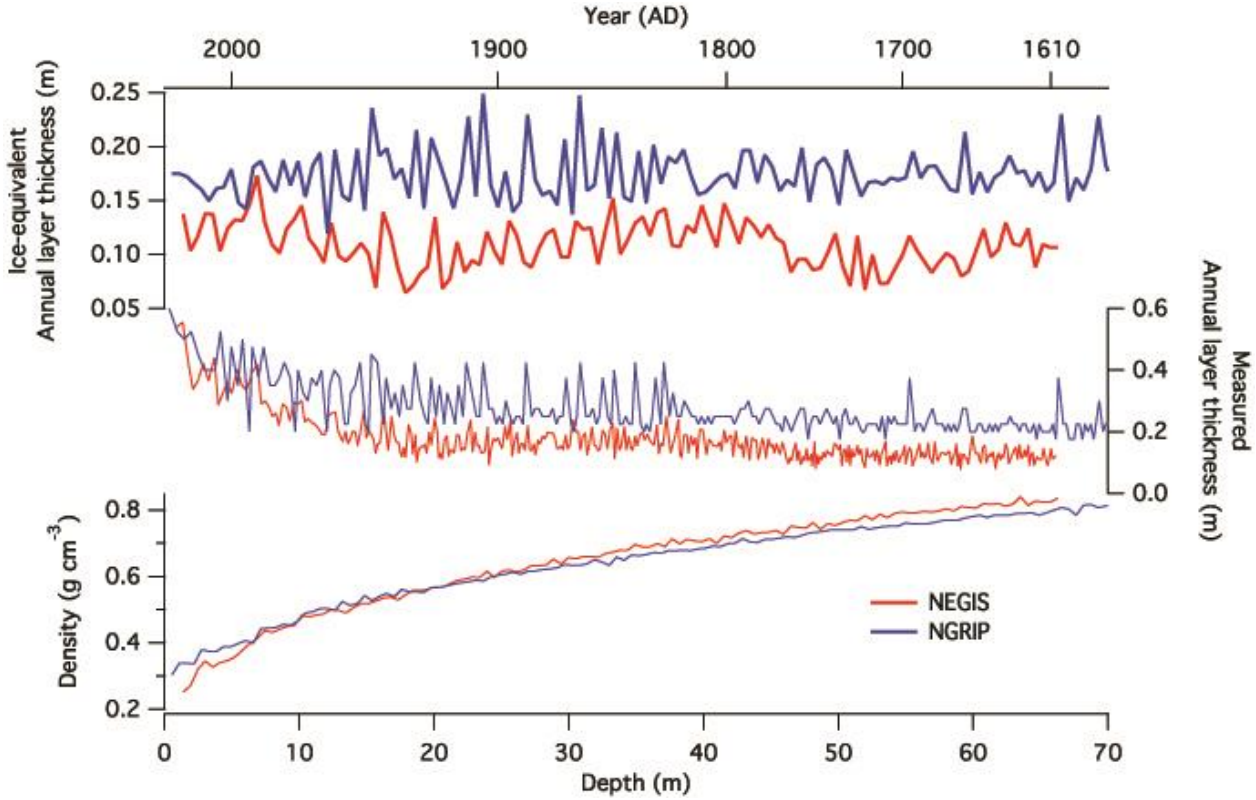
-high resolution climate records of greenhouse gasses, water isotopes and impurities through the last 25.000 years covering the onset of the present interglacial, the climatic optimum 8,000 years ago and the industrial period of the past two hundred years.

In 2012 a 67 m long pilot ice core was drilled in collaboration with researchers from the Alfred Wegener Institute (Germany) and the Penn State University (USA). The ice core properties are well preserved and the site is promising. The AWI ski equipped DC3 (Polar 6) supports the mission.

In 2012 a 67 m long pilot ice core was drilled from the proposed EGRIP drill site (75.6268N 35.9915W). The annual layer thickness is 11 cm and annual cycles are detected in water isotopes, dust and chemical impurities.

In 2012 detailed radio echo sounding and seismic work done by researchers from the Penn. State University. The ice flows 50+ m/yr horizontally to the Northeast at the selected site. The shear margins of the ice stream are observable on the surface but the bedrock topography does not show a trough in which the ice stream flows. The radio echo sounding and seismic measurements show zones with basal water and also zones with less water. Studies of the flow pattern from the internal

layers and from ice stream models could determine if the ice stream has been permanent or if it can switch on and off.



Reconstruction of the annual layer thickness from the 67 m shallow ice core from NEGIS. The accumulation rate is 0.11 m/yr and a significant increase of accumulation in the more recent warmer years is not observed. The results are compared with records from NGRIP. (P.Vallelonga et al, Preliminary glaciochemical and geophysical study of the Northeast Greenland Ice Stream (NEGIS), Cryosphere)

The deep drilling project is planned for the years 2016 to 2020. The project is an international collaboration between several nations. At present, national funding agencies in Denmark, Germany, Japan, Norway and the U.S. have committed themselves to support EGRIP, both financially and logistically. The in-kind support by U.S. NSF, by making ski equipped LC-130 available to the project and by sharing costs for flights and fuel and German in-kind support by ski equipped Basler (DC3) and vehicles is tremendously valuable to the project. At the EGRIP steering committee meeting in Copenhagen in the fall of 2016, Switzerland, France and China became contributing partners and Italy announced participation and there may well be additional partners that would supplement the EGRIP research plan well.

The main part of the equipment needed to establish the EGRIP camp was at the NEEM site. At NEEM in 2015 heavy sleds with cargo were excavated, the two garages were taken down and stowed everything was hauled 460 km by traverse train in May 2015. The main building, the Dome, was put

on skis in 2011 to enable surface transport to the new site. At EGRIP, the dome was parked on the ski, the two garages were built and outfitted, while the rest of the cargo was stored on sledges.

Left: The main dome at its parking position at EGRIP in June 2015.The undercarriage is covered by plywood before snow is packed around the base. Right: Photo from June 9 2015 just before the door is closed and crew leaves camp. Note the snow pack around the base.

In 2016 the EGRIP camp became almost fully equipped, and a trench system consisting of drill trench, science trench, ice core buffer, storage cave, tunnels, ramp and stairwells was constructed using the balloon technique. Drill trench and science trench were partially outfitted and the first 110 m of the deep ice core was drilled.

In 2017, the infrastructure of both science and drill trenches were completed. A freezer unit was installed inside the connecting tunnel between drill trench and core buffer. It was kept at -30 C and served as core logging area. At the end of 2017 season, the drillers reached a depth of 900 m. The top 300 m ice core was processed in the science trench, while the rest was stored in the buffer for de-stressing. The crew managed to keep the cores from the brittle zone (550 m – 900 m) at very high quality. Besides drilling and processing, EGRIP camp also supported surface snow studies, studies of water vapour and aerosols, a firn air sampling program, the Swiss RADIX fast access drill test and some associated programs.

Many of the deep drillings in Greenland have been made as collaborations between Denmark, US and other nations. We have a proud record of very efficient and successful projects. Part of our tradition is to bring science and scientists to the field camp. Many measurements are performed on the fresh ice core in the field camp in a clean environment. At EGRIP we are able to continue staffing in a similar way as NEEM, where 270 individuals spent 12,500 man days in camp with a man day distribution of 52 % young scientists, 26 % senior scientists and only 22 % logistics. Thus the project not only produces a deep ice core, but also provides education for young researchers and enhanced international collaboration.

We believe that the EGRIP project will give unique knowledge of the flow of the very important and unknown ice streams which will lead to improved predictions of sea level rise. The deep ice core drilling should be followed by additional studies of the NEGIS ice stream, and at the moment the research vessel Polarstern from AWI has a program planned in the ocean in front of the ice stream and in 2018 AWI also has an airborne radar campaign planned. Penn. State University research group is planning seismic work on the whole NEGIS ice stream and especially the onset zone of the ice stream in the center of the Greenland ice sheet to understand why the ice stream is here. We will work towards bringing further projects to the NEGIS ice stream and the EGRIP ice camp with infrastructure and airfield for ski planes opens the gateway for additional projects.

Drilling at EGRIP 2018

Summary of the status after 2016 field season:

Much of the 2016 field season was used to transform the freshly blown balloon trench into a working drilling trench with the aim to start deep drilling in earnest in 2017. These activities included 1) surveying, leveling, and construction of the drill trench floor, 2) installing the tower and winch foundation beams, 3) excavating the 7-meter inclined trench, 4) installing the deep winch and motor, 5) installing the tilting tower, 6) building cabins for the workshop, core logging, and chips melting operations, and 7) making the intial installation of the mechanical workshop, core handling system, and drill fluid chips handling infrastructure.

Meanwhile, the main core pilot hole was drilled to 117.5 m with a borehole diameter of 129.6 mm, and the first three of the four required reaming steps were completed through the firn-ice transition in preparation for installing the firn casing.

On the surface, the EGRIP S1 core (4” diameter) was drilled and logged to 60.76 m. The shallow drill was also deployed to make an acces hole to the firn-ice transition in support of the RADIX fast access drill test (J. Schwander, Uni. Bern). Numerous surface shallow cores (ca. 10 m) were collected throughout the season with the hand auger by various teams.

Deep drilling status after 2017 field season:

Access to the drill trench was available immediately upon arrival in camp in late April 2017. Installation of deep drill apparatus was completed, including electrical systems in trench, winch cable termination, chips and fluid handling systems, core handling, and trench outfitting for ventilation, work tables, and drill operation. The final reaming of pilot hole was completed and the casing installed to a depth of 68m below the 2015 surface.


The final reaming and casing installation was conducted using the deep winch and tower apparatus, May, 2017.

Fully operational deep drilling environment, June 2017.

Deep drilling with prototype borehole and surface control electronics with an intermediate length HT drill (2m RECAP Barrels) was eventually achieved after many challenges throughout the 2017 season. A final depth of about 900 m was reached. Final logging depth is yet to be determined, as the brittle ice was left to relax over the winter before logging. High borehole inclination observed via periodic measurements with the UCPH borehole logger led to the development of a procedure to steer the drill in the borehole with side force provided by a spring mounted on the outer core barrel and downhole orientation information.

Ice core from the brittle zone, with orientation mark on core, and side force spring mounted on outer core barrel, July, 2017.

2017 status in brief:

- Trench infrastructure and electrical systems OK
- Reached ca. 900 m (300+ m brittle ice remaining)
- Prototype electronics were stable by the end of the season, plan in place and being executed to improve performance 2018 (including core orientation)
- Core handling system in cold Viesmann OK. Brittle ice quality was generally good (improved over NEEM)
  Trouble with core breaks led to additional poor core quality at times
- Chips/liquid handling acceptable. Procedures established for chips melting for fluid recycling
  Secondary refreezing step after melting required for complete fluid/water separation when using ESTISOL240/COASOL
- Will need to improve production rate for 2018
  Longer cores in ductile ice
  Stable downhole electronics performance

Deep drilling operational plan for 2018:

200-400 meters of brittle ice remain to be drilled in 2018. Drilling will proceed using intermediate length HT drill barrels (2m core length) until it is determined that ductile ice has again been reached. The drill will then be reconfigured with core barrels for retrieving 3.5 m cores, exactly as was done for the majority of both the NGRIP and NEEM drillings. Additionally, several new or resigned borehole tools will be tested (eg. Borehole filters, downhole cable cutter, borehole deviation melt head.)

Brief operations summary:

- Opening phase (2-3 weeks)
  - Prepare for extended tower and long drill installation: cut into roof, expand inclined trench, expand core barrel pull-out system, reconfigure tower for long drill (3.5 m core length), and reconfigure core handling set-up for long cores.
  - Re-tension 4-km cable spool on deep winch

- Continue deep drilling with 2-m core barrels through declared end of brittle ice
- Install long drill (3.5 m cores) for ductile ice drilling
- 6-person overall deep drill team throughout the season
    - Two shifts
    - Crew to include team leader, mechanical specialist, and electrical specialist
- Surface drilling support
    - HT drill (4" core) and shallow winch for Firn-Gas sampling project (June)
    - Shallow drill (3" core) and shallow winch for numerous SC shallow core requests (as available)

Short summary of drill preparation for 2018:

EGRIP long drill

For ice below the brittle zone, an EGRIP drill will be constructed to accommodate 3.6 m core barrels and a 4 m chip chamber. The chip chamber will be constructed by removing ca. 2 m from the 6 m chip chamber that used for the NEEM drilling. The reduced chip chamber volume necessary for the EGRIP drilling, is a consequence of the extra volume in the NEEM design which was to accommodate 4 m cores and a bore hole diameter up to 134 mm. At least two new core barrels (3.6 m) are being constructed and three existing core barrels (3.6 m) are being refurbished.

Drill electronic development

Efforts are being made to improve the borehole electronics and drill motor control based on the experience of the 2017 season. Among the main improvements are 1) temperature control for stabilizing motor control function and power line communications, 2) redesign of the main motor controller, improved motor control functions, and integrated surface control software, 3) additional power downhole from mounting two 400 V DC-DC power converters in parallel, 4) improved pressure and temperature sensor function and mounting, and 5) improved plug and cable connections.

Drill and other borehole tools to be tested/deployed:

- 3-D printed hollow shaft booster design will continue to be used
- Hollow shaft pumps will be available if required for chips transport with long drill
- Improved and expanded borehole filter design
- Mounting tools for pressure tube and anti-torque sections improved
- Down hole cable cutter has been identified and will be tested: to deploy in the case of irretrievable stuck drill to rescue borehole, retrieve unspooled cable, and allow replicate drilling to proceed.
- Heated melt head to be tested for its potential to use for replicate drilling

Surface Drilling 2018:

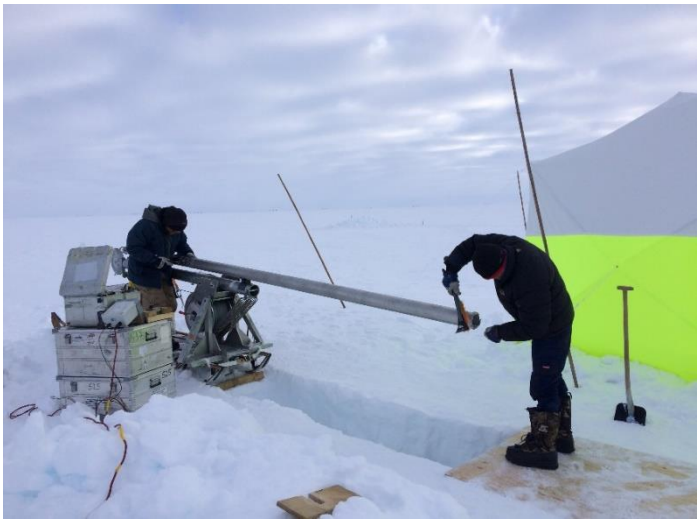
The Danish shallow drill, first deployed in 1976 (with Steffen Bo Hansen and Sigfus Johnsen), will enter its 42nd year of service at EGRIP in 2018.

1) Firn air sampling program drill support

A firn air sampling program will be supported using the HT drill (1.6 m core barrel; 4" core; 129.6 mm borehole) during the period ca. June 7 - 29. This activity will be coupled to a manning plan intended to provide training/drill school for setting up and operating the shallow and intermediate winch with the HT drill.

2) Shallow drilling

We will support as much surface shallow drilling as is reasonable in the second half of the field season, using with the 3" shallow drill and shallow winch. We will provide some training for new operators, and all surface drilling will be manned separately from the deep drilling operations. The drill leader on site will support both deep and surface drilling operations.



The HT drill mounted on the shallow winch and tower at EGRIP 2016.

Scientific plan for EGRIP 2018

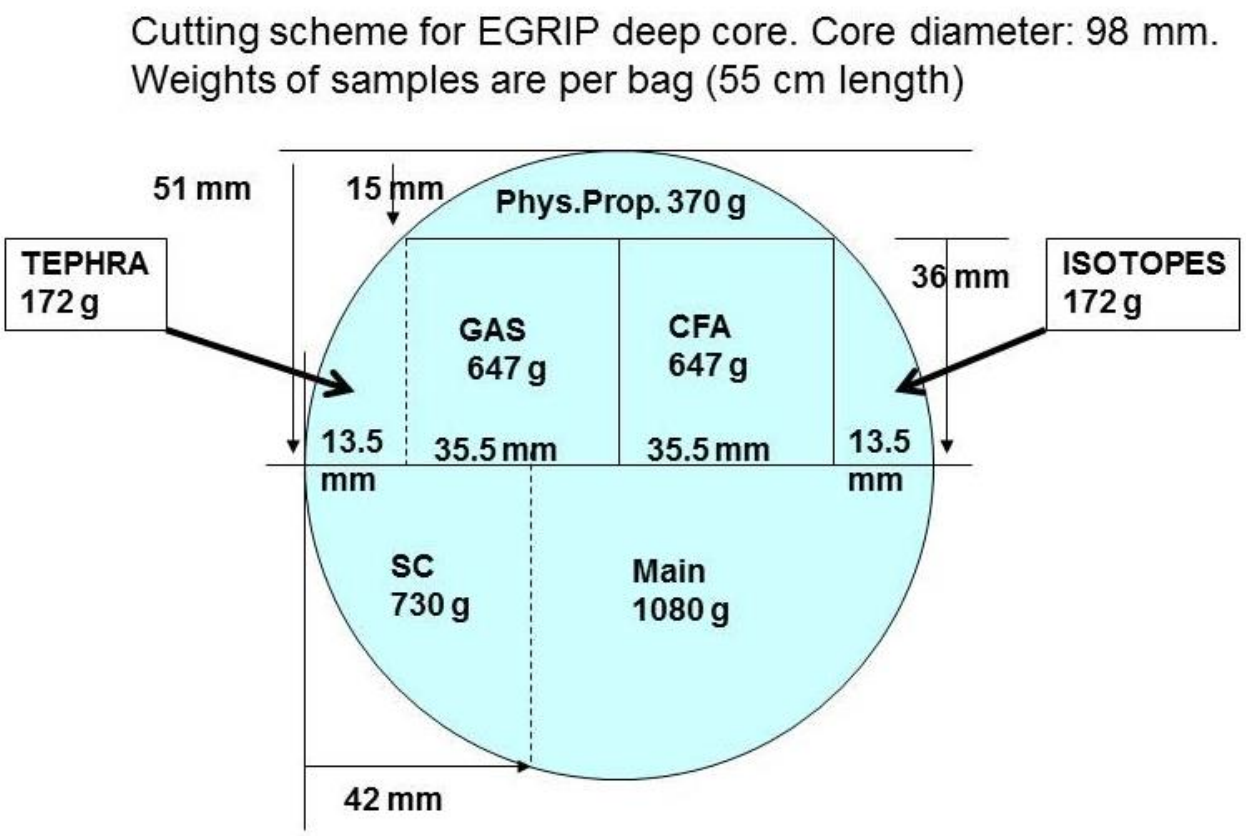
For the processing line, the focus will be on getting the line into production as soon as possible in order to maintain buffer capacity for cores drilled in 2018. In the core buffer rests 2017 ice ready for processing down to 679.24 m. The 2017 ice from the brittle zone (679.24 m to 893.18m (drillers depth)) is also stored in the buffer, but this has to be logged and made ready for processing. Loggers will work in parallel with processers and free up space for new brittle zone cores drilled in 2018. The drillers will most likely leave the brittle zone at 1250 m depth. If timed correctly, the processors will have freed up enough buffer capacity that the drillers can continue beyond 1250m. After allowing for 3 weeks for de-stressing, we believe that the 2018 brittle core (900m-1250m) can be logged without damaging it. After logging, this core is returned to the buffer to await processing in 2019. All cores below 1250 m depth will be logged and processed in 2018.

The CFA team will work independently of the processing line. The goal of the CFA team is to measure as much ice as possible in 2018, skipping the 800 m – 1250 m brittle zone. This means, that the CFA team will return to EGRIP in 2019 for measurement of the remaining brittle ice and deepest ice. The CFA analyses will be done on one side wedge of the CFA slab for isotopes while one wedge for tephra will be cut and packed separately discrete continuous screening. The CFA team has its own warm lab. in the science trench. The impurity and gas CFA will be done in Europe.

Details on science and processing plan.

The following studies and analyses are planned:

Logging and documentation:
All freshly drilled ice cores will be fitted to previous runs and core quality and integrity documented. Core depth and bag numbers will be assigned. Logging and documentation is done inside an active freezer unit installed in the logging tunnel.



Di-electric properties measurements (DEP). This integrated AWI system records di-electric properties on the full and uncut core.

Cutting of sample sections (Horizontal band saw, or Swiss saw). Two cuts along the core axis will split the core in three for later processing.

Electrical Conductivity Measurements (ECM). After the first cut in the horizontal saw, the core will be mounted in the Danish ECM setup for DC conductivity measurements. Afterwards, the core will be returned to the horizontal saw for cutting the central slab.

Line Scanning. The 36 mm thick central slab will be polished on both sides with a microtome knife and the scanned in the AWI line scanner.

Cutting of isotope and tephra samples. The wedges for stable isotopes and tephra will be cut at band saws and stored in a buffer before measurement in the field.

Measurements of physical properties. Samples for measurements of physical properties will be packed; but for those analyses that require fresh ice, systems will be set up in the science trench and in a designated warm lab. inside the science trench.

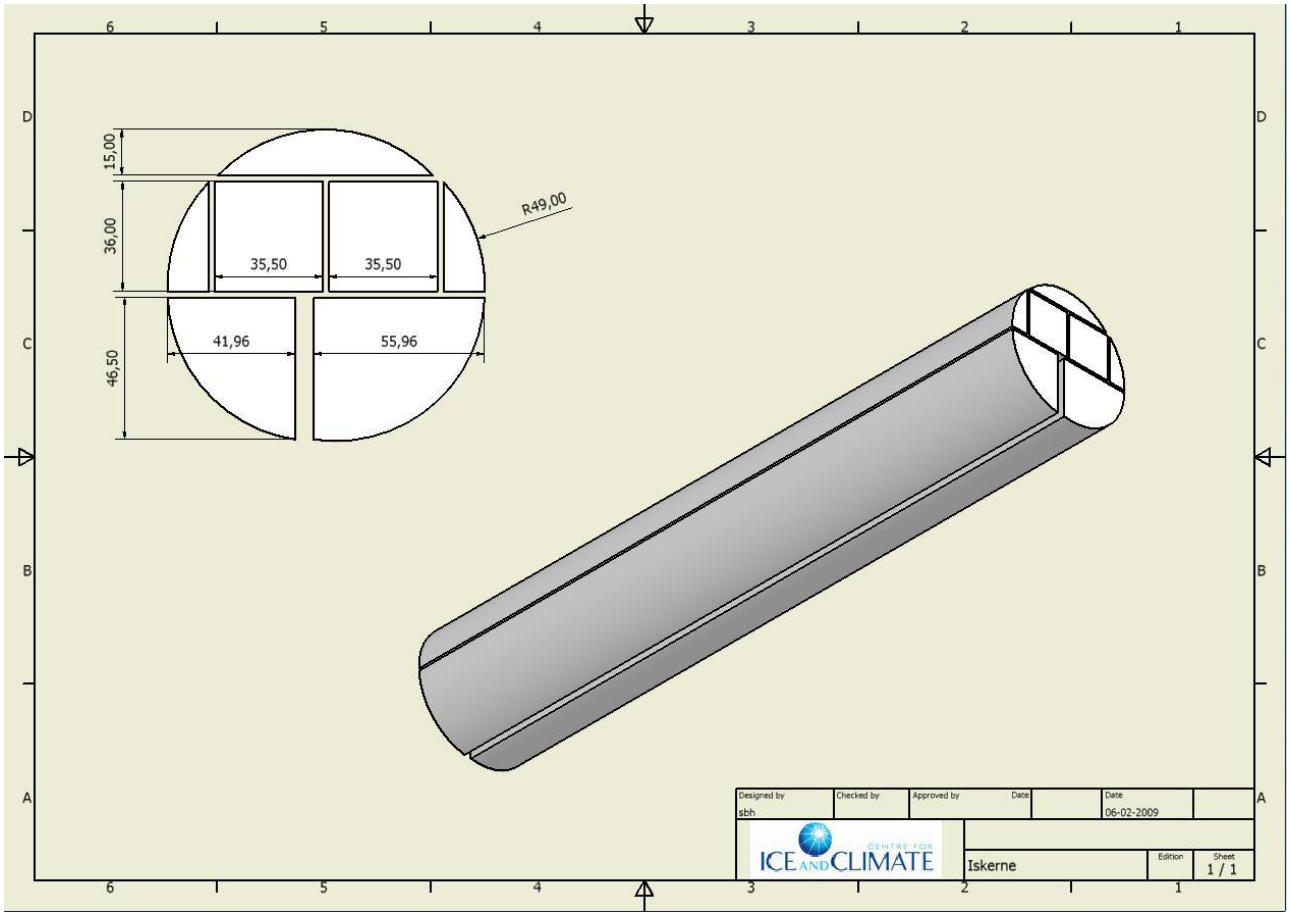
Continuous Flow Analysis (Gas and CFA). The Gas and CFA sections will not be split in the field. The section will be packed and sent to Europe.

Cutting of SC sections. The SC section will not be split from the main core piece in the field.

Ice core packing. All of core sections for Europe will be packed in crates and sent to Copenhagen.

