Field Instructions and Standards 2014

GEUS

Geological Survey of Denmark and Greenland
Ministry of Climate, Energy and Building

Colophon

Based on a concept by Asger Berthelsen in the early 1960s this booklet has been revised and extended yearly by the staff of first GGU, and later GEUS, especially 'Didom' Friderichsen and in the late 2000s by Julie Hollis. In 2010 the booklet was thoroughly revised by Michele Cittorio, Thomas Find Kokfelt and Marianne Vestergaard (editors) with contributions from Uffe Larsen, Frands Schjøth, Denis Martin Schlatter, Agnete Steenfelt, Bo Møller Stensgaard and Leif Thorning. Following a user survey after the 2011 field season it was decided that economic geology chapters be omitted to make the field guide relevant to all participants in GEUS fieldwork.

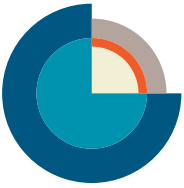
In 2014 conversion tables regarding distances, speed, geographical coordinates, temperature and wind have been added in Appendix B.

Editors 2014: Bo Møller Stensgaard and Marianne Vestergaard.

Lay-out: Henrik Klinge Pedersen
Cover photos: Ole Bennike, Henrik Nøhr, Pierpaolo, and Anders Scherstén.
Illustrations: Carsten Egestal Thuesen and Henrik Klinge Pedersen
Photos: Carl Egede Bøggild, Adam A. Garde, Jochen Kolb, Jakob Lautrup, Henrik Højmark Thomsen, Henning Sørensen and Dirk van As.
Print: Afet Neimi

The Danish Ministry of Climate, Energy and Building
Øster Voldgade 10
DK-1350 Copenhagen K

Field Instructions and Standards 2014



GEUS

Geological Survey of Denmark and Greenland
Ministry of Climate, Energy and Building

Table of contents

Equipment in function

Photo: Andreas Ahlstrøm

Introduction

This booklet is the result of experiences from geological fieldwork carried out by GGU (Geological Survey of Greenland) and GEUS staff for more than six decades. Initially the Field Instructions and Standards was merely a pamphlet setting out guidelines and standards on how to map and collect geological samples