The first few weeks will be spent activating all stations of the processing line. Some work on the core logging freezer is needed to activate the cooling system and some work is needed to adjust and repair the horizontal bandsaw. In the science trench, benches for DEP, Swiss saw, ECM and line scanning as well as tables for cutting and packing samples will have to be adjusted. The two warm labs. (Viessmann cabins) for physical properties and isotope CFA will be outfitted again. The science team will work on establishing an ice core processing routine and work flow that minimizes the risk for errors and maximizes the processing rate.

Processors will follow a detailed ice core cutting, processing and sampling plan that has been made to comply with EGRIP Steering Committee decisions.



Surface movement by GPS (Christine Hvidberg, Lars B. Larsen, Aslak Grinsted).

Surface velocity and strain rates will be measured by GPS in 2018 at EGRIP. The purpose is to provide 6 year long records 2015-2020 of surface movement at EGRIP and along NEGIS to validate satellite observations and reveal spatial and temporal variations of flow speed and elevation.
In 2015, a strain net of 17 GPS poles were established at EGRIP and their 3D positions were measured (latitude, longitude, height). These poles were re-measured in 2017 and will be measured again in 2018. See figure. A permanent GPS pole was established in 2015 at EGRIP. The station is planned as

part of a survey along the NEGIS ice stream from the ice divide to the coast done in collaboration with DTU-Space, and the station will be monitored continuously. The station will be maintained and checked in 2018. More permanent poles were established in 2016, both upstream and downstream from EGRIP. Additional detailed surveys of surface movement are planned in 2018 in particular regions near EGRIP using a combination of surface GPS and drones.

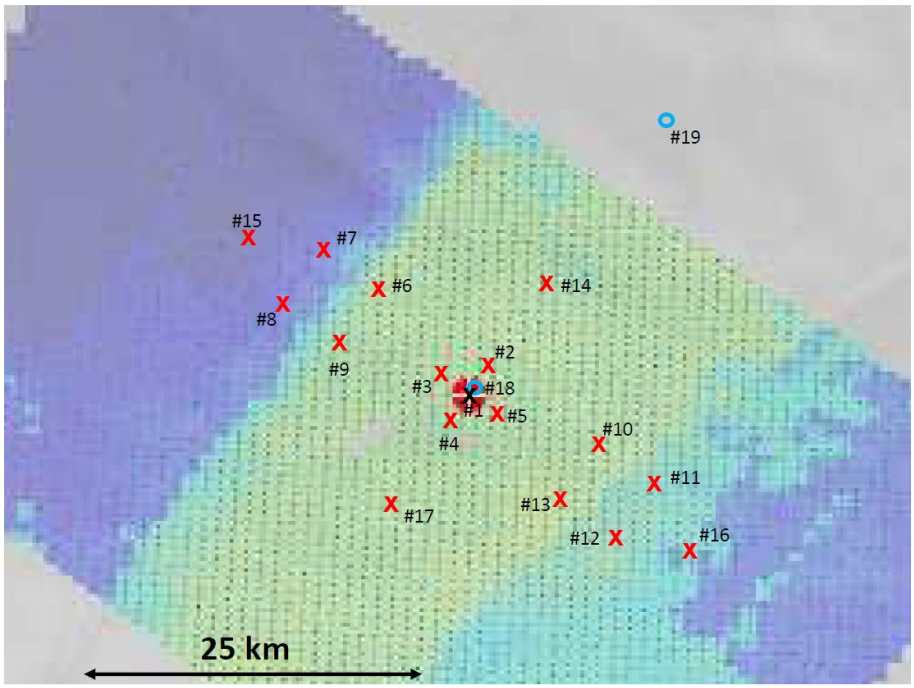


Figure: Map of the strain net at EGRIP showing the 17 poles established in 2015 (red crosses) and the two permanent GPS stations (blue circles). Only the permanent station close to the EGRIP camp as established in 2015. The EGRIP camp is indicated by the black cross. The background shows surface velocity derived from an optical IV method (Imgraft/Grinsted).

Airborne radar measurements at EGRIP and in NE Greenland (Daniel Steinhage, Olaf Eisen and Tobias Binder, AWI).

The planned radar campaign using EGRIP camp as base for operations for the AWI Basler (DC3) carrying German radar and survey equipment is planned for 1. May – 16 May 2018. In preparation, EGRIP in collaboration with AWI has placed a fuel depot at EGRIP of 28,800 liter for operations in 2018.

EGRIP surface processes program

Main responsible: Hans Christian Steen-Larsen (hanschr@gfy.ku.dk), Sepp Kipfstuhl (Sepp.Kipfstuhl@awi.de), and Thomas Blunier (blunier@nbi.ku.dk)

<u>Snow-air water vapor exchange</u>

Purpose:

To characterize and parameterize the water vapor isotopic exchange between the snow pack and the atmosphere in order to understand the post-depositional processes affecting the snowpack water isotopic composition

Measurements:

Continuous water vapor isotope measurements at multiple levels
Eddy-covariance
PROMICE weather station including atmospheric temperature, wind, and humidity, snow surface temperature, snow pack temperature, snow height variations, incoming and outgoing radiation. See http://www.geus.dk/DK/publications/geol-survey-dk-gl-bull/33/Documents/nr33_p69-72.pdf
Surface sampling along 1000 m transect multiple times daily, for isotopic analysis. The top 30 cm will be sampled in high resolution.

Snow surface and snow pack properties

Purpose:

To characterize and parameterize the post-depositional processes influencing the structure and spatial variability in the snow surface and snow pack properties

Measurements:

Specific Surface Area of top 2.5 cm along a 100-300 m transect daily.
A specific experiment with 'painted' water will be carried out in the top 2 meters of the snow pack to characterize the snow-pack isotope post-depositional processes.

Accumulation and precipitation isotope studies

Purpose:

To establish a dataset to be used for benchmarking of regional and general circulation model in the area around EGRIP

Measurements:

Bamboo stake 'forest' will be measured daily to constrain accumulation and sublimation rates.
Snow height lasers will be installed scanning surface structures variability.
Low cost sonic snow height rangers will be validated against the bamboo stake 'forest' and left year round to measure accumulation rate.
Go-Pro cameras will take pictures of sky and snow surface structures. '
Precipitation samples will be collected on tables lifted above the snow surface on event and sub-event resolution for sub-sequent isotopic analysis.

Interstitial-atmosphere air exchange

Purpose:

To characterize and parameterize the synoptic caused wind pumping and its influence on the mixing of the interstitial air in the top meters of the snow pack

Measurements:

Continuous CH4 atmospheric measurements at several levels above the snow pack as well as in-situ interstitial air measurements at several depths in the snow pack.

Remote sensing satellite radiation validation and characterization

Purpose:

To characterize and validate the Sentinel-3 radiation observations of the snow near the EastGRIP camp. The characterization will also consist of sub-grid variability observations.

Measurements:

Combined black carbon, SSA, radiation measurements, and snow structure (SSA and Density) measurements of the snow surface at multiple sites upwind and downwind of camp. Each site will consists of 20 cm profiles.

Remote sensing of the atmospheric boundary layer structure

Purpose:

To quantify the structure of the atmospheric boundary layer above the EastGRIP region and to produce a dataset, which can be used to benchmark regional climate simulations.

Measurements:

Vertical atmospheric temperature profiler, ceilometer, Parsivel2 drop size disdrometer (measuring precipitation type, phase, and spectra of fall velocity and size) and a Metek Micro Rain Radar (vertically pointing precipitation radar with up to 3000m range and 32 range bins).

Sampling of water vapour isotopes with drone.

During the season it is planned to have regular launches with a drone to collect water vapour in the boundary layer up to a height of 1 km. This project is done in collaboration with Bruce Vaughn from INSTAAR in Boulder Colorado.

Studies of recent precipitation by shallow cores in snow pits and aerosol sampling (Japanese and Danish scientists).

This study will be conducted throughout the field campaign at EGRIP.

Drilling with RADIX drill.

RADIX Drilling in IceFlow Project 2018

The RADIX system: Design and construction of a prototype of a fast-access ice drilling equipment (RADIX) for prospecting a potential drilling site in Antarctica for the “Oldest Ice Project” has been started in 2012 at the University of Bern. The aim is to develop a system using minimal resources and logistics support. After the prototyping phase, the final goal will be to drill several holes at potential deep drilling sites to or near to bedrock. The holes will be used for temperature and other downhole measurements. The drilled ice chips and/or core samples from specific depths will be analysed with the main goal to determine the age of the ice near the bottom and to assure the integrity of the ice core record in order to determine the site for the main deep drilling. The RADIX drill is hydraulically powered and designed to drill in a continuous mode a 20 mm hole at a penetration rate of 10 mm/s.

Previous tests: After an initial feasibility test on an Alpine Glacier we made further tests in 2015 on Renland and 2016 and 2018 at East GRIP. These tests included the evaluation of suitable firn hole casing and its tight connection at the base, tuning the fluid recycling system, and implementing a new fast access 40 mm firn drill. A first drilling of 15 m below the casing at nominal penetration rate was done in 2017.

Planned drilling at IceFlow site in 2018: A full scale drilling to a maximum depth of 3000 m is planned at 75.7438N 36.8621W, which is approx.. 30 km NW of the EGRIP deep drilling site at the margin of the North-East Greenland Ice Stream (NEGIS). Cuttings are continuously flushed to surface, separated from drilling fluid by a vibrating screen and a screw compactor, and collected for further analysis. After drilling a micro-logger will be deployed into the fluid filled hole measuring inclination, azimuth, temperature, and dust concentration in the surrounding ice.

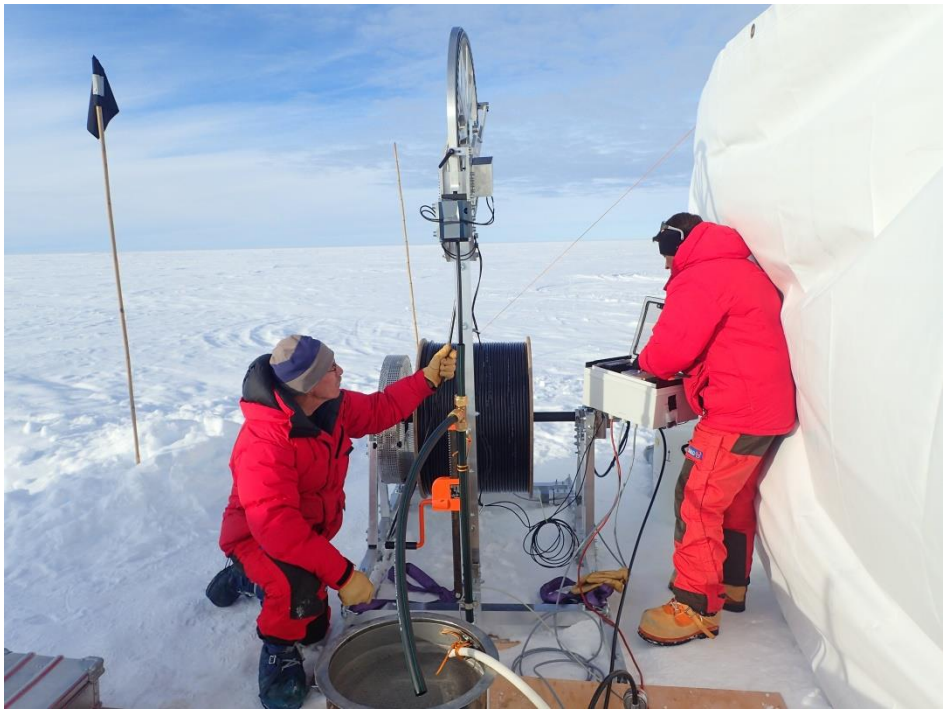


Fig. 11 RADIX test site at EGRIP

University of Alabama "Mills Cross" radar test

Four people from the University of Alabama will test an new prototype ice deep sounder in the EGRIP area for two week in August.

Associated projects at EGRIP:

Earthquake station at EGRIP (Trine Dahl-Jensen and Tine B. Larsen, GEUS)
Starting in 2000, the seismological groups at KMS and GEUS – now all at GEUS – have placed earthquake seismic stations at over 20 sites in Greenland, both on the coast and on the ice sheet. We record globally occurring earthquakes, and use the data to investigate the local structure beneath and between the stations. A station was placed placed at EGRIP in a garage tent in 2015, and in 2016 the station was moved to the newly constructed core buffer trench. The station is solar/battery powered and collects data onto a memory chip. Once a year the memory chip is exchanged and the station is maintained.

PARCA AWS station system maintenance (Koni Steffen, ETH Zürich, CIRES Colorado)
During the annual maintenance of the Automated Weather Stations in N-Greenland, the EGRIP camp will be re-fuelling station and base for the PARCA team for several days in May. PARCA uses a Twin Otter air craft.

Remote sensing reference station at EGRIP (Waleed Abdalati, CIRES Colorado).
This group visited EGRIP last year and maintained surface equipment 1 km SE of EGRIP. The equipment measures surface snow properties with the aim to obtain ground truth readings for satellite observations. This year they will visit EGRIP again, but only for a few hours.

GLISN seismic network. (The GLISN project)
The GLISN network operates several permanent seismic stations on the Greenland ice sheet, e.g. at Summit and at the NEEM site. During the annual maintenance of the sites, the team will use EGRIP as a re-fuelling and over-night stop in June.

Windsled team (Danish representative: Prof. Jason Box, GEUS)
A Spanish team stored its equipment at EGRIP in 2017. In the beginning of 2018 season, this equipment will be returned to Kangerlussuaq.

Logistic plan for EGRIP 2018

The logistic plan for 2018 is to maintain the infrastructure of the drill trench and science trench and the actively cooled core extraction facility that protect the ice cores from the brittle zone from temperature shock as they are retrieved. We expect the main generator to be in fine shape as it was overhauled in 2017. The satellite dish from 2016 and 2017 will be supplied with an upgraded communications package. After tests in 2017, the polar bear Doppler radar will be active in 2018. This radar is capable of detecting movement in a 4 km radius of camp. EGRIP have a LIDAR to measure cloud base in 2018 to improve weather reporting and reduce the risk of aborted flights. One balloon trench project is planned: Building a balloon trench garage for heavy equipment. At entrances and in tunnels, doors and curtains will be installed to maintain low temperatures in the trenches.

The overall logistical goal is keep a fully operational deep drilling camp with ice core storage facilities, science trench, drill trench, workshops, warm laboratories and housing for 35 people running.

To accomplish the overall goals, the campaign can be broken down into the following steps:

1. Open and re-activate EGRIP camp and skiway. Skiway markers will be set back in line and a test of using the Pistenbully snow blower to harden the skiway surface will be carried out.
2. Hosting the 2018 AWI Basler radar campaign for more than two weeks.
3. Reopening of all entrances to the trenches and making necessary adjustments.
4. Re-activating infrastructure in drill trench, science trench and the core extraction freezer.
5. With full manning, drill and process and measure core from 300 m to 900 m and from 1250 m and below (2018 brittle core from 900m to 1250m will be logged only).
6. Support a firn air pumping campaign.
7. Support RADIX project.
8. Support Univ. of Alabama “Mills’ Cross” radar testing.
9. Building an overwintering garage with balloon technique.

10. Facilitate the return to Kangerlussuaq of the equipment of the wind sled team.
11. Once the brittle ice from 2018 (900m – 1250m) is reached, processing of deep core will skip this and this section will be logged only and stored in the buffer.
12. Support the PARCA program.
13. Support several visits from Distinguished Visitors.
14. Support media and special events people.
15. Support 25 students from the Joint Committee Student Exchange Program (JSEP).
16. Support surface snow, water vapour and aerosol sampling throughout the season.
17. Support surface ice dynamics measurements, e.g GPS strain net.
18. Support the Abdalati project and GLISN seismic project.

2018 calendar overview.

19/04/2018	Thursday		Period 1. FOM's arrive. Setup radio, comm. Register vehicles.
27/04/2018	Friday		Mission 1. EGRIP put-in. Camp opening.
30/04/2018	Monday		Mission 2. 2nd put-in
01/05/2018	Tuesday		Mission 2a. Basler operations begin
10/05/2018	Thursday		2 x T.O. with visitors from west coast
14/05/2018	Monday		Period 2. Basler operations end?
16/05/2018	Wednesday		Mission 3a. PARCA + GLISN fuel
21/05/2018	Monday		PARCA Begins
22/05/2018	Tuesday		Mission 3. Drill fluid, equipment
28/05/2018	Monday		Memorial Day PARCA ends.
31/05/2018	Thursday		Abdalathi group ?
01/06/2018	Friday		Period 3
07/06/2018	Thursday		Mission 4.
09/06/2018	Saturday		Mission 4a. Placeholder
10/06/2018	Sunday		GLISN visit
20/06/2018	Wednesday		Period 4.
25/06/2018	Monday		Mission 5a crew exchange. TV and press begin
29/06/2018	Friday		Mission 5. crew exchange. TV and press end
13/07/2018	Friday		Period 5
16/07/2018	Monday		Mission 6c JSEP in
18/07/2018	Wednesday		Mission 6b JSEP out
20/07/2018	Friday		Mission 6a DV visit begin
22/07/2018	Sunday		Mission 6. DV visit end.
07/08/2018	Tuesday		Period 6
09/08/2018	Thursday		Mission 7. First pull-out.
11/08/2018	Saturday		Glisn?
20/08/2018	Monday		Running of Musk Ox
22/08/2018	Wednesday		Period 7
25/08/2018	Saturday		Mission 8. Final pull-out
26/08/2018	Sunday		Row club dinner
31/08/2018	Friday		FOMs leave Kangerlussuaq

EGRIP Manning 2018 (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.

EGRIP 2018 Manning plan, 30.Apr 2018						
Sorted by name	Name	Country	Latest arrival to SFJ	To EGRIP	From EGRIP	Earliest departure from SFJ
COOK	Amtoft Christensen, Kevin	DK	06-jun	07-jun	29-jun	01-jul
Driller	Ashurst, Daniel	UK	21-jul	22-jul	09-aug	11-aug
FOM	Bang-Christensen, Tina	DK	09-maj			28-maj
Phys.prop.	Bayer, Madalena	D	06-jun	07-jun	29-jun	01-jul
Surface (vapour and snow)	Behrens, Melanie	D	24-jun	25-jun	20-jul	22-jul
Tephra	Berben, Sarah	N	19-jul	20-jul	09-aug	11-aug
Associated (AWI radar)	Binder, Tobias (AWI Basler)	D	29-apr	29-apr	16-maj	18-maj
FOM	Blunier, Thomas	DK/CH	09-maj			30-maj
Firn Air	Blunier, Thomas	DK/CH	06-jun	07-jun	29-jun	01-jul
Drill Mechanic	Bo Hansen, Steffen	DK	15-maj	16-maj	07-jun	09-jun
Drill Mechanic	Bo Hansen, Steffen	DK	28-jun	29-jun	22-jul	24-jul
Surface (GPS strain)	Born, Andreas	N	21-jul	22-jul	09-aug	11-aug
processing + logging	Buchardt, Susanne Lilja (logging)	DK	19-jul	20-jul	09-aug	11-aug
COOK	Bugge Nielsen, Frederik	DK	28-jun	29-jun	25-aug	27-aug
processing + logging	Capron, Emilie (logging)	F	06-jun	07-jun	29-jun	01-jul
processing+packing	Christensen, Jens Hesselbjerg	DK	28-jun	29-jun	22-jul	24-jul
Associated (AWI radar)	Clark, Stewart (AWI Basler-crew)	CAN	29-apr	29-apr	17-maj	19-maj
Tephra	Cook, Eliza	DK/UK	15-maj	16-maj	25-jun	27-jun
RADIX TEAM	Dahl-Jensen, Dorthe	DK	24-jun	25-jun	20-jul	20-jul
FIELD LEADER	Dahl-Jensen, Dorthe	DK	20-jul	20-jul	25-aug	27-aug
Tephra	Davies, Siwan	UK	24-jun	25-jun	20-jul	22-jul
Field Assistant	de Fleurian, Basile	N	26-apr	27-apr	22-maj	24-maj
processing + scan ECM	della Lunga, Damiano	D	21-maj	22-maj	29-jun	01-jul
Field Assistant	Ditlevsen, Peter	DK	21-jul	22-jul	09-aug	11-aug
processing+packing	Du, Zhiheng	CHN	21-maj	22-maj	07-jun	09-jun
Drill Mechanic	Duphil, Romain	F	06-jun	07-jun	29-jun	01-jul
Phys.prop.	Eichler, Jan	D	21-maj	22-maj	29-jun	01-jul
processing+ Swiss saw	Erhardt, Tobias	CH	21-maj	22-maj	25-jun	27-jun
Doctor	Eriksen, Lasse	DK	28-jun	29-jun	22-jul	24-jul
Surface (vapour and snow)	Faber, Anne-Katrine	DK/N	19-jul	20-jul	09-aug	11-aug
processing + scan ECM	Faria, Sergio Henrique	J	21-jul	22-jul	09-aug	11-aug

Doctor	Florian, Hans Chr.	GRL	26-apr	27-apr	16-maj	18-maj
Firn Air	Fourteau, Kévin	F	06-jun	07-jun	29-jun	01-jul
Firn Air	Freitag, Johannes (driller)	D	06-jun	07-jun	25-jun	27-jun
Driller	Furusaki, Atsushi	J	21-jul	22-jul	09-aug	11-aug
processing + DEP	Gkinis, Vasileios	GR/DK	24-jun	25-jun	20-jul	22-jul
Surface (GPS strain)	Grindsted, Aslak	DK	21-jul	22-jul	09-aug	11-aug
Phys.prop.	Götz, Pia	D	28-jun	29-jun	22-jul	24-jul
Doctor	Hackmann-Nielsen, Erik	DK	06-jun	07-jun	29-jun	01-jul
COOK	Harvey, Sarah	US	26-apr	27-apr	07-jun	09-jun
Drill Mechanic	Hedegaard, Thomas	DK	30-apr	01-maj	22-maj	24-maj
Doctor	Helms, Lydia V.	GRL	15-maj	16-maj	07-jun	09-jun
FOM	Hillerup, Jens Christian	DK	17-apr			27-apr
IT and comms	Hillerup, Jens Christian	DK	27-apr	27-apr	22-maj	24-maj
IT and comms	Hillerup, Jens Christian	DK	21-jul	22-jul	09-aug	11-aug
MECHANIC	Hilmarsson, Sverrir Æ.	IS	26-apr	27-apr	22-maj	24-maj
MECHANIC	Hilmarsson, Sverrir Æ.	IS	21-jul	22-jul	25-aug	27-aug
Chief scientist	Hvidberg, Christine (Chief sci.)	DK	28-jun	29-jun	20-jul	22-jul
Driller	Hüther, Matthias	D	06-jun	07-jun	29-jun	01-jul
MECHANIC	Jacobs, Chris	UK	06-jun	07-jun	22-jul	24-jul
Phys.prop.	Jansen, Daniela	D	17-maj	18-maj	07-jun	09-jun
Associated (AWI radar)	Jansen, Daniela (AWI Basler)	D	29-apr	30-apr	18-maj	18-maj
electronics	Jensen, Bent Neumann	DK	15-maj	16-maj	07-jun	09-jun
Driller	Jensen, Camilla Marie	CH/DK	06-jun	07-jun	29-jun	01-jul
CFA isotopes	Jensen, Mari Fjalstad	N	24-jun	25-jun	22-jul	24-jul
CFA isotopes	Jones, Tyler	US	21-jul	22-jul	09-aug	11-aug
DV and Media	JSEP (25 people)	US/DK/GRL	15-jul	16-jul	18-jul	20-jul
electronics	Justesen, Jan Thomas	DK	24-jun	25-jun	09-aug	11-aug
Associated (AWI radar)	Kandora, Lucas (AWI Basler)	D	29-apr	30-apr	16-maj	18-maj
Chief scientist	Kipfstuhl, Sepp (Chief sci.)	D	26-apr	27-apr	07-jun	09-jun
FOM	Kirk, Marie	DK	20-apr			11-maj
FOM	Kirk, Marie	DK	30-maj			07-jul
Field Assistant	Kirk, Marie	DK	08-aug	09-aug	25-aug	25-aug
FOM	Kirk, Marie	DK	25-aug			28-aug
processing + logging	Kjær, Helle (logging)	DK	24-jun	25-jun	20-jul	22-jul
FOM	Koldtoft, Iben	DK	14-jul			15-aug
Phys.prop.	Kuiper, Ernst-Jan	D	06-jun	07-jun	22-jul	24-jul
Surface (top firn)	Lee, Khanghyun	KOR	21-jul	22-jul	25-aug	27-aug
processing+packing	Li, Chuanjin	CHN	21-jul	22-jul	09-aug	11-aug
processing + DEP	Lund, Kasper Holst	DK	19-jul	20-jul	25-aug	27-aug
processing+ Swiss saw	Løkkegaard, Anja	DK	24-jun	25-jun	20-jul	22-jul
Associated (AWI radar)	Marshall, John (AWI Basler-crew)	CAN	29-apr	29-apr	17-maj	19-maj
Surface (satellite)	Matoba, Sumito	J	28-jun	29-jun	20-jul	22-jul
Driller	Miyahara, Morihiro	J	06-jun	07-jun	29-jun	01-jul
processing + DEP	Mojtabavi, Hamid	D	21-maj	22-maj	29-jun	01-jul

Doctor	Molzen, Line	DK	19-jul	20-jul	09-aug	11-aug
CFA isotopes	Morris, Valerie (1st July)	US	15-maj	16-maj	29-jun	01-jul
Associated (AWI radar)	Murtsell, Garry (AWI Basler-crew)	CAN	29-apr	29-apr	17-maj	19-maj
Driller	Nielsen, Karl Emil	DK	26-apr	27-apr	16-maj	18-maj
Driller	Nielsen, Karl Emil	DK	24-jun	25-jun	09-aug	11-aug
processing+packing	Nisancioglu, Kerim	N	06-jun	07-jun	29-jun	01-jul
Surface (satellite)	Niwano, Masashi	J	28-jun	29-jun	20-jul	22-jul
Associated (PARCA)	nn (PARCA)	E	20-maj	21-maj	28-maj	30-maj
Associated (PARCA)	nn (PARCA)	E	20-maj	21-maj	28-maj	30-maj
Associated (PARCA)	nn (PARCA)	GRL	20-maj	21-maj	28-maj	30-maj
Associated (PARCA)	nn (PARCA)	US	20-maj	21-maj	28-maj	30-maj
DV and Media	Norway Ice music (3 people)	N	24-jun	25-jun	29-jun	01-jul
DV and Media	Norwegian film crew (3 people)	N	24-jun	25-jun	29-jun	01-jul
DV and Media	NOVA channel (3 people)	US	24-jun	25-jun	29-jun	01-jul
DV and Media	NRK (3 people)	N	24-jun	25-jun	29-jun	01-jul
Associated (Mills Radar)	Nunn, Joshua	US	08-aug	09-aug	25-aug	27-aug
CFA isotopes	Nunn, Richard (1st July)	US	15-maj	16-maj	25-jun	27-jun
processing + logging	Oyabu, Ikumi (logging)	J	28-jun	29-jun	22-jul	24-jul
Associated (AWI radar)	Paden, John (AWI Basler)	US	29-apr	30-apr	16-maj	18-maj
Driller	Podoliak, Alexei	RUS	21-jul	22-jul	09-aug	11-aug
Driller	Popp, Trevor	DK/US	30-apr	01-maj	29-jun	01-jul
processing + logging	Rasmussen, Sune O. (logging)	DK	30-apr	01-maj	07-jun	09-jun
Driller	Rathmann, Nicolas	DK	21-maj	22-maj	29-jun	01-jul
CFA isotopes	Rheinlænder, Jonathan	N	21-jul	22-jul	09-aug	11-aug
Firn Air	Röckmann, Thomas	NL	06-jun	07-jun	29-jun	01-jul
Carpenter	Rønning, Ståle	N	29-apr	30-apr	07-jun	09-jun
Phys.prop.	Saruya, Tomotaka	J	21-jul	22-jul	09-aug	11-aug
processing + logging	Schmidt, Mikkel (logging)	DK	21-jul	22-jul	25-aug	27-aug
RADIX TEAM	Schwander, Jakob	CH	24-jun	25-jun	22-jul	24-jul
Driller	Seth, Bärbel	CH	28-jun	29-jun	22-jul	24-jul
Surface (satellite)	Shimada, Rigen	J	28-jun	29-jun	20-jul	22-jul
MECHANIC	Simonsen, Jens Jacob	GRL	15-maj	16-maj	07-jun	09-jun
Driller	Simonsen, Marius	DK	30-apr	01-maj	07-jun	07-jun
FOM	Simonsen, Marius	DK	07-jun			20-jun
Associated (Mills Radar)	Simpson, Christopher D.	US	08-aug	09-aug	25-aug	27-aug
CFA isotopes	Skorski, Will	US	28-jun	29-jun	09-aug	11-aug
Surface (GPS strain)	Smith-Johnsen, Silje	N	21-jul	22-jul	09-aug	11-aug
Surface (vapour and snow)	SNOWISOPHD	0	28-jun	29-jun	09-aug	11-aug
Surface (vapour and snow)	Steen-Larsen, H.C.	DK	29-apr	30-apr	07-jun	09-jun
Associated (PARCA)	Steffen, Koni (PARCA)	CH	20-maj	21-maj	28-maj	30-maj
FOM	Steffensen, Jørgen Peder	DK	23-apr			27-apr
FIELD LEADER	Steffensen, Jørgen Peder	DK	26-apr	27-apr	07-jun	09-jun
FOM	Steffensen, Jørgen Peder	DK	10-jul			28-aug
Electric Engineer	Stocker, Bruno	CH	26-apr	27-apr	16-maj	18-maj

Electric Engineer	Stocker, Bruno	CH	08-aug	09-aug	25-aug	27-aug
Phys.prop.	Stoll, Nicolas	D	28-jun	29-jun	09-aug	11-aug
FIELD LEADER	Svensson, Anders	DK	06-jun	07-jun	29-jun	01-jul
Chief scientist	Svensson, Anders (Chief sci.)	DK	19-jul	20-jul	09-aug	11-aug
Driller	Tell, Jan	D	28-jun	29-jun	22-jul	24-jul
CFA isotopes	Thayer, Abby	US	06-jun	07-jun	22-jul	24-jul
CFA isotopes	Vaughn, Bruce	US	15-maj	16-maj	07-jun	09-jun
processing + logging	Vaxevani, Nikoletta (logging)	GR/DK	06-jun	07-jun	25-jun	27-jun
DV and Media	Villum Group (6 people)	DK	19-jul	20-jul	22-jul	24-jul
FIELD LEADER	Vinther, Bo	DK	28-jun	29-jun	20-jul	22-jul
Chief scientist	Vinther, Bo (Chief sci.)	DK	06-jun	07-jun	29-jun	01-jul
processing+ Swiss saw	Vudayagiri, Sindhu	DK/IND	19-jul	20-jul	09-aug	11-aug
RADIX TEAM	Walther, Remo	CH	24-jun	25-jun	22-jul	24-jul
Driller	Wang, Shimeng	CHN	21-maj	22-maj	07-jun	09-jun
Phys.prop.	Weikusat, Ilka	D	15-maj	16-maj	07-jun	09-jun
processing + scan ECM	Westhoff, Julien	D	28-jun	29-jun	22-jul	24-jul
Doctor	Winther Nielsen, Lise Lotte	DK	08-aug	09-aug	25-aug	27-aug
Associated (Mills Radar)	Yan, Stephen	US	08-aug	09-aug	25-aug	27-aug
Firn Air	Yang, Ji-woong	KOR	06-jun	07-jun	25-jun	27-jun
Driller	Zhang, Nan	CHN	28-jun	29-jun	09-aug	11-aug
Surface (vapour and snow)	Zolles, Tobias	N	06-jun	07-jun	29-jun	01-jul
Surface (vapour and snow)	Zuhr, Alexandra	D	29-apr	30-apr	25-jun	27-jun

Important: Sudden changes in manning plan due unforeseen issues.

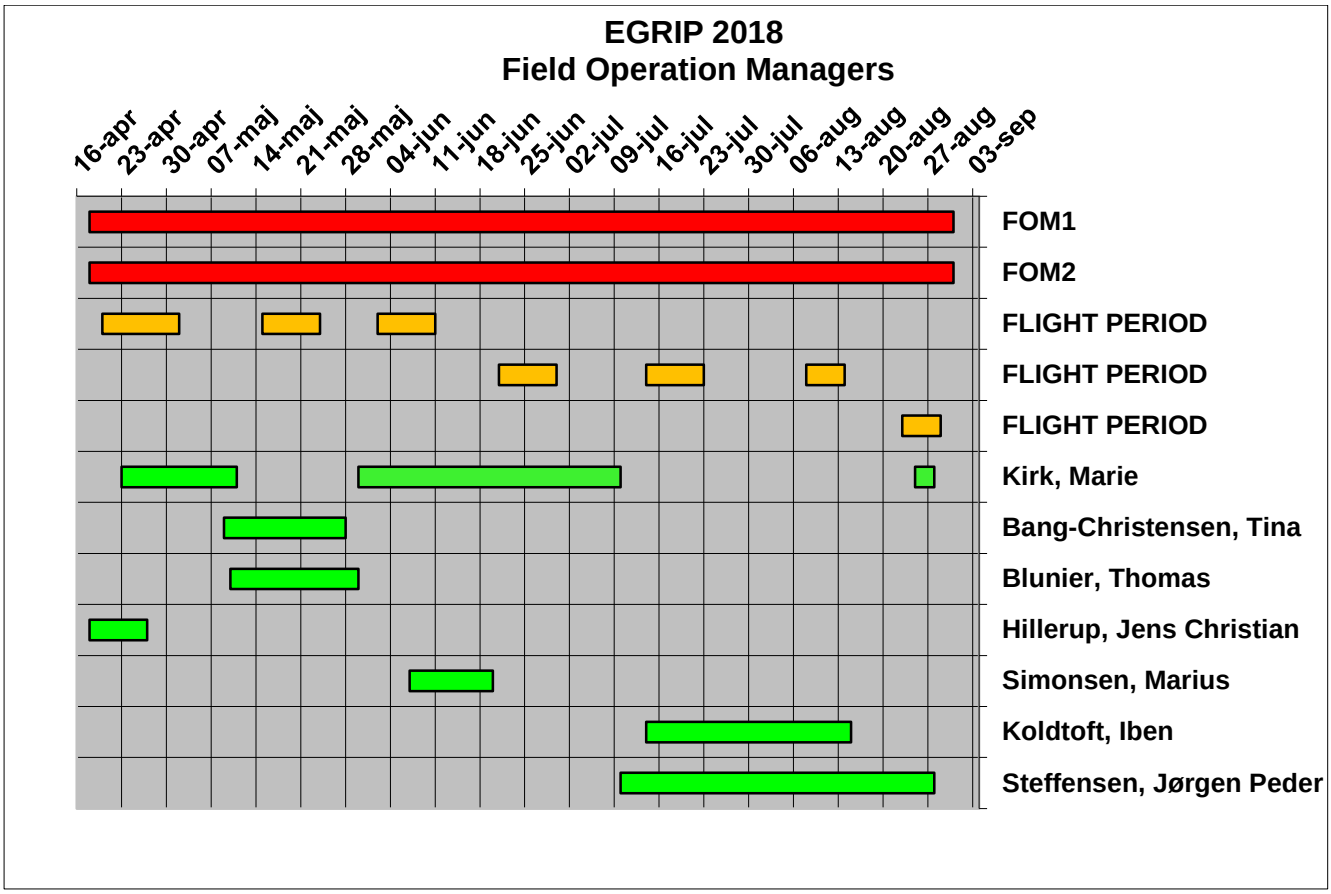
Please keep in mind, that being on the manning plan for 2018 is not a guarantee that you will go to EGRIP and stay there for the scheduled time. In this line of work, even small incidents may have large consequences. Even though we are scientists, we also share a treat with sea-men – we are superstitious. 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 ARE SCHEDULED FOR DEEP DRILLING, ICE CORE PROCESSING AND CFA IN JULY AND AUGUST 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 EGRIP HOME PAGE BEFORE YOU LEAVE FOR GREENLAND.

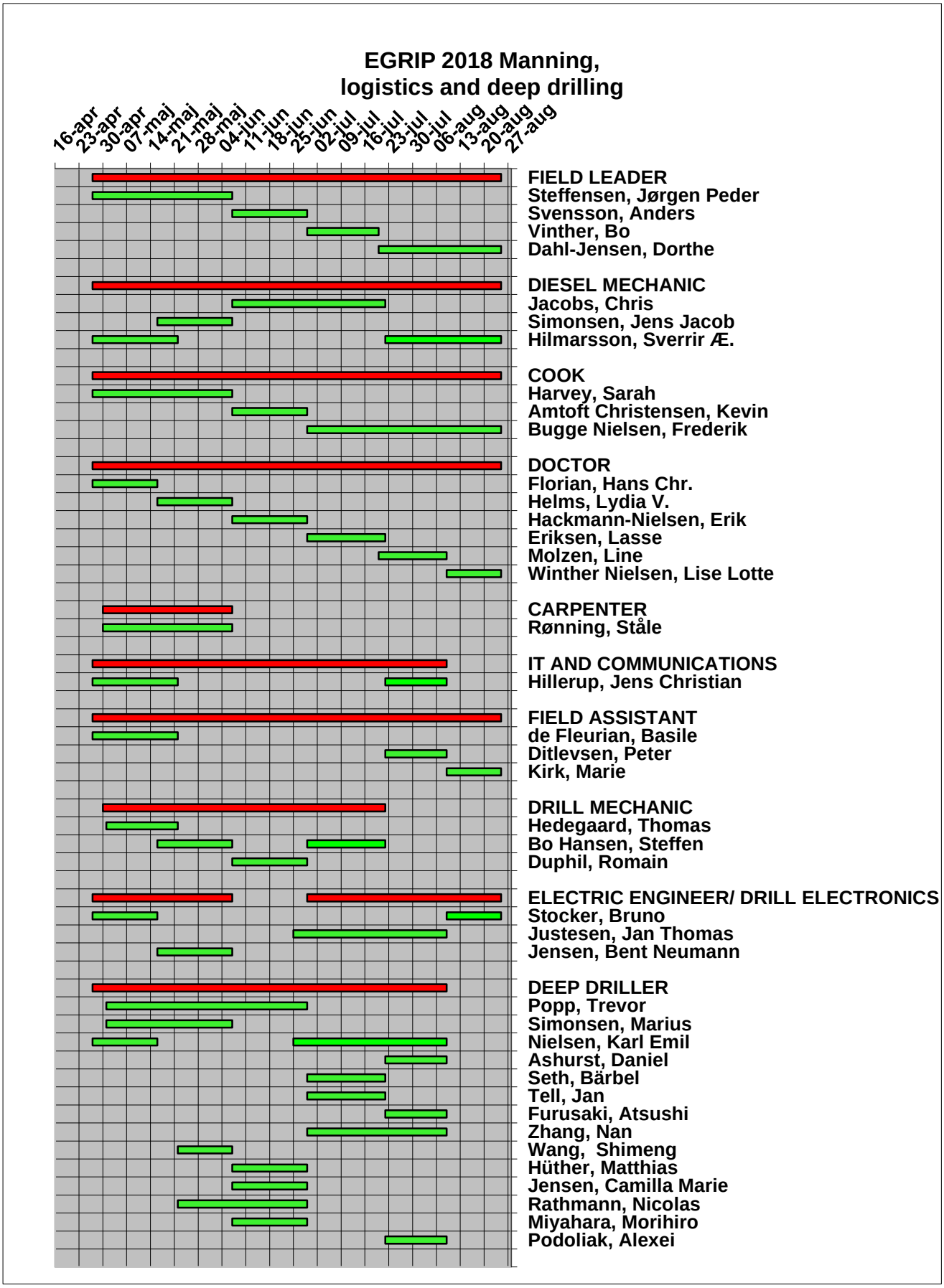
We are sorry for this inconvenience, but in our planning we have been forced to assume the most optimistic outcome of drilling, i.e. the situation where the most people are needed in processing and CFA. If we had planned for less, a smaller number of people would have been planned for, and we could end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

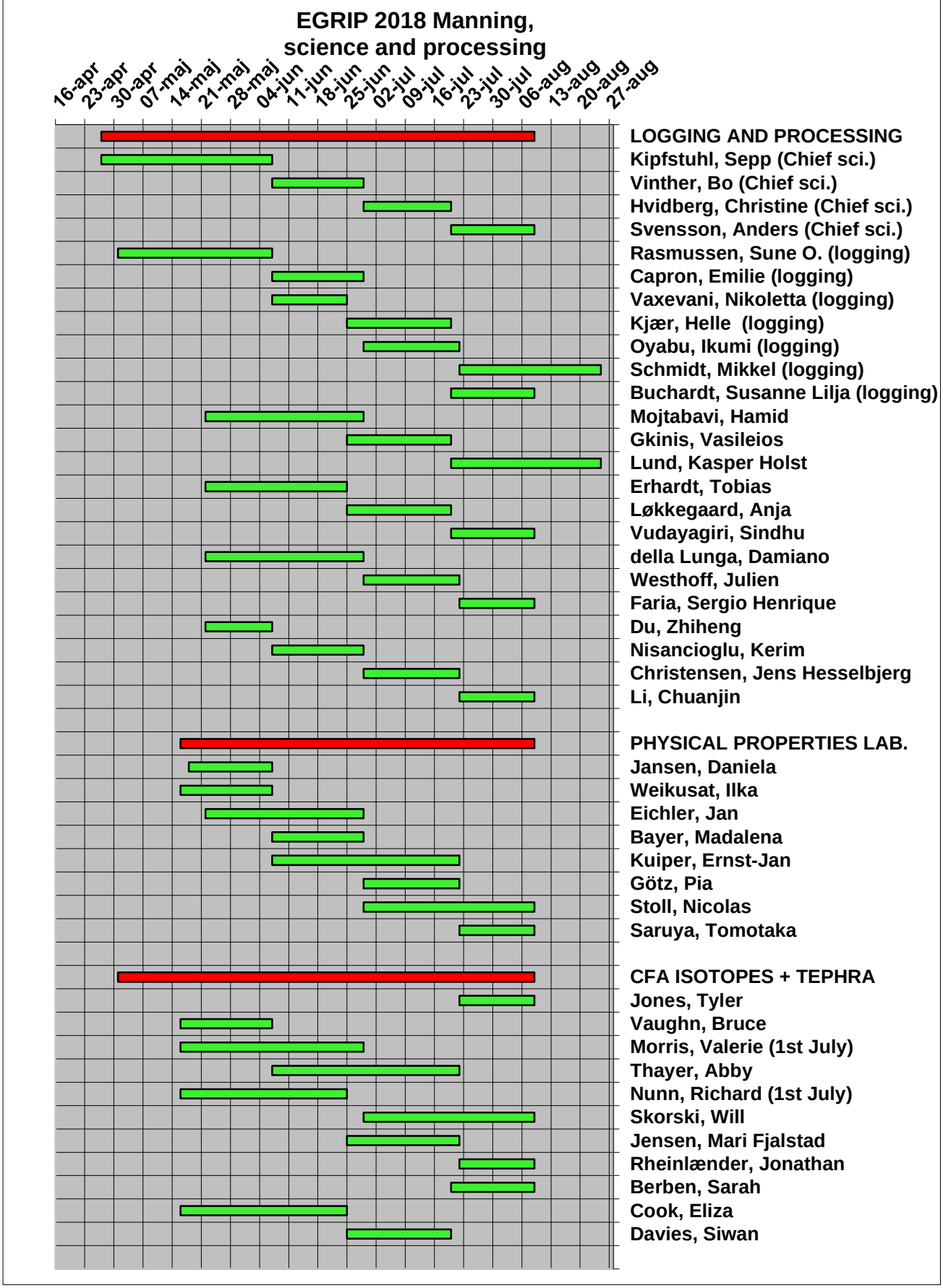
EGRIP GANNT sheets.

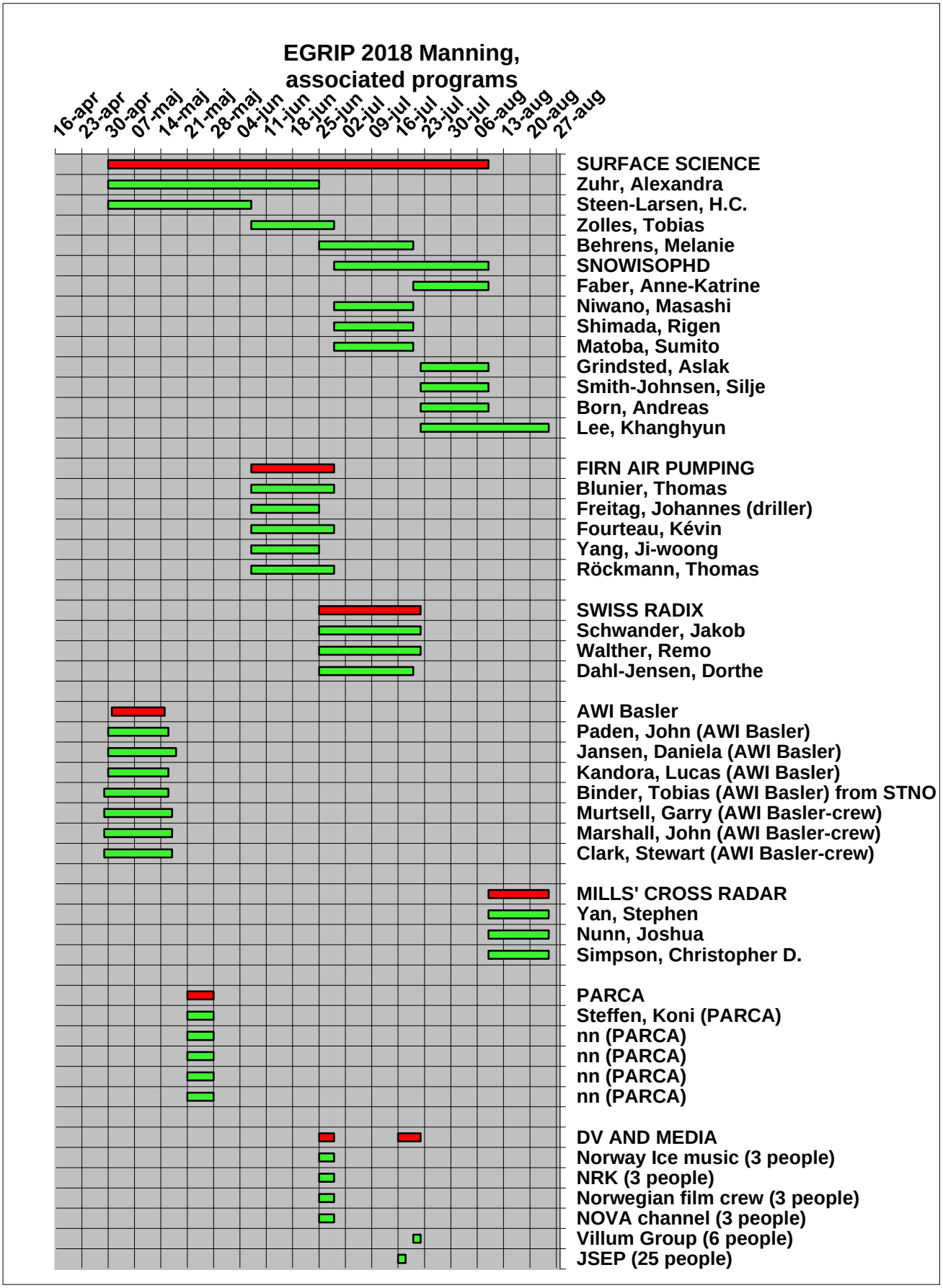
FOM's:


EGRIP 2018
Field Operation Managers
16-apr
23-apr
30-apr
07-maj
14-maj
21-maj
28-maj
04-jun
11-jun
18-jun
25-jun
02-jul
09-jul
16-jul
23-jul
30-jul
06-aug
13-aug
20-aug
27-aug
03-sep
FOM1
FOM2
FLIGHT PERIOD
FLIGHT PERIOD
FLIGHT PERIOD
Kirk, Marie
Bang-Christensen, Tina
Blunier, Thomas
Hillerup, Jens Christian
Simonsen, Marius
Koldtoft, Iben
Steffensen, Jørgen Peder

EGRIP manning:

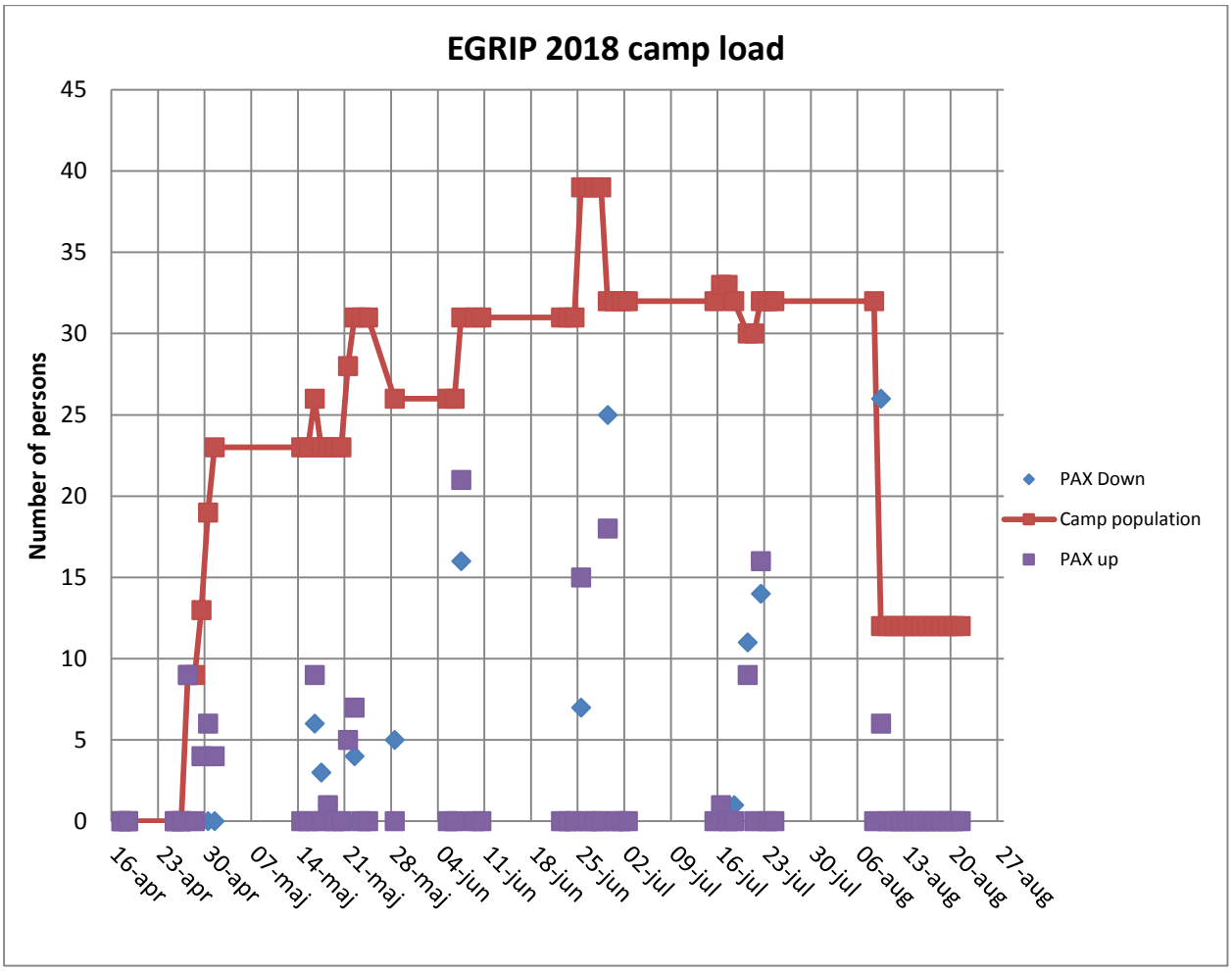



EGRIP 2018 Manning,
science and processing
16-apr
23-apr
30-apr
07-maj
14-maj
21-maj
28-maj
04-jun
11-jun
18-jun
25-jun
02-jul
09-jul
16-jul
23-jul
30-jul
06-aug
13-aug
20-aug
27-aug
LOGGING AND PROCESSING
Kipfstuhl, Sepp (Chief sci.)
Vinther, Bo (Chief sci.)
Hvidberg, Christine (Chief sci.)
Svensson, Anders (Chief sci.)
Rasmussen, Sune O. (logging)
Capron, Emilie (logging)
Vaxevani, Nikoletta (logging)
Kjær, Helle (logging)
Oyabu, Ikumi (logging)
Schmidt, Mikkel (logging)
Buchardt, Susanne Lilja (logging)
Mojtabavi, Hamid
Gkinis, Vasileios
Lund, Kasper Holst
Erhardt, Tobias
Løkkegaard, Anja
Vudayagiri, Sindhu
della Lunga, Damiano
Westhoff, Julien
Faria, Sergio Henrique
Du, Zhiheng
Nisancioglu, Kerim
Christensen, Jens Hesselbjerg
Li, Chuanjin
PHYSICAL PROPERTIES LAB.
Jansen, Daniela
Weikusat, Ilka
Eichler, Jan
Bayer, Madalena
Kuiper, Ernst-Jan
Götz, Pia
Stoll, Nicolas
Saruya, Tomotaka
CFA ISOTOPES + TEPHRA
Jones, Tyler
Vaughn, Bruce
Morris, Valerie (1st July)
Thayer, Abby
Nunn, Richard (1st July)
Skorski, Will
Jensen, Mari Fjalstad
Rheinlænder, Jonathan
Berben, Sarah
Cook, Eliza
Davies, Siwan


EGRIP 2018 Manning,
associated programs
16-apr
23-apr
30-apr
07-maj
14-maj
21-maj
28-maj
04-jun
11-jun
18-jun
25-jun
02-jul
09-jul
16-jul
23-jul
30-jul
06-aug
13-aug
20-aug
27-aug
SURFACE SCIENCE
Zuhr, Alexandra
Steen-Larsen, H.C.
Zolles, Tobias
Behrens, Melanie
SNOWISOPHD
Faber, Anne-Katrine
Niwano, Masashi
Shimada, Rigen
Matoba, Sumito
Grindsted, Aslak
Smith-Johnsen, Silje
Born, Andreas
Lee, Khanghyun
FIRN AIR PUMPING
Blunier, Thomas
Freitag, Johannes (driller)
Fourteau, Kévin
Yang, Ji-woong
Röckmann, Thomas
SWISS RADIX
Schwander, Jakob
Walther, Remo
Dahl-Jensen, Dorthe
AWI Basler
Paden, John (AWI Basler)
Jansen, Daniela (AWI Basler)
Kandora, Lucas (AWI Basler)
Binder, Tobias (AWI Basler) from STNO
Murtsell, Garry (AWI Basler-crew)
Marshall, John (AWI Basler-crew)
Clark, Stewart (AWI Basler-crew)
MILLS' CROSS RADAR
Yan, Stephen
Nunn, Joshua
Simpson, Christopher D.
PARCA
Steffen, Koni (PARCA)
nn (PARCA)
nn (PARCA)
nn (PARCA)
nn (PARCA)
DV AND MEDIA
Norway Ice music (3 people)
NRK (3 people)
Norwegian film crew (3 people)
NOVA channel (3 people)
Villum Group (6 people)
JSEP (25 people)

Camp population

The diagram below gives an overview on the population in camp.



Personnel Transport 2018

The field participants will deploy to Kangerlussuaq, Greenland mostly via Copenhagen and in a some cases from Stratton AB, Scotia, N.Y. The transport to and from EGRIP camp will be direct from/to Kangerlussuaq with a U.S. air force LC130. Some members of the AWI Basler team will arrive and leave with this aircraft.

During the stay in **Kangerlussuaq**, people will be billeted 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. The increasing number of tourists travelling to Greenland results in a long waiting list, so please make the reservations as early as possible. EGRIP has a general financial guarantee for extraordinary Search and Rescue operations and Medical Evacuations (MEDEVAC) will be covered by EGRIP.

Personal field equipment

All participants, except for those who have special arrangements with EGRIP 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 favourite cooking book
1 Your favourite music on IPOD
1 Your favourite game
1 Your favorite instrument - if it allows for transportation
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 air lines, 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.

READ CAREFULLY THIS SECTION: Welcome to the EGRIP Camp (Rules and information)

EGRIP camp at pull out August 2016 with Main dome and three garages and the cargo line. (photo: DDJ).

The living conditions on the ice cap 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 aeroplane 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 in time, to make is easy for the cook).
    - Breakfast is individual (normally between 7:00 and 8:00),
    - Lunch is at noon (13:00 on Sundays),
    - Dinner is at 19:00. 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 2nd gear.
        - Park the scooters with the gear in non-engaged position
        - 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 start.

  - Skidoos are not toys - only drive skidoos when necessary.
  - Do not drive in the clean zone, South and West 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 cooks snow melter. Refill it with snow from the marked area when there is room in the pot to keep a steady water supply in the camp.
- 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.

You can bring the following tax free to Greenland: 200 cigarettes or 100 cigarillos and 50 ml perfume or 250 ml Eau de toilette are allowed.

1 liter strong alcohol, 2 liter beer (typical six-pack) and 2.25 liter wine (typical 3 bottles) are allowed. If you are caught with excess tobacco, perfume or alcoholic beverages on arrival, it will be confiscated and you will be fined around 1,200 DKK

You cannot import goods in excess of the allowance and declare it. You'll have to buy it in Kangerlussuaq.

In case you have not purchased the allowed duty free items in Copenhagen, you can do it in Kangerlussuaq on arrival, showing the boarding pass, and before you leave the secure area.

You can buy alcoholic beverages and tobacco in the local store in Kangerlussuaq. The price of one beer in Greenland is approximately 20 DKK, one litre hard liqueur costs approximately 500 DKK.

People can bring their own prescription medicine. If prescription medicine is needed, make sure 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

Prepared for the NEEM-SC meeting by Sune Olander Rasmussen, Copenhagen, olander@gfy.ku.dk. Final version adopted by the EGRIP-SC October, 2016.

All persons, including visitors, going to Greenland as part of the EGRIP 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 EGRIP field work participant approves use of digital and analogue pictures, filmed material, and sound recordings made during the EGRIP 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 EGRIP 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. "EGRIP-main-dome-4-July-2017-John-Doe.jpg"

Material produced as part of the field campaign or obtained from participants can be used by all EGRIP collaborators crediting the EGRIP project as a community: "Photo/Source: EGRIP ice core drilling project, www.eastgrip.dk". 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, EGRIP ice core drilling project, www.eastgrip.dk".

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

Declaration of liability release for EastGRIP field participants

The EastGRIP project aims to have qualified medical staff in the camp at all times, and is prepared to arrange medical evacuation of field participants or visitors if deemed necessary by the medical staff and field leader. However, participation in the EastGRIP field work or visits to the EastGRIP camp are performed at your own risk, and each participant (or his/her institution) is responsible for obtaining medical clearance and insurance.

By joining the Eastgrip fieldwork, each participant waive any rights to hold University of Copenhagen, the EastGRIP project, 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.
Each participant will have to sign a declaration that he/she understands that is it the responsibility of himself/herself or his/her home institution to arrange appropriate insurance cover for personal injury or liability.

Evacuation from the camp to a medical facility will as a general rule be arranged by and covered by the project.

By signing the declaration, each participant also expresses understanding that it is the responsibility of himself/herself or his/her home institution to cover the costs of medical treatment and repatriation, and/or arrange appropriate insurance cover.
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 and will be kept in the field operations office in Kangerlussuaq.

Policy on handling cases of work place accidents, safety issues, mobbing, harassment and sexual harassment at EGRIP.

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 EGRIP is the project appointed safety officer. All work related incidents should be reported to the Field Leader.

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. Sunday morning breakfast is 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. We expect all to help keeping the dishwashing an easy duty.

Snow melter. Although one person is assigned, everybody has the duty to keep the snow melter 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 snowmelter full. Use ONLY the assigned buckets and showels and take ONLY snow at the assigned spot. Hygiene is very important.

House mouse duty.

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

Terms of reference for the EGRIP 2018 Field Season (formal control and command)

During the field season J.P. Steffensen, Anders Svensson, Bo Vinther and Dorthe Dahl-Jensen will be Field Leaders at EGRIP having formal command & 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, Lars Berg Larsen, Marie Kirk, Eliza Cook, Susanne Munk Andersen, Tina Bang Christensen and J.P. Steffensen will be field Operations Managers (FOMs). The FOM is the official spokesperson for EGRIP and the FOM has control of all EGRIP assets in Kangerlussuaq, such as the office, cars, bicycles etc. The FOM is the formal liason between EGRIP and U.S. logistics (CPS), New York Air National Guard and Greenland authorities. The FOM has final say on composition of cargo and on passenger lists for all flights to and from EGRIP.

Dangerous goods (HAZMAT) Lithium batteries.

While certification of dangerous goods and the packing thereof rests with qualified personnel, Lars Berg Larsen and Marie Kirk have IATA, DOT (49 CFR) and U.S.Air Force certification (AFMAN 24-204), we want to point out some new important regulations,

Under normal circumstances people travelling do not carry HAZMAT in amounts that require certification and declaration. As there have been a series of incidents involving fires on aircraft from shorted lithium batteries, you must take special care.

All modern electronics: Cell phones, GPS, laptops, cameras etc. contain lithium batteries. Most of these batteries are considered "small" in the new regulations, except for laptop batteries with extended life time. They are considered "medium". And for "medium" batteries the following apply:

Quote from IATA regulations 2.3.3.2 Lithium Ion Batteries:
"Lithium ion batteries exceeding a watt-hour rating of 100 Wh but not exceeding 160 Wh may be carried as spare batteries in carry on baggage, or in equipment in either checked or carry on baggage. No more than two individually protected spare batteries per person may be carried."

As long as the batteries are installed in the appropriate equipment, they are not considered HAZMAT, but loose spare batteries have to be packed in such a manner that shortening is impossible by e.g. covering the poles with tape. The quoted IATA regulation says, that you may not put medium sized spare batteries into your checked baggage. You may be allowed to have two spares in your carry on – HOWEVER, THIS DEPENDS ON THE AIRLINE. CHECK RULES FOR LITHIUM BATTERIES WITH THE AIRLINES YOU ARE USING.

When travelling with the 109th to and from EGRIP keep all your batteries in your carry on. Do not put spare batteries in your luggage (suitcase or duffelbag).

For all scientists that ship lithium batteries by cargo, please note that Lithium batteries are Dangerous Goods and have to be packed and certified by authorized companies. It is still possible to pack a laptop in a zarges box, but be careful with spare batteries. If in doubt, consult us or your local HAZMAT company.

Note: There is a huge distinction between "lithium batteries" and "lithium ion batteries".

"lithium batteries" are non-rechargeable high-power cells that work very well in the cold. They are always HAZMAT. In size they vary from button cells in remote controls to car battery size. Automatic defilibrators contain Lithium batteries.

"lithium ion batteries" are rechargeable batteries that are in almost any computer, cell phone or GPS. They are only HAZMAT under the regulations mentioned above.

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.

EGRIP 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 at EGRIP this field season. Also, the doctor will have a hot line to doctors in Denmark. In case of illness the camps 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 aeroplane will be called in from Kangerlussuaq, East Greenland, Thule, Summit, 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) 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

EGRIP has been imposed with strict environmental conditions on EGRIP camp operations by the Greenland government. As EGRIP 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 EGRIP 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 is 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 is necessary to insure no leakage to the environment.

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 EGRIP 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 on in the cargo line.

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

Power Supply

Within all operations during 2018, 230 Volts, 50Hz will be the standard supply. The camp will be powered by diesel generators. For projects away from camp, such as firn air pumping and shallow coring, we will also use diesel generators where possible to limit the use of gasoline.

EGRIP:

Diesel

1 – Iveco	125KVA	3 x 230V (400V/50Hz)	Main generator.
1 – SDMO	40KVA	3 x 230V (400V/50Hz)	Backup generator
1 – SDMO	15KVA	3 x 230V (400V/50Hz)	2nd backup
1 – Hatz	5 KVA	1 x 230V / 50Hz	available

MoGas

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

Reserves in Kangerlussuaq:

Diesel

3 - SDMO	12KVA	1 x 230V/50Hz

MoGas (i.e. petrol or benzin)

1 – Honda	4KVA	1 x 230V / 50Hz

Please help to conserve fuel by conserving power.

EGRIP 2018 – Address and useful numbers

Official address: EGRIP 2018
Box 12
DK-3910 Kangerlussuaq
Greenland
Phone +299 84 11 51; or +299 84 12 27 FOM cell +299 52 41 25
fax +299 84 12 27; e-mail: 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 field season contact to the participants at the EGRIP camp can be made as described below:

Camp Internet Connection - VSAT

At EGRIP in 2018, we continue using the satellite communication system, VSAT, which is connected to a geostationary satellite. In 2016 and 2017, the system worked well, and while it was operational, all communications and data traffic was handled through a flat rate package with unlimited data and communications. This system will be set up again at EGRIP 2018, with an even higher bandwidth than in 2017.

Camp Cell phones - VSAT

For telephony in camp, people can use their smartphones on the EGRIP wireless network to make calls between each other. The app to download is **Zoiper**. Links: iPhone, Android. Installation guides will be available in the dome.

We plan to install a computer that will act as a hub for WIFI connection of all cell phones in camp. It is the intention to link this computer to the internet via the VSAT system. If the VSAT connection is available, participants can also make international calls from their phones, and the outside world can call into camp.

The number for the EGRIP exchange is: +45 77 34 74 44.

The caller will be asked to put in the local extension for the desired participant.

EGRIP field Leader is ext. 401, EGRIP FOM is ext. 301, public phone in EGRIP Dome is ext. 402.

Details on how to connect and when the system is on-line will be posted on the EGRIP webpage.

Camp Iridium OpenPort system

EGRIP camp will utilize the Iridium OpenPort system as backup in case the VSAT system goes off-line. This system consists of an array of antennae and receivers that multiplex to obtain two ingoing phone lines and internet connection. This system has been reliable in previous years. At EGRIP there are two complete OpenPort systems (One emergency back-up). 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 for per Mbyte (price is about 10 USD per Mb). If unlimited, unnecessary uploads & downloads of software updates, large email attachments, images, movies, etc. by EGRIP participants will very quickly cost the EGRIP budget a fortune! Please, turn off all automatic downloads and all banners and pictures on your browser before connecting. Communication costs for NEEM 2010: 360,000 DKK

Iridium OpenPort telephone to EGRIP Camp

This number may change. 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	15:00 – 16:00 GMT
Evening dinner	21:00 – 22:00 GMT

The Iridium system OpenPort will be operational 24 hours if VSAT connection is not active.

EMAIL:

The Field Operations Manager will check arriving E-mail at least once a day on the following email:

fom@egrip.camp

Don’t forward large attached files.

For Field leader at EGRIP : fl@egrip.camp

On the ice, when we use the Iridium OpenPort system to send & 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 NEEM diary on the NEEM home page every day on behalf of everybody.

Please look up on the EGRIP web-page to check if EGRIP camp is communicating by VSAT or OpenPort.

EGRIP official communications:

SITREP

The two Field Leaders will Sunday night prepare a **SIT**uation **REP**ort "SITREP", i.e. a report on the preceding week's field activity. This report will be transmitted by E-mail to the Copenhagen office. From here, it will be retyped and put on the EGRIP home page for download and sent by e-mail on Monday the EGRIP project group and 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 programmes
6. Drill depth and time
7. Status for drilling
8. Other info
9. Signature of the Field Operations Manager

Daily report on the web (www.eastgrip.org or www.icecores.dk)

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 EGRIP camp to the Field Operations Manager office in Kangerlussuaq who, in turn, will take care of the home page. The Field Operations Manager (fom@egrip.camp) will coordinate this activity.

Description of EGRIP camp

Quartering and buildings

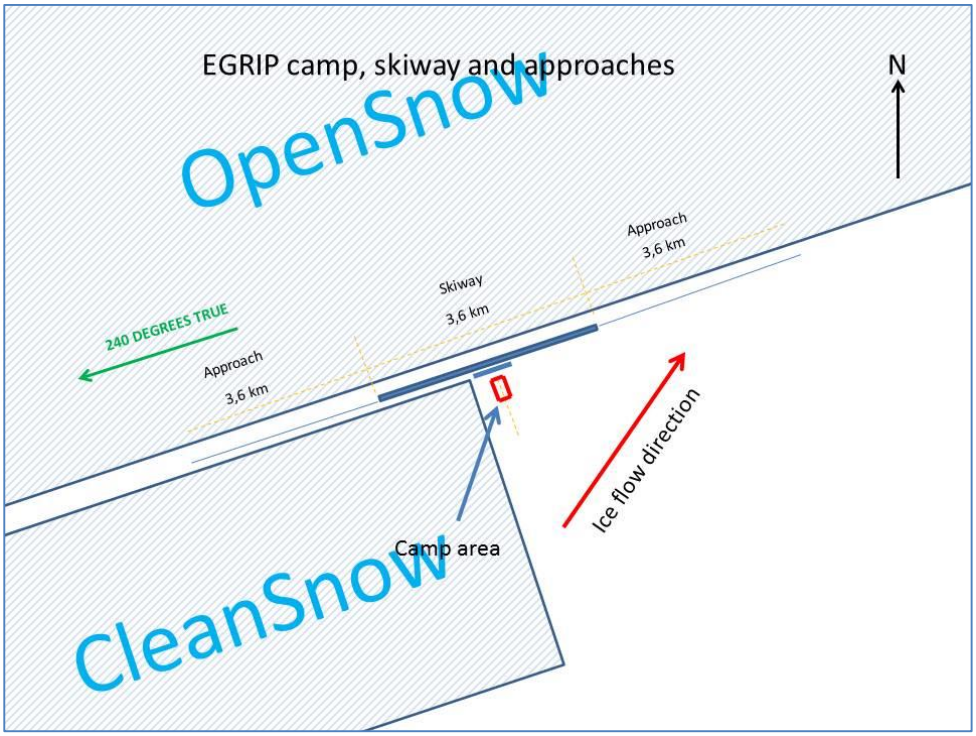
EGRIP camp July 2016.

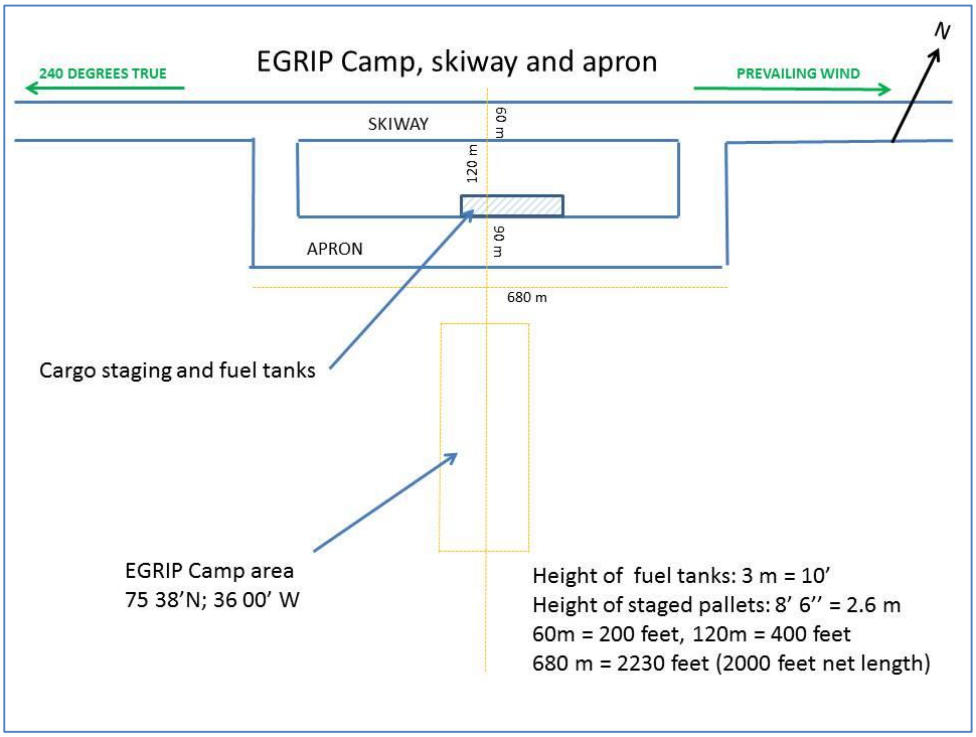
EGRIP	until May 5:	after May 16:	
	PAX Normal(max)	Pax Normal(max)	
Kitchen/office	4(10)	4(10)	40’ wooden dome
Big tomato	1(2)	1(2)	Fiberglass hut
Small tomato	1(1)	1(1)	Fiberglass hut
Flexmobil	0(1)	0(1)	Cabin
Flexmobil	0(1)	0(1)	Cabin
New Pistenbully	0(1)	0(1)	Cabin
Garage, mechanic			26’ x 40’ Weatherport
Garage, carpenter			26’ x 40’ Weatherport
Garage, storage			24’ x 28’ Weatherport
Quarter (WP 1)	2(4)	2(4)	10’ x 15’ Weatherport
Quarter (WP 8)	3(6)	3(6)	12’ x 20’ Weatherport
Quarter (WP 2)	3(6)	3(6)	12’ x 20’ Weatherport
Total	14(32)		
Freshie shack (WP 9)		0(2)	12’ x 20’ Weatherport
New quarter (WP 8)		3(6)	12’ x 20’ Weatherport
New quarter (WP 4)		3(6)	12’ x 20’ Weatherport
Quarter (WP 3)		3(6)	12’ x 20’ Weatherport
Quarter (WP 5)		2(4)	10’ x 15’ Weatherport
Quarter (WP 7)		1(2)	10’ x 10’ Weatherport
New quarter (WP 6)		1(2)	12’ x 10’ Weatherport
Total	14(32)	27(60)	

For those individuals who prefer to sleep in small tents, EGRIP has a few tents to lend out. This takes the strain off

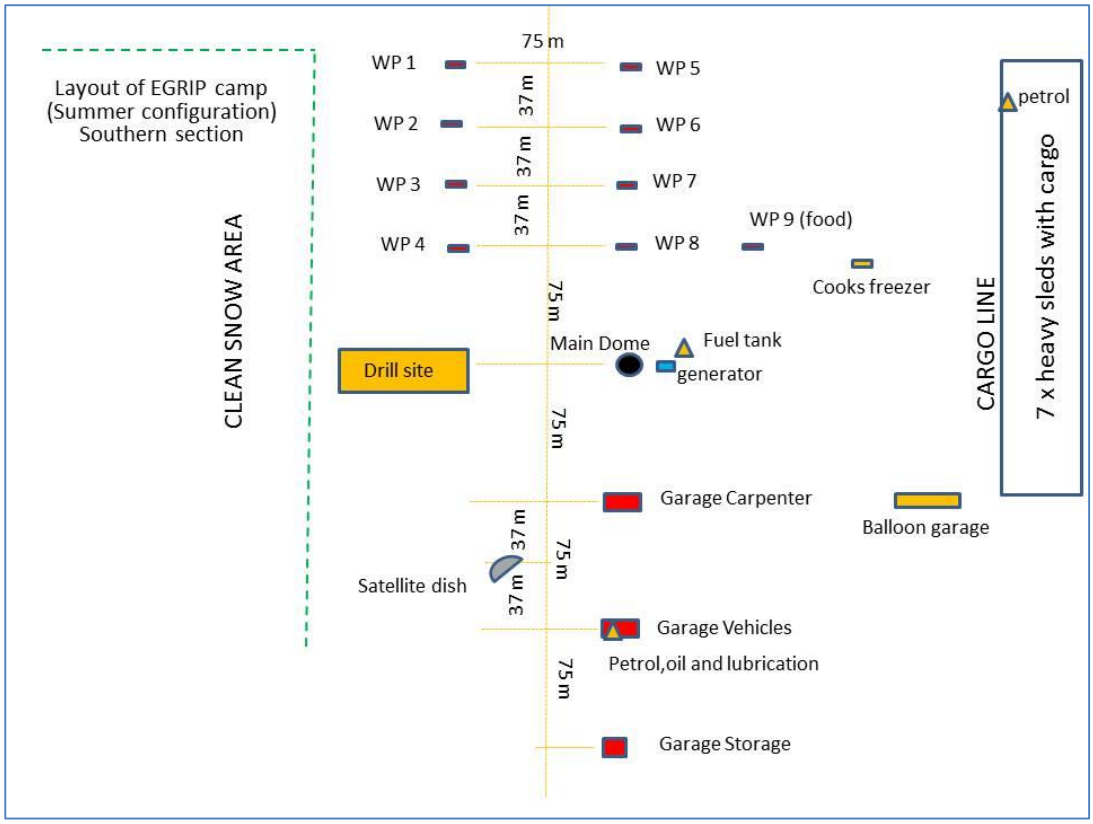
Maps of the EGRIP camp area.

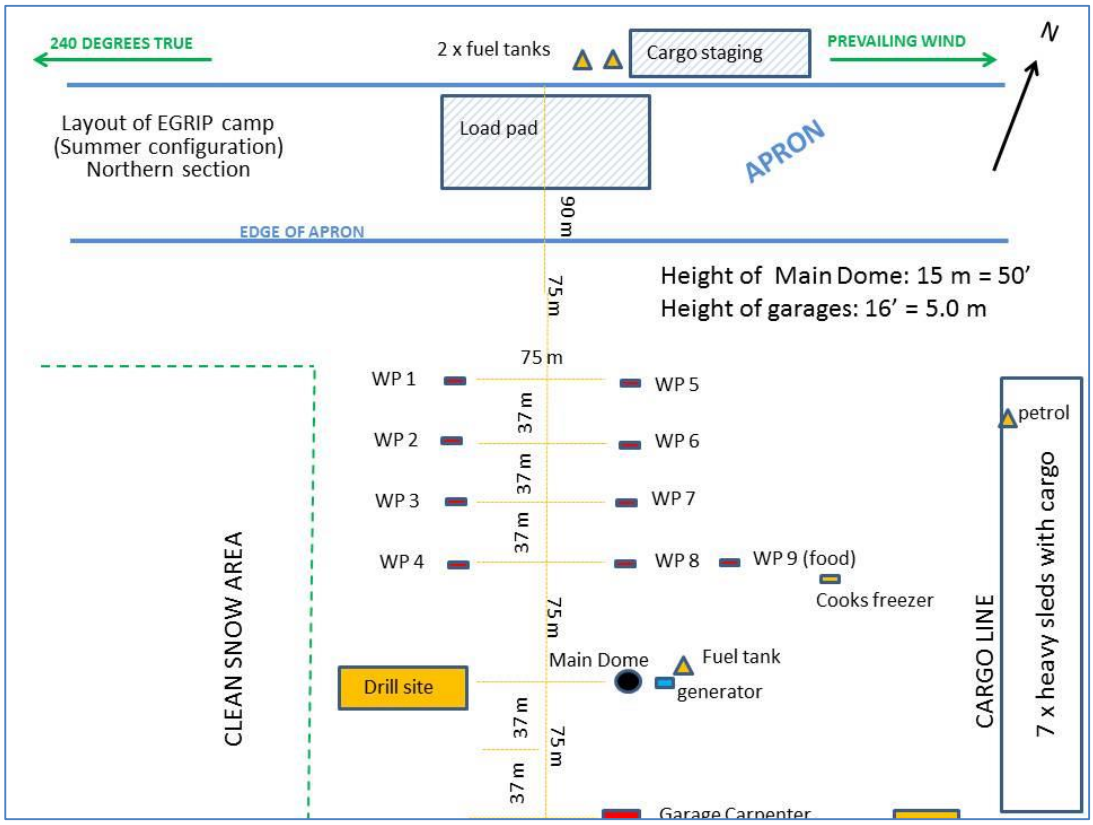
On the following three pages are maps of the EGRIP camp and Science areas in different scales.



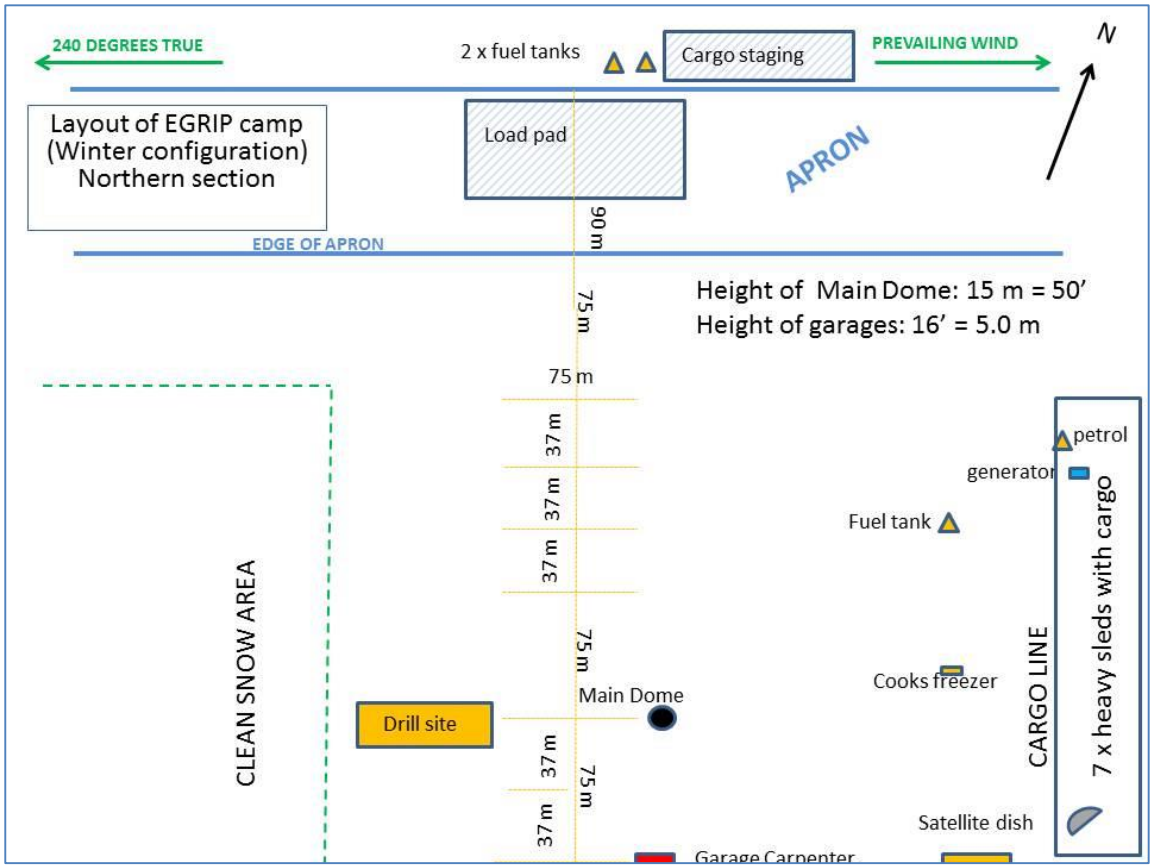


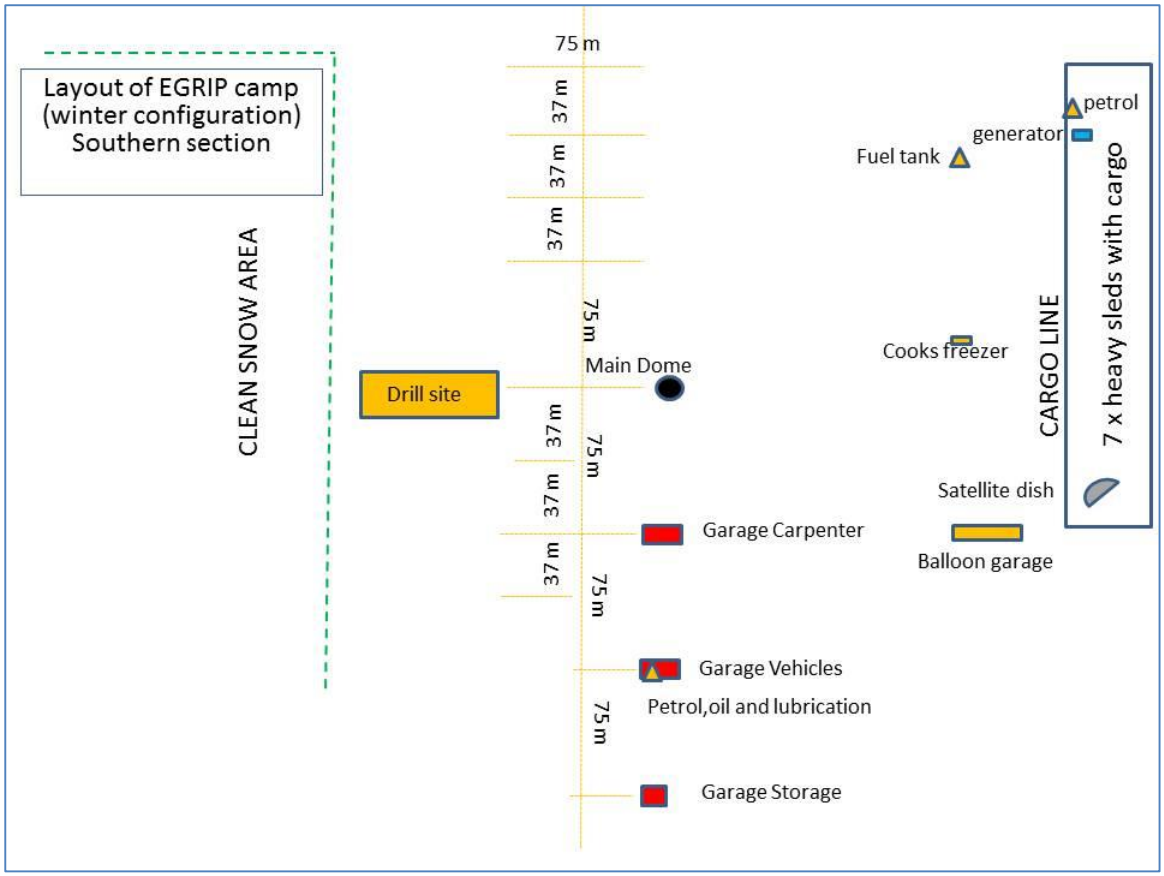
Camp, skiway and apron layout.





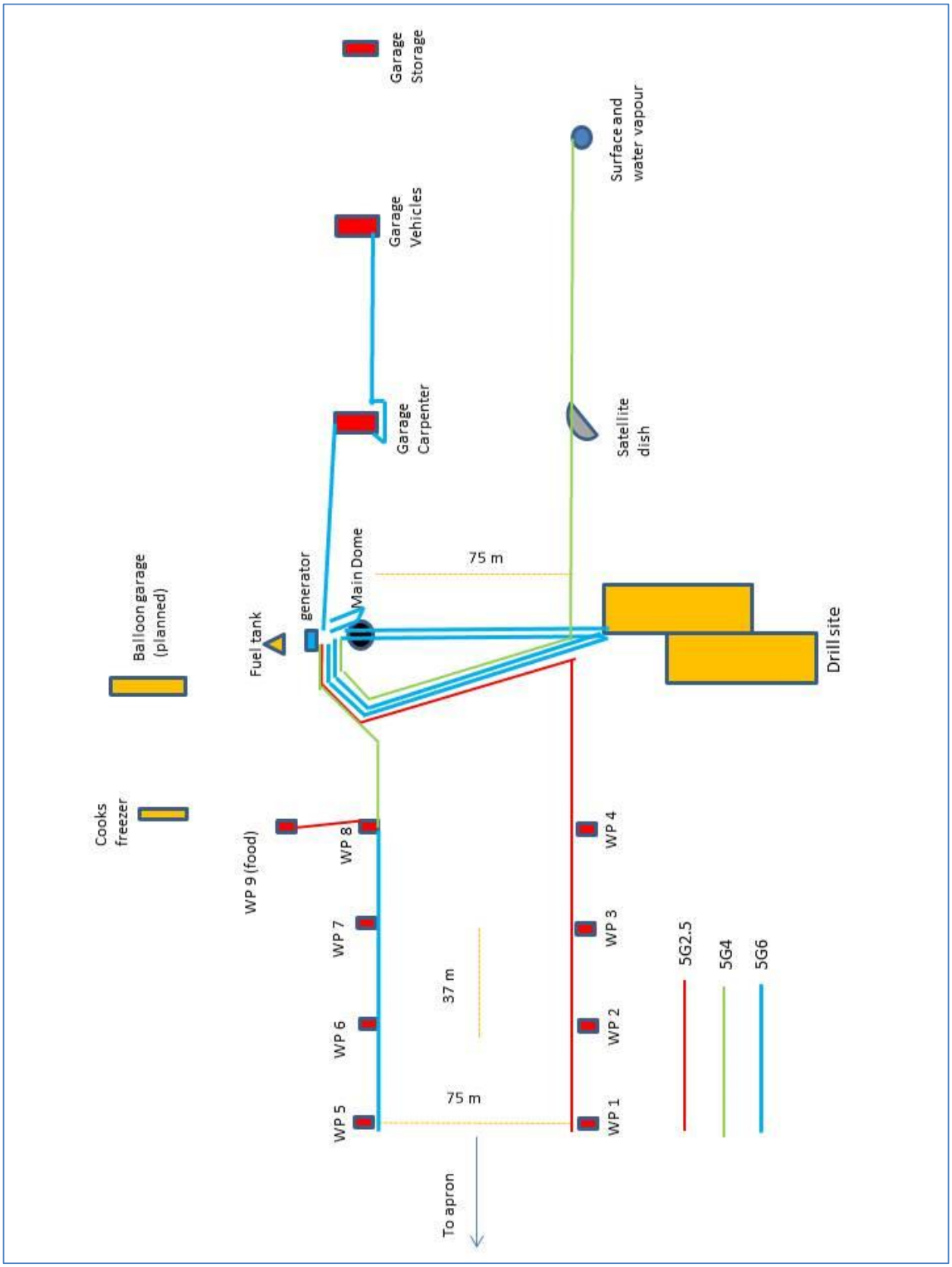
Map of EGRIP camp summer situation with all weatherports built.



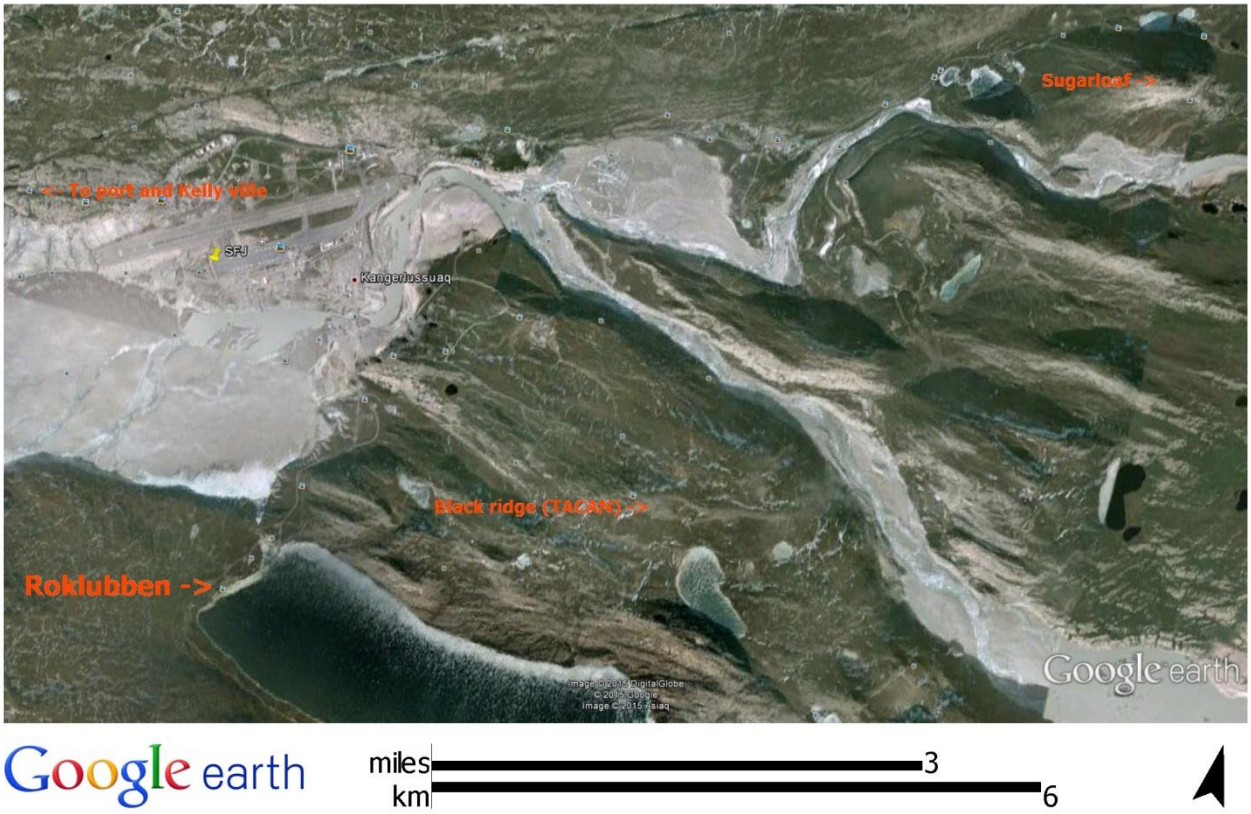


Map of EGRIP camp in winter situation. All weatherports are stowed on cargo line.

Electrical cabelling of EGRIP camp.



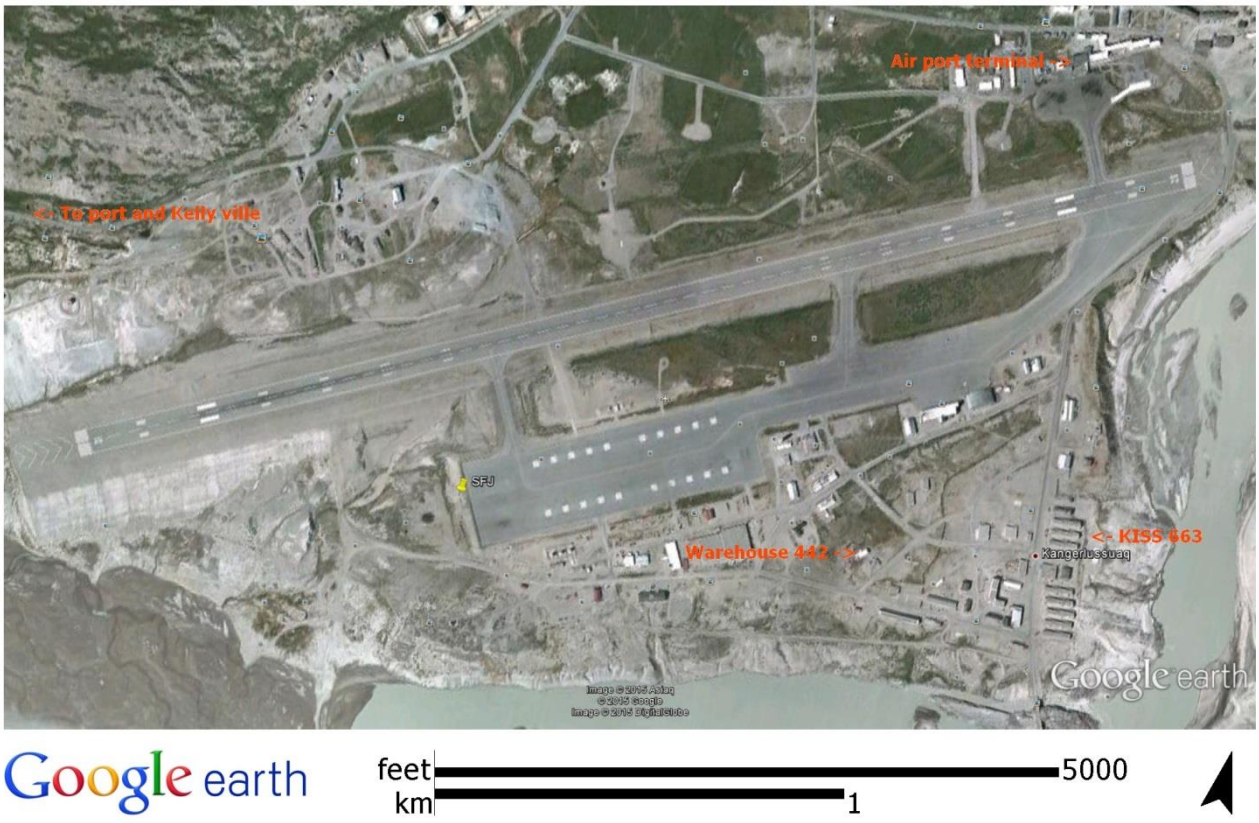
Description of Kangerlussuaq and Surrounding Area



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.

The population is approximately 650 including many kids. The terminal area is composed of several businesses: Met office, (Flight Information Center "FIC" has moved to Nuuk) Air Greenland, local supermarket "Pilersuisoq", some souvenir shops, a road side grill and Air Greenland. The terminal side includes private housing, a combination of Air Greenland terminal and Hotel Kangerlussuaq, which also houses the GLAIR offices and an ATM in DK Kroner. There are also buildings to the west of the terminal which house the Airport Administration and Air Cargo terminal (where outgoing and incoming cargo between Denmark and points in Greenland can be sent and received). The Greenlandic Post Office is located next to the local supermarket.

On the South side of the runway is the old U.S. Base. Here EGRIP office and quarters will be in KISS (Building 662). The project warehouse is building 442.



Weather: The climate is continental and dry with an annual precipitation averaging 120mm; winter temperatures reach down to -50°C and the summer temperature increases to above +20°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 5-21°C. Rain is rare in these months, but given the right conditions, it can still be quite cool.

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.

Kangerlussuaq is the main hub for air traffic to and within Greenland with regular direct international connections to and from Copenhagen (Denmark) and occasionally Keflavik (Iceland).

In Kangerlussuaq you can buy regular, canned or freeze-dried foods, fuels (jet fuel/kerosene, gasoline, and field stove alcohol). There is also a post office, an airport hotel with cafeteria, a gym centre 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. Check **www.greenland-guide.gl** for information.

There are a few alternative dining and drinking establishments in Kangerlussuaq. The Roklub at Lake Ferguson is sometimes open in summertime and offers informal dinners at reasonable prices although the quality is varying. In the old dining hall, 100 m from KISS there is a small shop, a bar and fast food place. Dining is available at the terminal. There is a cafeteria where the price of a typical meal is DK Kr.90. 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 specialities.

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 at the labs of the KISS building.

KISS (bldg. 662 in the map) is owned by the Home Rule Government 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 realise 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 winter time

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

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1 Air National Guard Rd.
Scotia, New York 12302-9752

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EGRIP FOM (Field Operations Manager) telephone	+299 84 11 51
FOM mobile	+299 52 41 25
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FOM satellite phone	
e-mail	fom@egrip.camp

Iridium Satellite handheld telephones to EGRIP camp.

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

Iridium OpenPort system (EGRIP only)

Please ask the Field Operations Manager (FOM) which number is current.

Kangerlussuaq

While participants are in Kangerlussuaq they can be reached by:

Fixed line:	+299 84 11 51
EGRIP FOM Cell :	+299 52 41 25

CPS 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:	cpskangerops@polarfield.com (Jessy Jenkins)
	kyli@polarfield.com (Kyli Cosper)
	robin@polarfield.com (Robin Abbott)

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e-mail:	139ravenops@gmail.com
FIC: telephone:	+299 36 33 53 (sector north)
FIC e-mail	fic@naviair.dk
Notam & com centre	+299 36 33 04
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Cargo shipments to Greenland

EGRIP will have a Field Operations Manager in Kangerlussuaq all the time this season. It is essential that all shipments are labelled correctly, and that EGRIP is informed about every shipment. In addition, we can expect delays in the Air Greenland transport from Copenhagen to Kangerlussuaq although Air Greenland has increased the number of flights in summer.

Cargo to Kangerlussuaq should be labelled:

EGRIP Operations 2017
Box 12
DK-3910 Kangerlussuaq
Phone +299 84 11 51. Mobile +299 52 41 25 Fax +299 84 12 27
Greenland

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

We would like following information about each collo:
Weight
Dimensions
Volume.

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

We urge people to ship cargo as early as possible. Based on our experience and this year available air cargo space to Greenland we as a minimum recommend following:

SHIPPING DEADLINES:

Shipping by air to EGRIP from/via Europe:
Cargo for EGRIP April 27, **Must arrive** Kangerlussuaq (SFJ) latest **APRIL 21**
Cargo for EGRIP June 7, **Must arrive** Kangerlussuaq (SFJ) latest **MAY 31.**

By Boat:
Delivery deadline for the ship in Aalborg is 29 May (25 May in CPH) for arrival SFJ 15. June 2016. The cargo will most likely be available 22 June.

Shipping to EGRIP from the United States

CPS POLAR FIELD SERVICES and the EGRIP 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 NOTE: Be sure to mark your cargo with “EGRIP 2018” to avoid your cargo ending up at Summit!
CPS POLAR FIELD SERVICES contacts: Jessy Jenkins (jessy@polarfield.com) and Robin Abbott (robin.abbott@polarfield.com)

It is necessary for you to enter your shipment into the CPS cargo tracking system (CTS). Robin Abbott or Jessy Jenkins (robin or jessy@polarfield.com will provide you with a password and login. You will receive an email from us when we have received your cargo in good order in Kangerlussuaq.

Below are the instructions provided to us by CPS Polar Field Services (http://www.polar.ch2m.com).

U.S. Shipping and CUSTOMS INFORMATION – 2018

CH2MHILL Polar Services

2018 Greenland ANG Shipping Requirements

Due to heightened security and military shipping requirements, it is imperative that all cargo transiting to Greenland by Air National Guard (ANG) meet the requirements and delivery timelines outlined below. All ANG cargo requires customs and military review/approvals.

****** Cargo will NOT be accepted on the day of an ANG flight******

CUSTOMS

All cargo shipped to Stratton (Scotia) Air Base for delivery to Greenland must be **registered** (examined and certified) with U.S. Customs & Border Patrol (CBP) before leaving the country.
Registration options are:

1) **Self-registration**
   Optional for Scotia shipments.

   Completed by the researcher or a representative at home institution prior to shipping to CPS.
   Shipper must provide 3ea originals (no copies) CBP signed, dated, and stamped CBP-4455 forms to CPS NY Office.

2) **CPS registration**
   Available for Scotia shipments

   CPS arranges CBP to register the shipment once cargo on-site at Scotia, NY.
   Shipper must provide 3ea CBP-4455 to CPS NY Office.
   Cargo must be received **3 weeks** prior to the scheduled ANG departure flight.

See "*2018 ANG Customs Instructions*" for more detailed information.

HAZARDOUS CARGO

1) All hazardous cargo shipped via the NYANG to Greenland MUST be registered by CPS.
2) CPS cargo representatives must be provided with advance notice of haz cargo's arrival on base.
3) Cargo must arrive at least **3 weeks** prior to requested ANG flight date.

SHIPPING ADDRESS

Stratton Air Base, Scotia NY

109th Small Air Terminal, Bldg. 20
1 Air National Guard Rd.
Scotia, NY 12302-9752
Attn: Dino Guthrie
Phone: 518.364.6975

CONTACTS

Dino Guthrie, Phone 518.364.6975, NYcargo1@polarfield.com

Please do not hesitate to contact CPS with questions regarding cargo, hazardous materials shipping, or customs documentation.

CH2MHILL Polar Services

2018 ANG Customs Instructions

ANG GREENLAND CARGO

STEP 1: COMPLETE CUSTOMS FORMS

A Certificate of Registration (form CBP-4455) is **required** when shipping your cargo to Greenland via the Air National Guard.

US Customs & Border Protection website: http://www.cbp.gov/xp/cgov/toolbox/forms/

- From the "FORMS" page, select "CBP form 4455."
- Complete CBP-4455. Include the following information:
    - **Carrier:** 109th Air National Guard (C130) or 105th Air National Guard (C17)
    - **Date:** [Insert Current Date]
    - **Name, address and zip code:** You, the shipper
    - **Articles exported for:** "Other - science use in Greenland"
    - **Number packages:** [Include total number of items] Item number must be identifiable on each package.
    - **Kind of packages:** Examples: Hardiggs, steel boxes, aluminum poles, wooden crate
    - **Description:** Type "See following (#) pages."
        - Attach a packing list to each CBP-4455 Form. This list will be automatically generated when using CPS Cargo Tracking System (CTS) to send cargo to ANGB.
        - The number of items should match the information presented on the packing list information.
        - You do **NOT** need a separate Certificate for each item; one CBP-4455 Certificate will cover all items listed in the shipment.
        - You do not need to certify personal clothing or food.
    - **Sign and date.**
- Print six (6) copies of completed CBP 4455 form.

See Example CBP 4455 & Packing List

Complete CBP-4457 for shipment of personal gear. This form eliminates any questions or problems with personal equipment such as computers, electronic gadgets, etc.

STEP 2: CARGO INSPECTED BY CUSTOMS

The CBP-4455 Certificate MUST be signed by a customs agent to be valid.

A customs agent will inspect the contents of a shipment and check the corresponding packing list for accuracy. Cargo traveling to Greenland via the Air National Guard can be inspected in 1 of 2 ways:

- **OPTION 1– Self-registration**
  REQUIRED for Newburgh shipments. Optional for Scotia shipments.
    - Cargo is inspected at local CBP Office BEFORE shipment to CPS NY
    - Schedule an appointment with your local Customs and Border Protection Office (airports, harbors) to have them inspect and certify cargo for shipment to Greenland.
    - Prepare CBP-4455 and packing list as noted in Step 1. (Six copies of the completed form are needed.)
    - Following the inspection, the CBP officer will sign and stamp ALL 6 copies of the CBP-4455 form and packing lists.
    - CBP will retain a copy for their records.

- Include one copy of signed/stamped CBP-4455 and packing list with your cargo shipment to NY.
- Send 3 copies to CPS NY Office
- Retain a copy for your records. Approved CBP-4455 forms will be needed when cargo is returned to the U.S.

**** *A signed/stamped Certificate of Registration, CBP-4455, is valid for one year* ****

➢ **OPTION 2 – CPS Registration at Stratton Air Base**
Available ONLY for Scotia shipments

- Cargo MUST arrive three weeks prior to your scheduled ANG flight.
- Mail three (**3**) completed and signed CBP-4455's and corresponding packing lists to:
  Dino Guthrie/ CH2M HILL Polar Services
  Stratton Air Base
  1 Air National Guard Rd., Bldg. 20
  Scotia, NY 12302
  cell: 518-364-6975
- Pick up your CBP approved CBP-4455 from CPS NY Office when transiting through NY.
- If not flying with the ANG, plan for the CPS NY Office to send a stamped copy of the approved forms. Approved CBP-4455 forms will be needed when cargo is returned to the U.S.

**** *A signed/stamped Certificate of Registration, CBP-4455 is valid for one year* ****

Returning Cargo to the U.S. from Greenland via ANG

The export signed/stamped Certificate of Registration, CBP-4455, and packing list provides proof that the cargo originated in the U.S. A copy of your outbound approved CBP-4455 will be required to bring cargo back into the U.S. via the ANG.

Contact the local CPS support office with questions regarding customs forms for retro cargo. If not traveling with your cargo, you will need to complete additional customs forms to be compliant.

Prohibited and Restricted Items

Some items, including samples, may be prohibited or require a special permit to import into the U.S.

Review CBP's website for a list of Prohibited/Restricted items: https://www.cbp.gov/travel/us-citizens/know-before-you-go/prohibited-and-restricted-items

Sending Cargo to/from Greenland via Carrier OTHER than ANG

Check with your local Customs and Border Patrol office if cargo will originate or return via a Port of Entry other than NY ANG. There may be additional requirements to process your cargo, and your local customs office is the best resource for all non-ANG shipments.

For additional Customs information, refer to the U.S. CBP service online brochure "Know Before You Go." available on the official CBP site, http://www.cbp.gov/travel/us-citizens/know-before-you-go

Contact CBP directly at http://www.cbp.gov/ or via telephone at (518) 431-0200.

CPS Cargo Offices
New York Office: Dino Guthrie at NYcargo1@polarfield.com
Kangerlussuaq Office: CPSKangerops@polarfield.com

CH2MHILL Polar Services

2018 ANG Customs Instructions

EXAMPLE CBP 4455 & PACKING LIST

DEPARTMENT OF HOMELAND SECURITY
U.S. Customs and Border Protection

OMB Control Number: 1651-0010
Expiration Date: 08/31/2019

NO.

CERTIFICATE OF REGISTRATION

19 CFR 10.8, 10.9, 10.68, 148.1, 148.8, 148.32, 148.37

(NOTE: Number of copies to be submitted varies with type of transaction. Inquire at Port Director's office as to number of copies required.)

VIA *(Carrier)*	B/L or INSURED NO.	DATE
109th -or- 105th Air National Guard		Insert Date

NAME, ADDRESS, AND ZIP CODE TO WHICH CERTIFIED FORM IS TO BE MAILED *(If Applicable)*

Name
Address
Zip Code

ARTICLES EXPORTED FOR:

- ☐ ALTERATION*
- ☐ REPAIR*
- ☐ USE ABROAD
- ☐ REPLACEMENT
- ☐ PROCESSING*
- X OTHER, *(specify)* Science use in Greenland

*** NOTE:** *The cost or value of alterations, repairs, or processing abroad is subject to CBP duty.*

LIST ARTICLES EXPORTED

Number Packages	Kind of Packages	Description
2 1 4	Hardigg Wood Crate Fibreboard box	*See following [insert #] pages

SIGNATURE OF OWNER OR AGENT *(Print or Type and Sign)* Print Name Insert Signature — DATE Insert Date

The Above-Described Articles Were:

EXAMINED		LADEN under my supervision	
DATE	PORT	DATE	PORT
SIGNATURE OF CBP OFFICER		SIGNATURE OF CBP OFFICER	

CERTIFICATE ON RETURN

Duty-free entry is claimed for the described articles as having been exported without benefit of drawback and are returned unchanged except as noted: (use reverse if needed)

SIGNATURE OF IMPORTER *(Print or Type and Sign)* — DATE

NOTE: Certifying officers shall draw lines through all unused spaces with ink or indelible pencil.

Paperwork Reduction Act Notice: An agency may not conduct or sponsor an information collection and a person is not required to respond to this information unless it displays a current valid OMB control number and an expiration date. The control number for this collection is 1651-0010. The estimated average time to complete this application is 10 minutes. If you have any comments regarding the burden estimate you can write to U.S. Customs and Border Protection, Office of Regulations and Rulings, 799 9th Street, NW., Washington DC 20229.

CBP Form 4455 (08/16)

CH2MHILL Polar Services

2018 ANG Customs Instructions

CBP 4455 - PACKING LIST EXAMPLE

Project Name - Institute						
Cargo Tracking System (CTS) Code	**Weight (lbs)**	**Length**	**Width**	**Height**	**Kind of Package**	**Contents**
XX-Project-0061	150	30	27	17	Hardigg	weather station & hardware/parts, data loggers
XX-Project-0062	105	30	27	17	Hardigg	GPS receivers, antenna cable, computer, charge controllers
XX-Project-0069	525	60	48	14	Wood Crate	aluminum pipe
XX-Project-0066	40	60	10	10	Fibreboard box	PVC pipe, steel pipe sections
XX-Project-0068	50	60	18	18	Fibreboard box	PVC solar panel mounts
XX-Project-0063	40	24	18	9	Fibreboard box	GPS & power cables, seismometer, antenna cables
XX-Project-0064	80	30	20	11	Fibreboard box	GPS, connectors & cables, tools

Useful tables
for planners, field leaders, Field Operation Managers, drillers and other interested parties.

Positions of NEEM and EGRIP camps and 2015 traverse route.

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

Start of route is approx. 2 km N of NGRIP camp.

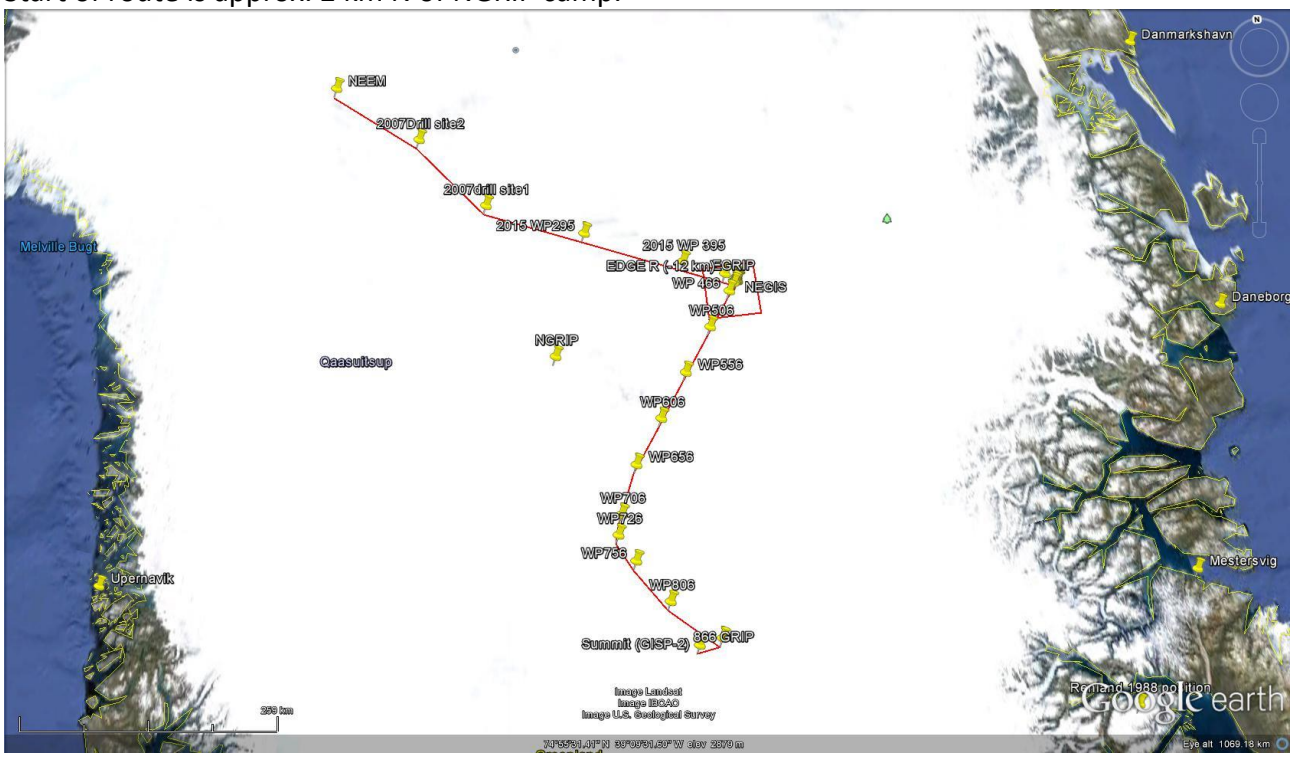


Fig. 5 1 The red line shows the 2015 route from NEEM to EGRIP and on to Summit.

Positions of EGRIP skiway (official-2017):

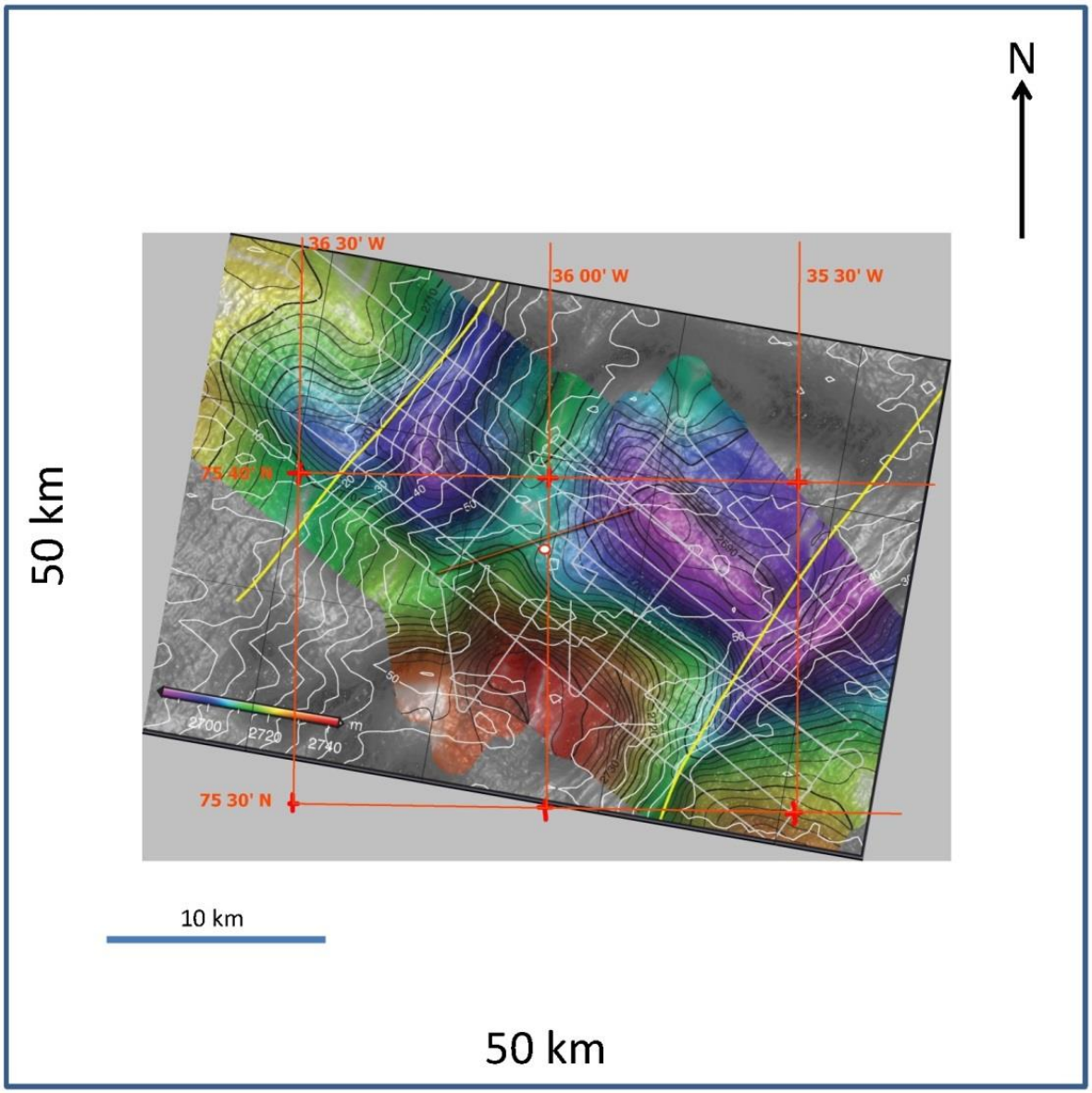
NorthEast end: N 75 degrees 38.592 min, W 35 degrees 56.637 min, alt. 2705 m

SouthWest end: N 75 degrees 37.610 min, W 36 degrees 3.512 min, alt. 2712 m

Skiways runs 240 and 060 degrees true.

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

Note: The entire camp moves 51m towards NNE each year.



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.

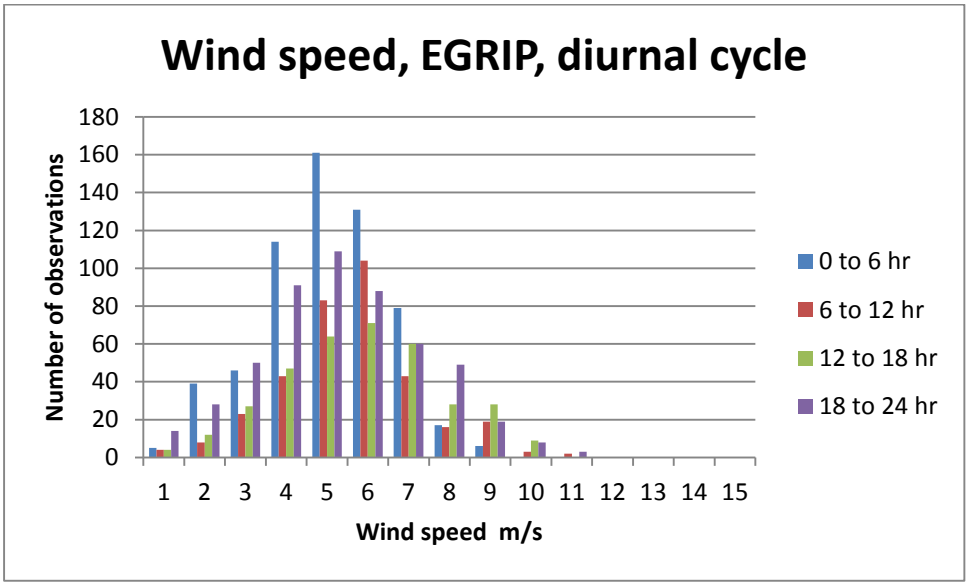
List of waypoints of 2015 traverse

Waypoint	route distance km	lat. dec. Deg	long. dec.deg	altitude m	deg	min	sec	deg	min	sec
1	**NEEM**	**77.45**	**-51.06**	**2484**	**77**	**27**	**0**	**51**	**3**	**36**
2	0 (6.6 km from NEEM)	77.461	-50.817	2453.9	77	27	40	50	49	1
3	10	77.413	-50.468	2472.1	77	24	47	50	28	5
4	20	77.367	-50.114	2490.1	77	22	1	50	6	50
5	30	77.321	-49.759	2508.1	77	19	16	49	45	32
6	40	77.277	-49.405	2525.5	77	16	37	49	24	18
7	50	77.232	-49.051	2542.9	77	13	55	49	3	4
8	60	77.187	-48.699	2560.1	77	11	13	48	41	56
9	70	77.142	-48.349	2577.1	77	8	31	48	20	56
10	80	77.097	-47.999	2594.1	77	5	49	47	59	56
11	90	77.052	-47.651	2611.1	77	3	7	47	39	4
12	**95 (Drilling 2 (265))**	**77.029**	**-47.479**	**2619.5**	**77**	**1**	**44**	**47**	**28**	**44**
13	100	77.006	-47.308	2627.8	77	0	22	47	18	29
14	110	76.96	-46.965	2644.5	76	57	36	46	57	54
15	120	76.913	-46.624	2661.1	76	54	47	46	37	26
16	130	76.867	-46.284	2677.2	76	52	1	46	17	2
17	140	76.821	-45.944	2693.4	76	49	16	45	56	38
18	150	76.772	-45.616	2709	76	46	19	45	36	58
19	160	76.721	-45.291	2724.7	76	43	16	45	17	28
20	170	76.66	-45.004	2740.3	76	39	36	45	0	14
21	180	76.581	-44.834	2754.2	76	34	52	44	50	2
22	190	76.493	-44.765	2766.1	76	29	35	44	45	54
23	**195 (Drilling 1 (165))**	**76.448**	**-44.771**	**2771**	**76**	**26**	**53**	**44**	**46**	**16**
24	295 (100 km)	76.1783	-41.1561	2760 est	76	10	42	41	9	22
25	395 (200 km)	75.8594	-37.6958	2730 est	75	51	34	37	41	45
26	437.5 (Edge)	75.7094	-36.2742	2701	75	42	34	36	16	27
27	449.1 (Fix N)	75.6667	-35.8833	2698	75	40	0	35	53	0
28	452.8 (Fix E)	75.6333	-35.8833	2694	75	38	0	35	53	0
29	**456 (EGRIP)**	**75.629900**	**-35.986700**		**75**	**37**	**48**	**35**	**59**	**12**
30	466	75.554848	-36.206372		75	33	17	36	12	23
31	476	75.479595	-36.423818		75	28	47	36	25	26
32	486	75.404144	-36.639067		75	24	15	36	38	21
33	496	75.341118	-36.816783		75	20	28	36	49	0
34	506	75.265311	-37.028077		75	15	55	37	1	41
35	516	75.189314	-37.237253		75	11	22	37	14	14
36	526	75.113131	-37.444339		75	6	47	37	26	40
37	536	75.036763	-37.649360		75	2	12	37	38	58
38	546	74.972985	-37.818654		74	58	23	37	49	7
39	556	74.896287	-38.019961		74	53	47	38	1	12
40	566	74.819413	-38.219279		74	49	10	38	13	9
41	576	74.742366	-38.416632		74	44	33	38	25	0
42	586	74.678029	-38.579612		74	40	41	38	34	47
43	596	74.600670	-38.773431		74	36	2	38	46	24
44	606	74.523145	-38.965357		74	31	23	38	57	55
45	616	74.445457	-39.155415		74	26	44	39	9	19
46	626	74.367607	-39.343628		74	22	3	39	20	37

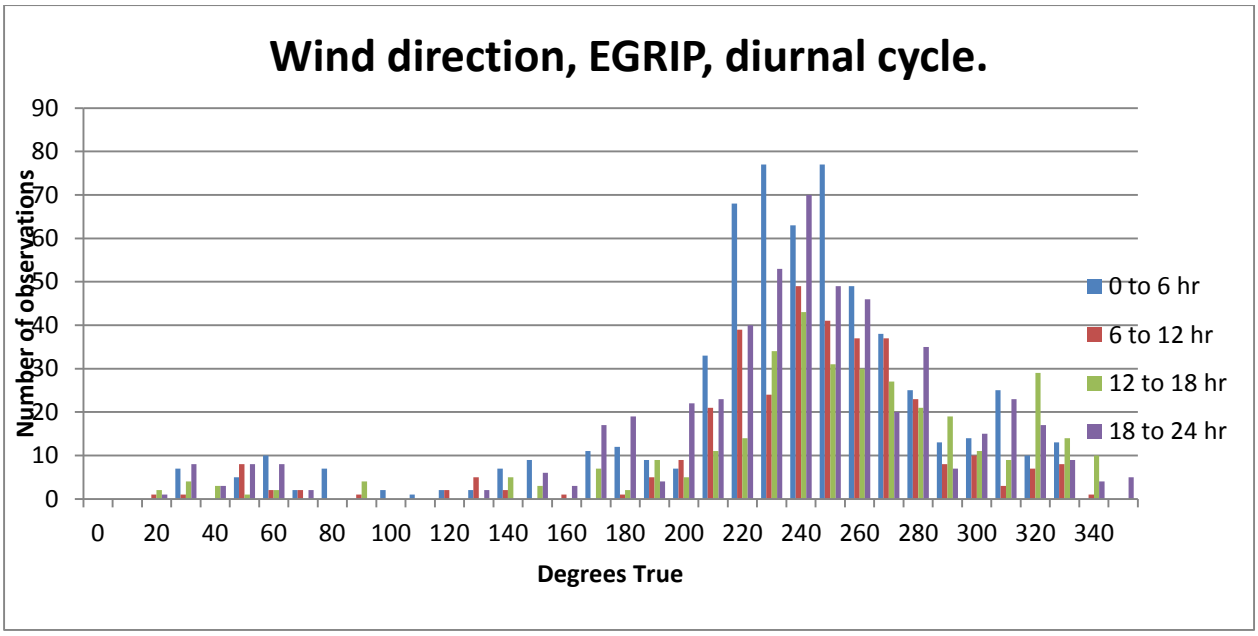
47		636	74.302610	-39.499080		74	18	9	39	29	57
48		646	74.224471	-39.683972		74	13	28	39	41	2
49		656	74.146177	-39.867087		74	8	46	39	52	2
50		666	74.067731	-40.048445		74	4	4	40	2	54
51		676	73.993497	-40.205827		73	59	37	40	12	21
52		686	73.906012	-40.281126		73	54	22	40	16	52
53		696	73.818500	-40.355632		73	49	7	40	21	20
54		706	73.730963	-40.429358		73	43	51	40	25	46
55		716	73.643401	-40.502316		73	38	36	40	30	8
56		726	73.560108	-40.563919		73	33	36	40	33	50
57		736	73.472239	-40.430987		73	28	20	40	25	52
58		746	73.401909	-40.257650		73	24	7	40	15	28
59		756	73.331506	-40.085393		73	19	53	40	5	7
60		766	73.252076	-39.893592		73	15	7	39	53	37
61		776	73.181208	-39.725133		73	10	52	39	43	30
62		786	73.110509	-39.557000		73	6	38	39	33	25
63		796	73.030682	-39.369698		73	1	50	39	22	11
64		806	72.968086	-39.169340		72	58	5	39	10	10
65		816	72.912809	-38.945014		72	54	46	38	56	42
66		826	72.850315	-38.694376		72	51	1	38	41	40
67		836	72.794496	-38.473498		72	47	40	38	28	25
68		846	72.738430	-38.253637		72	44	18	38	15	13
69		856	72.674986	-38.008189		72	40	30	38	0	29
70	**866 (GRIP)**		**72.618183**	**-37.792072**	**3232**	**72**	**37**	**5**	**37**	**47**	**31**
71	**896 (Summit Camp)**		**72.5797**	**-38.4556**	**3220**	**72**	**34**	**47**	**38**	**27**	**20**

Traverse route NEEM -> NGRIP until “drilling 1” and then on to EGRIP. From EGRIP up along the flow line of NEGIS to main NS ice ridge and then S to GRIP/Summit.

EGRIP weather 2014 from PARCA AWS



Wind speeds are in m/s. The ordinate is number of observations



When compared, it becomes clear that the wind is much more localized at EGRIP than at NEEM. Therefore a EGRIP skiway of 240 degrees true is within 20 degrees of the wind more than 60 % of the time. EGRIP is slightly colder than NEEM, but there are fewer cases with high winds. Finally, the annual accumulation of 11 cm ice eq. (30 cm snow) is less than half of NEEM.

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 nr	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^3, 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.

The costs of transporting boxes are considered to be part of the field expenses.

Useful container data

Standard containers

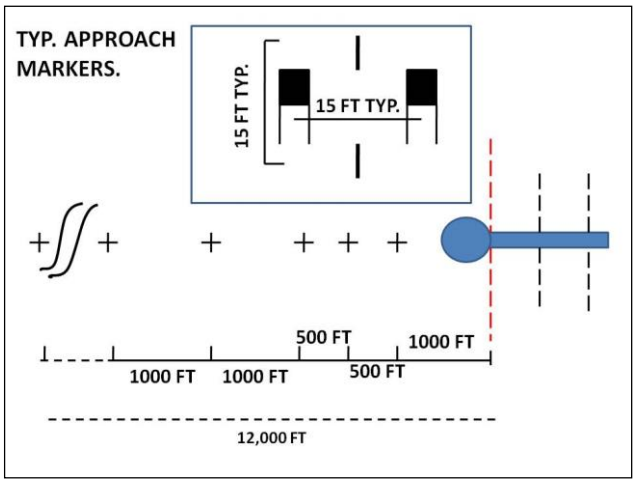
The following table shows the weights and dimensions of the three most common types of containers worldwide. The weights and dimensions quoted below are averages, different manufacture series of the same type of container may vary slightly in actual size and weight.

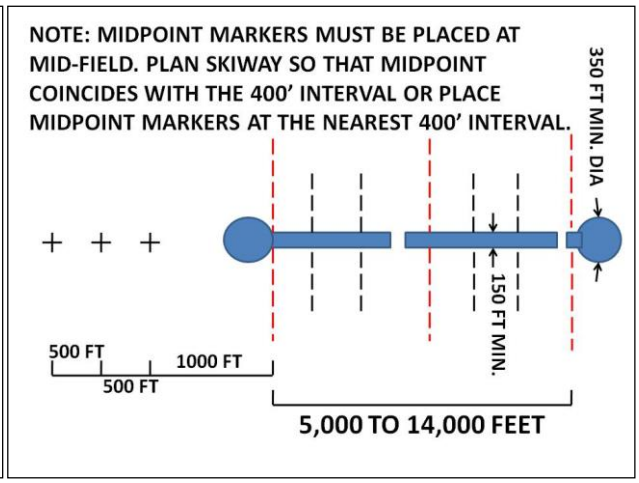
		20′ container		40′ container		45′ high-cube container	
		imperial	**metric**	**imperial**	**metric**	**imperial**	**metric**
external dimensions	**length**	19' 10½"	6.058 m	40′ 0″	12.192 m	45′ 0″	13.716 m
	width	8′ 0″	2.438 m	8′ 0″	2.438 m	8′ 0″	2.438 m
	height	8′ 6″	2.591 m	8′ 6″	2.591 m	9′ 6″	2.896 m
interior dimensions	**length**	18′ 10 $^{5}/_{16}$″	5.758 m	39′ 5 $^{45}/_{64}$″	12.032 m	44′ 4″	13.556 m
	width	7′ 8 $^{19}/_{32}$″	2.352 m	7′ 8 $^{19}/_{32}$″	2.352 m	7′ 8 $^{19}/_{32}$″	2.352 m
	height	7′ 9 $^{57}/_{64}$″	2.385 m	7′ 9 $^{57}/_{64}$″	2.385 m	8′ 9 $^{15}/_{16}$″	2.698 m
door aperture	**width**	7′ 8 ⅛″	2.343 m	7′ 8 ⅛″	2.343 m	7′ 8 ⅛″	2.343 m
	height	7′ 5 ¾″	2.280 m	7′ 5 ¾″	2.280 m	8′ 5 $^{49}/_{64}$″	2.585 m
volume		1,169 ft³	33.1 m³	2,385 ft³	67.5 m³	3,040 ft³	86.1 m³
maximum gross mass		52,910 lb	24,000 kg	67,200 lb	30,480 kg	67,200 lb	30,480 kg
empty weight		4,850 lb	2,200 kg	8,380 lb	3,800 kg	10,580 lb	4,800 kg
net load		48,060 lb	21,600 kg	58,820 lb	26,500 kg	56,620 lb	25,680 kg

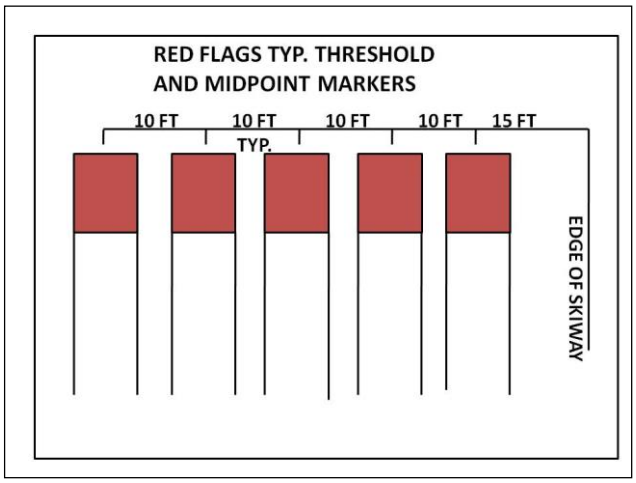
20-ft, "heavy tested" containers are available for heavy goods (e.g. heavy machinery). These containers allow a maximum weight of 67,200 lb (30,480 kg), an empty weight of 5,290 lb (2,400 kg), and a net load of 61,910 lb (28,080 kg).

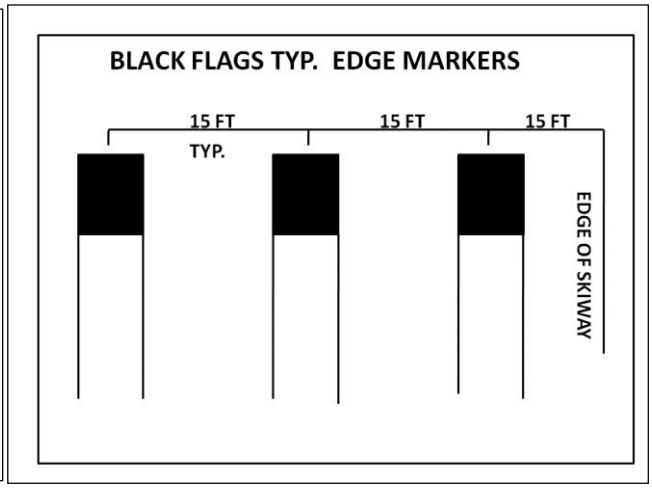
Skiway Marking:

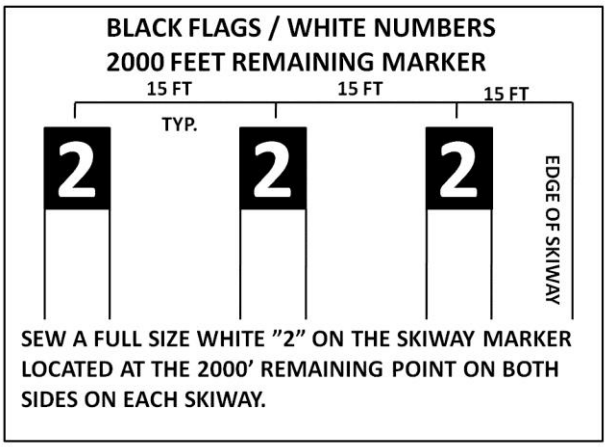
EGRIP ski way is 200’ x 12.000’ (Feet) – (choice of length 5,000’ – 16,000’, width 150’ – 400’)
Skiway design from AFI 13 – 217, 10.MAY 2007





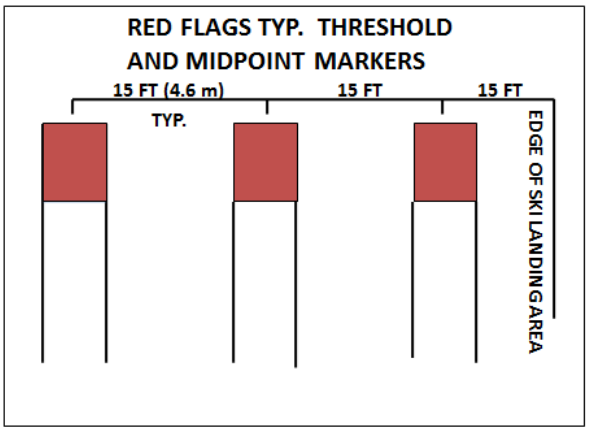


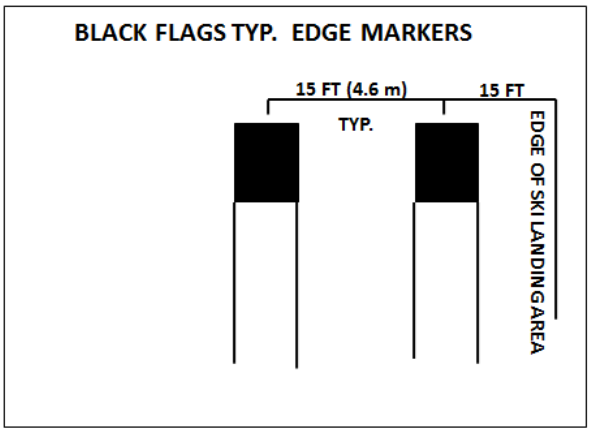


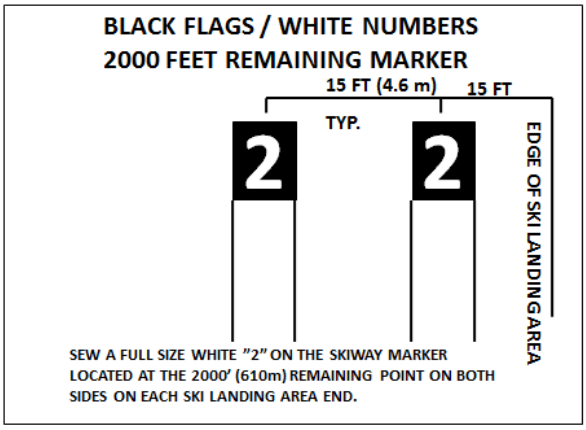


Ski Landing Area Marking (temporary skiway, last used at NEEM):

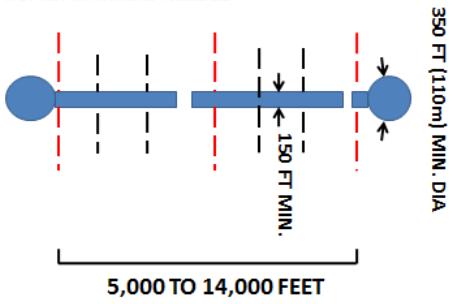
NEEM ski landing area will be 200' x 12.000' (Feet) – (choice of length 5,000' – 16,000', width 150' – 400'). Landing Area design from AFI 13 – 217, 10.MAY 2007







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

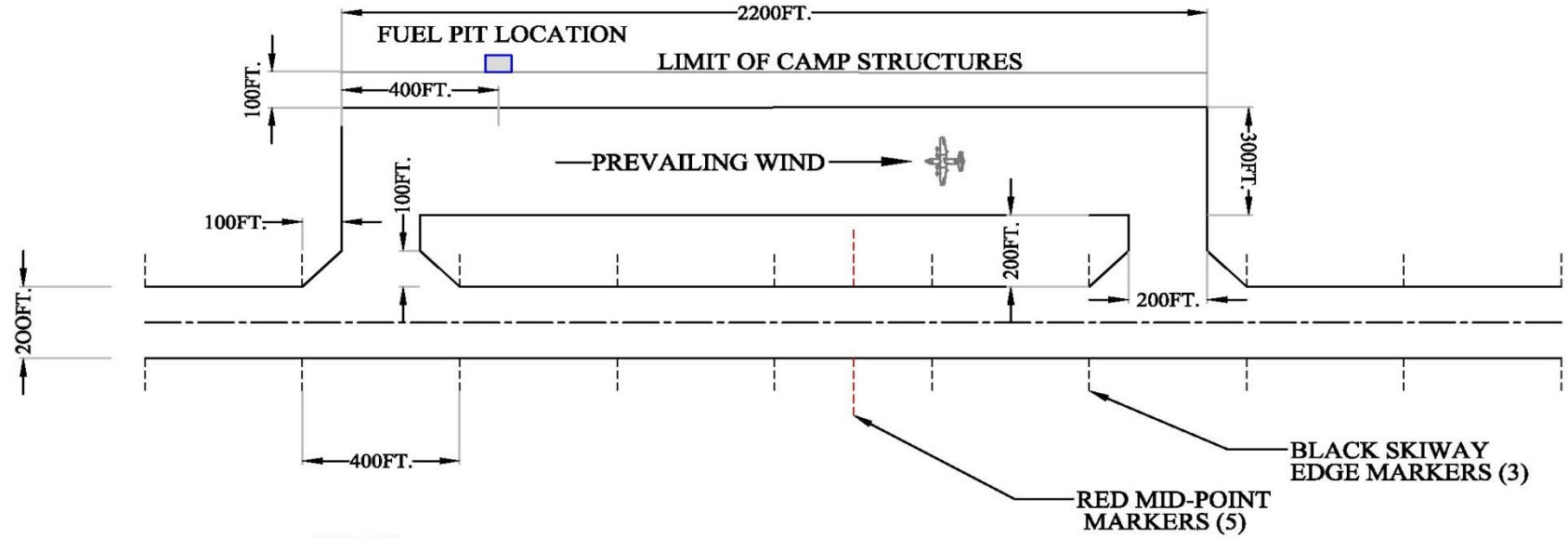


TYPICAL DIMENSIONS FOR MARKER BAMBOO:
2.4 m (94") x 2.5 cm (1 ")DIAMETER

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"

JCS 2011

Skiway official survey document:

May 29, 2015 survey in black **May 1, 2016 re-survey in red. June 8 2017 re-survey in blue. May 1 2018 estimate in brown.**

SURVEYOR: Jorgen Peder Steffensen (Document updated February 2018).

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. DUE TO ICE FLOW, EGRIP SKIWAY IS MOVING 150 FEET PER YEAR, BEARING 040

EGRIP CAMP (BGEG)

AIRFIELD REFERENCE POINT (ARP): CENTERLINE STATION 1640 (500 meter)
LATITUDE: 75-38-02.82 N LONGITUDE: 36-00-12.96 W
LATITUDE**: 75-38-04.26 N** LONGITUDE: **36-00-08.94 W**
POINT HAS MOVED 54 M, BEARING 35 DEGREES TRUE IN 11 MONTHS
LATITUDE: **75-38-06.32N** LONGITUDE: **36-00-04.90 W**
LATITUDE: **75-38-08.00N** LONGITUDE: **36-00-00.90 W**

ELEVATION: 8885 (2708 meter)
DISTANCE SKIWAY CENTERLINE POINT TO THRESHOLD:
APPROACH: 6000
DEPARTURE: 6000

MAIN SKIWAY (200 ft. x 12000 ft.)
APPROACH (24)
LATITUDE: 75-38-32.52 N LONGITUDE: 35-56-46.80 W
LATITUDE: **75-38-33.90 N** LONGITUDE: **35-56-43.08 W**
POINT HAS MOVED 51 M, BEARING 34 DEGREES TRUE IN 11 MONTHS
LATITUDE: **75-38-35.52N** LONGITUDE: **35-56-38.26 W**
LATITUDE: **75-38-37.10N** LONGITUDE: **35-56-34.30 W**

ELEVATION: 8871 (2704 meter)
DEPARTURE (06)
LATITUDE: 75-37-33.36 N LONGITUDE: 36-03-38.82 W
LATITUDE**: 75-37-34.80 N** LONGITUDE: **36-03-35.28 W**
POINT HAS MOVED 52 M, BEARING 32 DEGREES TRUE IN 11 MONTHS
LATITUDE: **75-37-36.62N** LONGITUDE: **36-03-30.74 W**
LATITUDE: **75-37-38.20N** LONGITUDE: **36-03-26.70 W**

ELEVATION: 8898 (2712 meter)
MAIN SKIWAY GRADIENT: 0.22%

SKIWAY AZIMUTHS from Approach True 24
True: 237 24'
Grid: unknown (mag. Declination Jan 2016: 28 42')

MAIN DOME (HIGHEST STRUCTURE)
LATITUDE: 75-37-47.52 N LONGITUDE: 35-59-37.44 W
ELEVATION: 8925 (top of structure) (2720 meter)
AGL:
DISTANCE TO SKIWAY CENTERLINE: 1640 (500 m)
DISTANCE SKIWAY CENTERLINE POINT TO THRESHOLD:
APPROACH 24 : 6000 (1829 meter)
DEPARTURE 06 : 6000 (1829 meter)

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^3]	13.7
Max vol ramp pallet [m^3]	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^3
Density of mogas	720 kg/m^3
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^3

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_o=1013.25 hPa, 288K standard air temperature at sea level (15 °C) and 6.5*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:

$$\boldsymbol{t_{Chill}[\,^oC] = \left(\frac{10.45 + 10\sqrt{v} - v}{22.034} \right) \cdot (t - 33) + 33\ [\,^oC; m/s]}$$

Current capability of electrical cables:

Area [mm^2]	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		**New system**
Yellow/green:	Protective ground	yellow/green
Blue	Neutral (0)	blue
Black	L1	brown
Brown	L2	black
Black	L3	grey

Attenuation of coaxial cables:

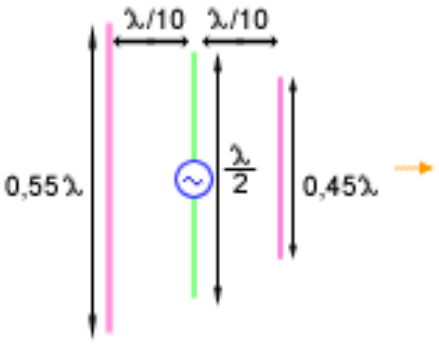
RG58/U attenuation per 30m:

10 MHz	1.5 dB at SWR 1.0.	+0.5 dB at SWR = 3
200 MHz	8.0 dB at SWR 1.0.	+1.2 dB at SWR = 3
1500 MHz	30 dB at SWR 1.0	+1.2 dB at SWR = 3

RG213/U attenuation per 30m:

10 MHz	0.7 dB at SWR 1.0	+0.4 dB at SWR = 3
200 Mhz	3.5 dB at SWR 1.0	+1.0 dB at SWR = 3
1500MHz	12 dB at SWR 1.0	+1.2 dB at SWR = 3

HF Radio Yagi-Uda Antenna:



From left to right, the elements mounted on the boom are called,

Reflector element, Driver element, Director element

The reflector is 5% longer than the driver element, and the director 5% shorter.

Typical dimensions for 3 element wide spaced 8093 kHz Yagi-Uda antenna:

Reflector length:	0.5*l	18.53m
Dipole length	0.475*l	17.60m
Director length	0.45*l	16.68m
Distance Reflector-Dipole	0.23*l	8.53m
Distance Dipole-Director	0.25*l	9.27m

With this length of the antenna the gain is expected to 7 dB, SWR<2

Coordination of LC-130 in Kangerlussuaq

Note regarding the coordination of CPS/EGRIP
and 109'th TAG activities in Kangerlussuaq.

This note is written to make the field coordination between CPS/CH2MHill, EGRIP 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 EGRIP and 109'th TAG personnel during periods with flights for the GISP and NEEM programmes.

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 EGRIP. 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 CPS and EGRIP in Greenland, plans and agreements have already been made between CPS/EGRIP 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 responsibles (Load masters and Aerial port) and the FOM's of CPS and EGRIP. Both FOM's need to be there since U.S. NSF activities and EGRIP 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 EGRIP 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 EGRIP 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 EGRIP 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.

Updated, February 25, 2018 by J.P.Steffensen

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 al 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: **Good:** Sharp horizon **Fair:** Identifiable
Poor: Barely discernable **Nil:** 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 VSAT satellite link, Iridium OpenPort and Iridium satellite communication. However, flight related communication close to camp is performed on VHF radio.

Call signs (Site Names): CPS Sonde, Summit Radio, East 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 109th. DMI needs at least three observations from camp to issue a local area forecast to the flight crews.

Summary of frequencies used in Greenland

VHF radio air band.	118.1	CNP AFIS
	118.3	SFJ Approach
	121.3	NUUK FIC
	121.5	**Call, Emergency**
	122.8	Air to ground, EGRIP or Summit
	126.2	SFJ Tower
VHF marine band:	Ch 8	EGRIP talk channel
	Ch 12	EGRIP 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 BENGTSSON
J.P.Steffensen, FL NEEM Camp
+8816 777 15686

Identity: Charlie-Golf Hotel Golf Foxtrot. Type: Turbo DC3 (Basler), Flying Visual Flight Rules. Safety equipment “M SHG/S” Departs NEEM 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.

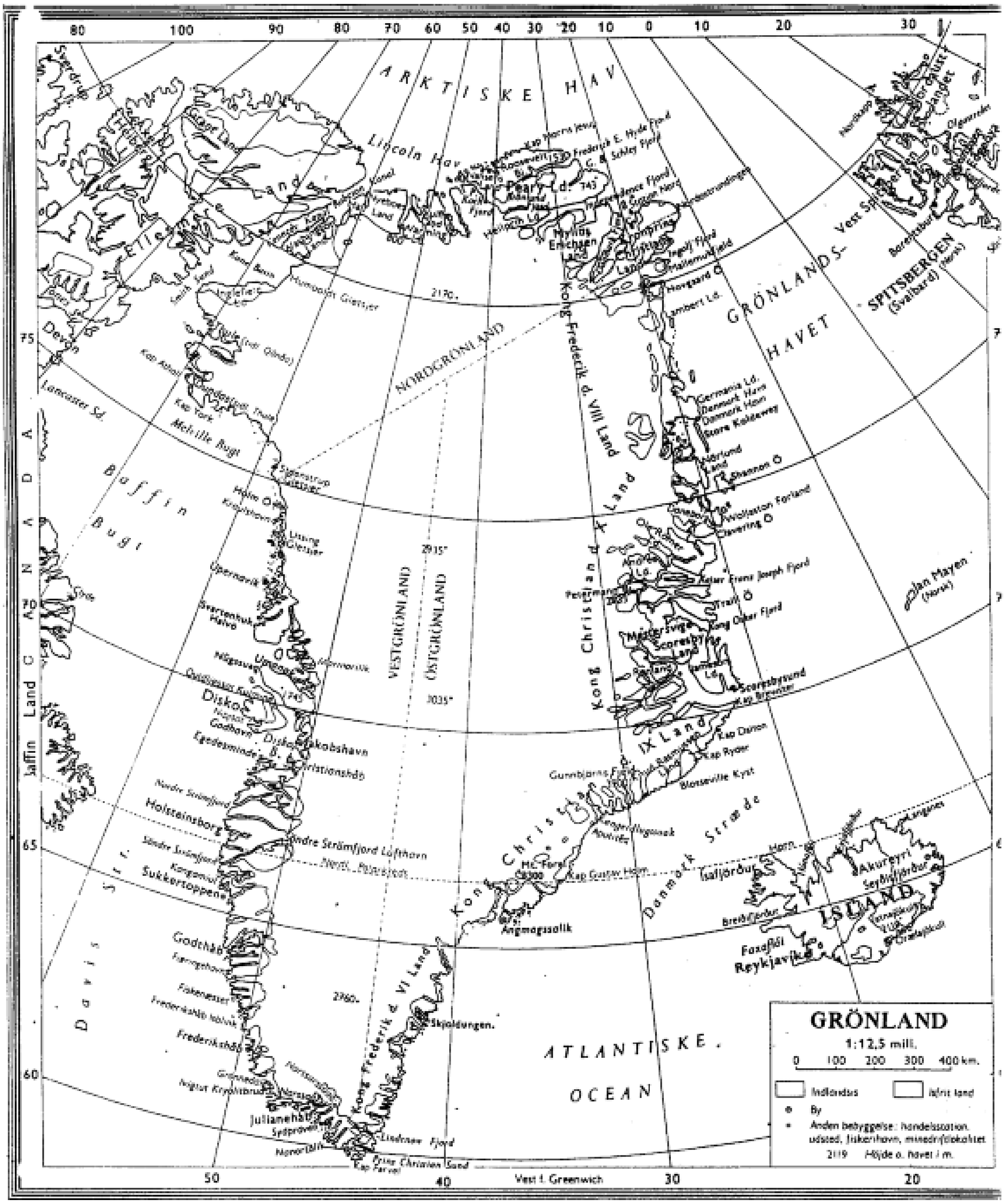
METAR and TAF:

METAR bgsf 111320z auto 08007kt 9999ndv ncd m30/m34 q0995=

METAR	METAR
Bgsf	Valid for Kangerlussuaq/Sdr Strømfjord
111320z	Issued the 11th day of the month at kl. 13:20UTC
auto	
08007kt	Wind from 80° at 7 knots
9999ndv	Visibility > 10 km
ncd	
m30/m34	Temperature -30 degrees C, dewpoint temperature -34 degrees C
q0995	Pressure 995 hektopascal (hPa)

TAF-FT bgsf 111058z 1112/1123 06006kt 9999 bkn150 tempo 1113/1123 4500 -shsn bkn024=

TAF-FT	Long TAF
Bgsf	Valid for Kangerlussuaq/Sdr Strømfjord
111058z	Issued the 11th day of month at 10:58 UTC
1112/1123	Valid from 09:00 and the next 11 hours
06006kt	Wind from 60° at 6 knob
9999	Visibility > 10 km
Bkn150	Broken at 15000 feet
Tempo	Periods with change
1113/1123	Between kl 13:00z and 23:00z
4500	Visibility 4500 meter (4,5 km)
-shsn	Light snowshowers
bkn024	Broken at 2400 feet


GRÖNLAND
1:12,5 mill.
0 100 200 300 400 km.
Indlandsis
Isfrit land
By
Anden bebyggelse: handelsstation, udsted, fiskerihavn, minedrift/lokalitet
2119 Höjde o. havet i m.
Vest f. Greenwich
ARKTISKE HAV
ATLANTISKE OCEAN
GRÖNLANDS-HAVET
Baffin Bugt
Davis Str.
Danmark Stræde
NORDGRÖNLAND
VESTGRÖNLAND
ÖSTGRÖNLAND
ISLAND
SPITSBERGEN (Svalbard) (Norsk)
Jan Mayen (Norsk)
Reykjavik
Akureyri
Angmagssalik
Godthåb
Julianehåb
Holsteinsborg
Sukkertoppen
Upernavik
Scoresbysund
Peary Ld.
Kong Frederik d. VIII Land
Kong Christian d. X Land
Kong Christian d. IX Land
Kong Frederik d. VI Land

Positions in Greenland

Positions in Greenland				
Site	N, deg	W, deg	N, deg, min	W, deg,min
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
GISP 2 (Summit)	72,58833	38,4575	72 34.78	38 27.27
GRIP	72,58722	37,64222	72 34.74	37 37.92
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

From	To	km
AEY	NOR	1780
AEY	CNP	600
CNP	THU	1532
CNP	DMH	686
CNP	RENLAND	161
DMH	NGT33	627
DMH	NOR	539
EGRIP	DMH	480
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

EGRIP Drilling Liquid Properties

A drilling liquid has been developed for NEEM based on ESTISOL 240 (coconut oil extract) mixed with COASOL. This liquid is non-polar, non-hazardous, no explosive risk, 'healthy', has a low environmental impact, and is available. BUT is twice the price of D-40/HCFC-141b and has 5 times the viscosity at -30'C. We have also included a new cold temperature version ESTISOL 140, which was tested and found suitable for Antarctic operations at Aurora basin in 2014, also as a one components fluid (see densities below). It has higher vapour pressure so it can be smelled and it dries out from clothing much faster.

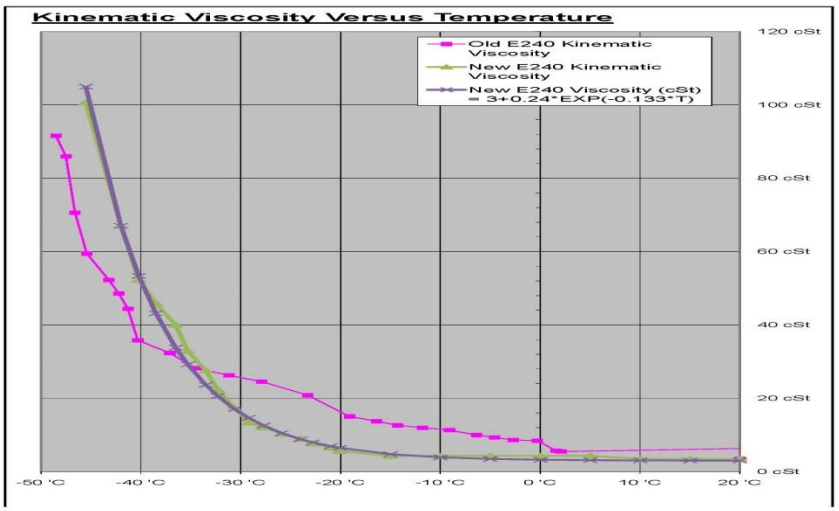
RECAP will utilize ESTISOL 140 in 2015 and EGRIP plans to use COASOL/ESTOSOL 240 in combination with ESTISOL 140 in the coming years.

TABLE .	**COASOL**	**ESTISOL 240**	**ESTISOL 140**
Manufacturer	DOW	DOW	DOW
Melting point	< - 60 °C	< -50 °C	<-89 °C
Boiling point	274 - 289 °C	255 - 290 °C	199 °C
Flash point	131 °C	136 °C	75 °C
Explosive limit	0.6 – 4.7 % (vol)	None	None
Vapour pressure (20°C)	0.004 kPa		0.03 kPa
Density (20°C)	960 kg/m^3	863 kg/m^3	865 kg/m3
Density (-30°C)	995 kg/m^3	898 kg/m^3	915 kg/m3
Viscosity (20°C)	5.3 cSt	3 cSt	1.0 cSt
Viscosity (-30°C)	25 cSt	13 cSt	2.2 cSt
Auto ignition temperature	400 °C	None	270 °C
Bio-degradable	Yes	Yes	Yes
Fire fighting equipment	Water spray, foam, CO_2	Water spray, CO_2 foam, dry chemical	Water spray, CO_2, foam, dry chemical
Special protection	No	No	No
Hazardous material	No	No	No
Explosive risk	None	None	None
Max. Workplace air levels	None	None	None
Price US$ equiv. in Kg	5.50 $/Kg	4.60 $/Kg	4.5 $/kg
Data on ESTISOL 240, 256, EGDA, & COASOL are from safety tests according to EU Safety 91/155/EU, article 204020, 203989, 205698 & 204872 respectively			

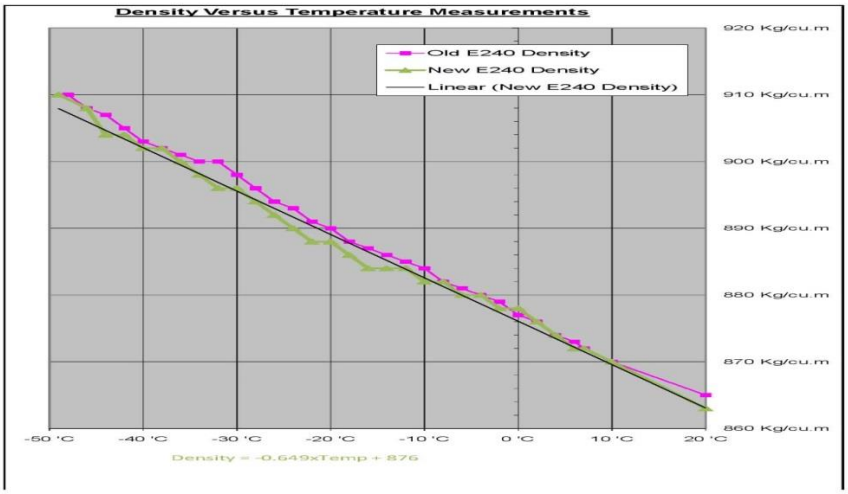
ESTISOL 240 was field tested as a drilling liquid at Flade Isblink, Greenland 2006 with a 4" diameter ice core drilled using the Hans Tausen electro-mechanical drill to a depth of 423.30m (260m of this core using the new liquid). The ice core quality was 'good', no problems encountered cleaning and processing the ice core, the mixture has a slippery feel with no discernable odour, and the liquid is very slippery when spilt on the smooth

wooden flooring. The Hans Tausen drill descents at speeds of 0.95m/s at drill liquid temperatures of -16 deg. C. By increasing the borehole diameter by 4mm (to 134mm) a 36% descent speed increase was achieved (1.28m/s). Further improvements can be achieved by adding a dead weight, reducing the pressure chamber diameter, or reducing the pressure chamber length.

The mix proportions for NEEM fluid , 2-3 litre ESTISOL 1 litre COASOL

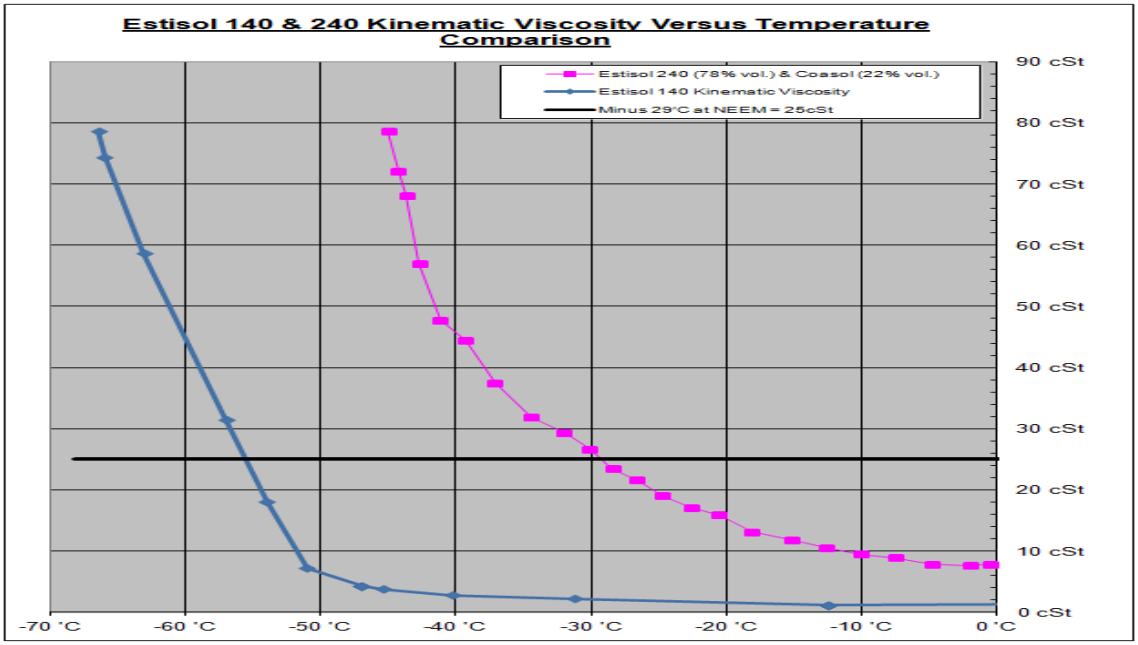


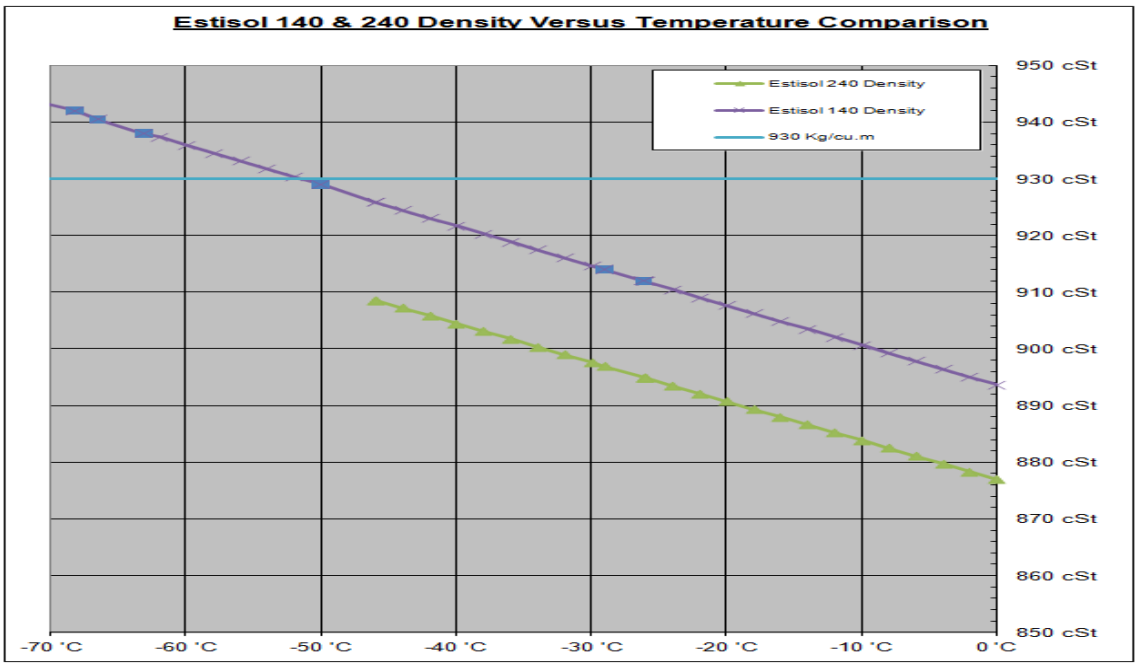
In February 2008, the supplier of Estisol 240 announced a change in specifications of the fluid due to a change in raw materials for the production (coconut oil has become too expensive) We therefore conducted a new set of measurements. As seen above, by cheer luck, this change has improved the fluid for our use. Purple: old Estisol 240; Green: New Estosol 240. Blue: simple model of kinematic viscosity vs. temperature.

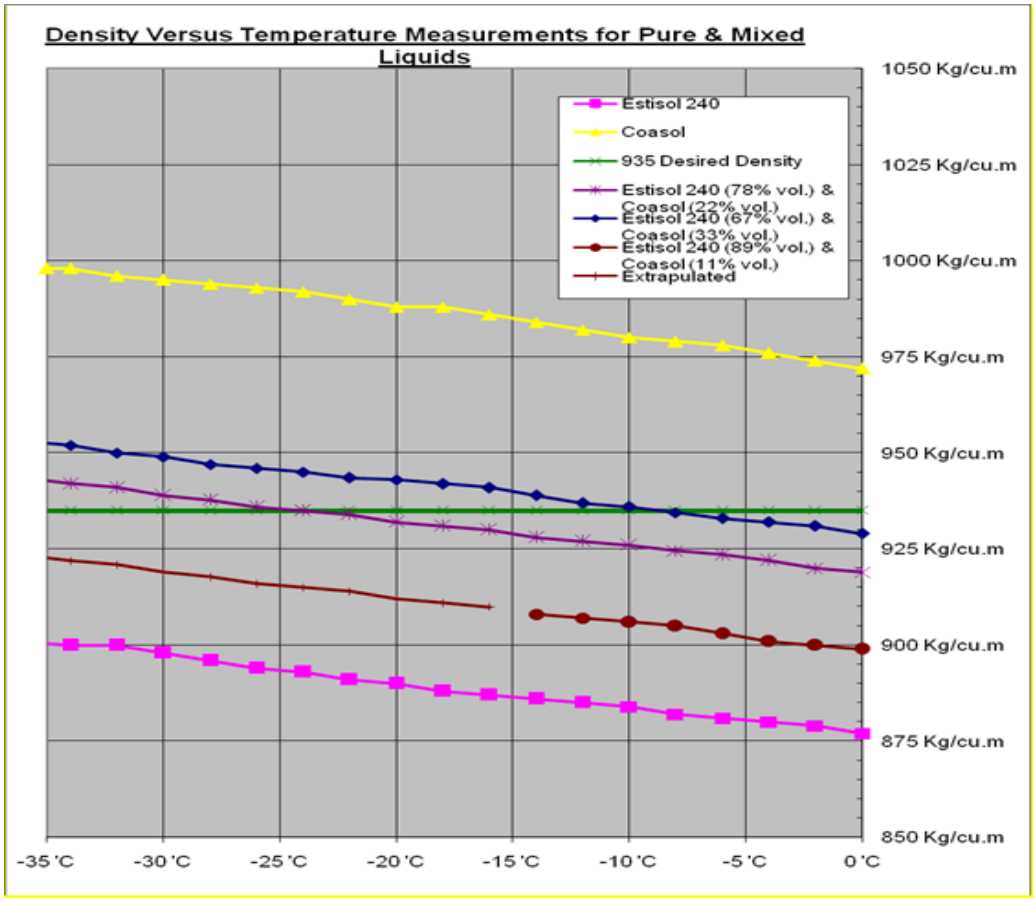


As seen above, the densities of new and old Estisol 240 are comparable.

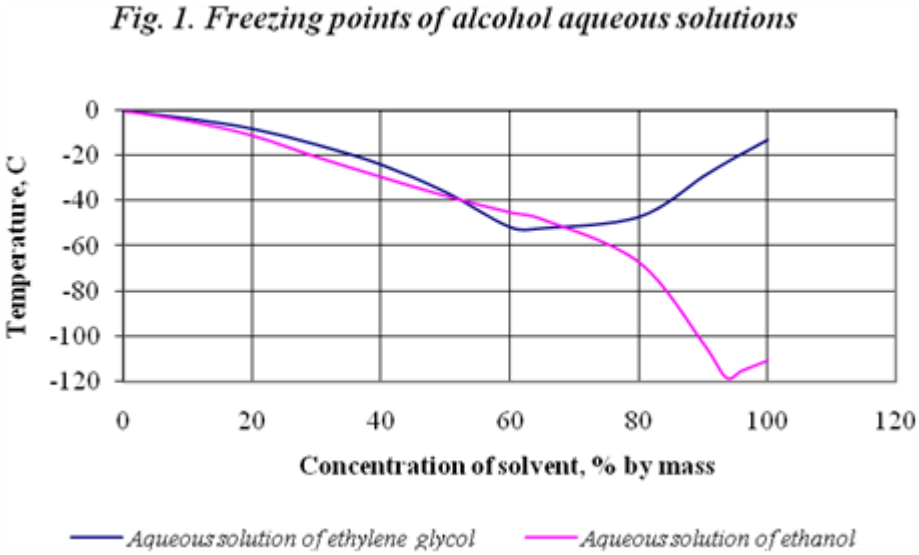
Properties of ESTISOL 140.



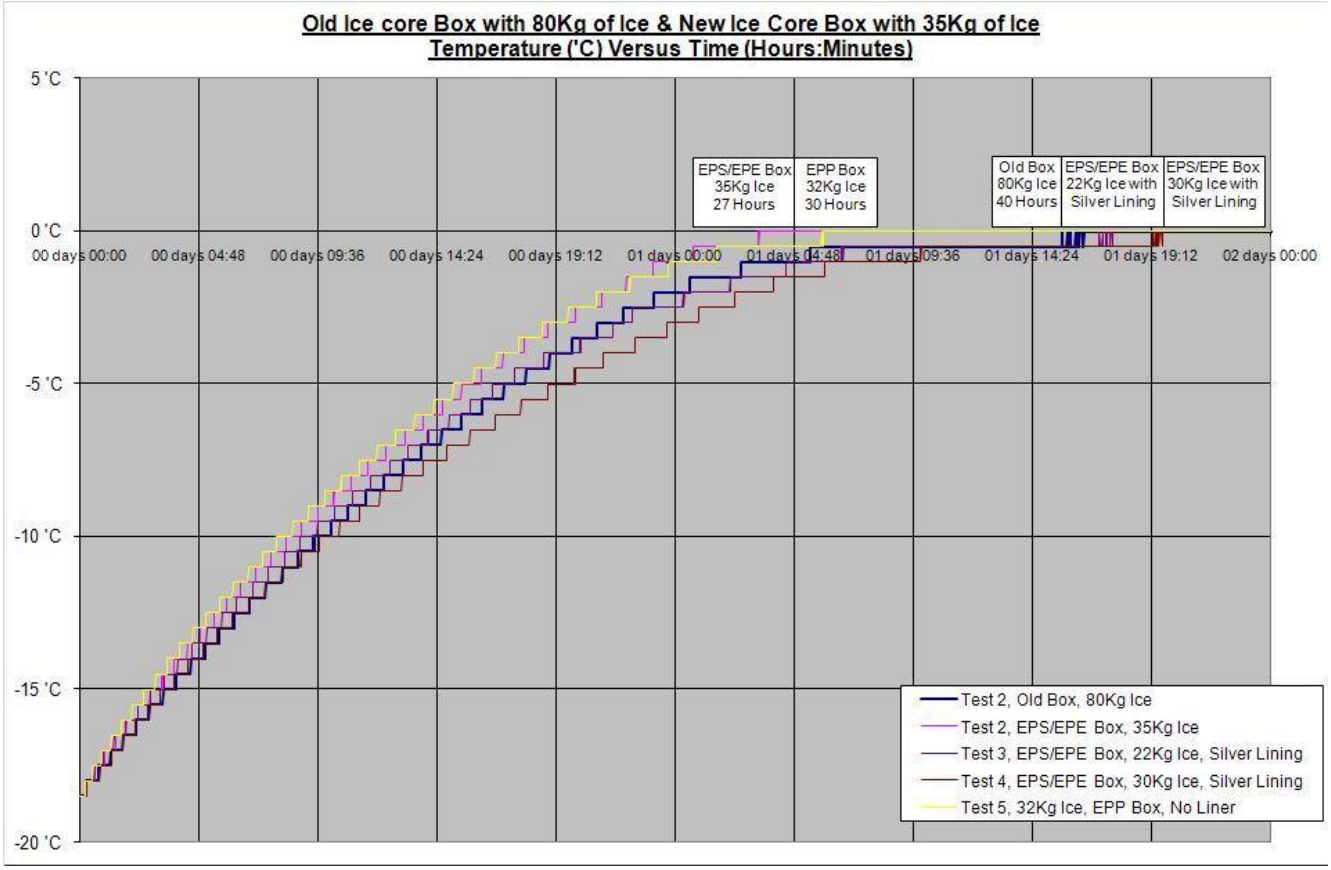




Above - density versus temperature of the drilling liquids in pure & in different mixes.



Ice core boxes, temperature measurements:



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 compliable 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 presurize the Gamow bag (use chrome inlet).
7. Do not connect the bag to oxygen.

Ambient conditions			**Inside Gamow bag when pressurized to 2 psi (103 mmHg)**		
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 outweights 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 stomac. 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.

Blood pressure	**Interpretation**	**Action**
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.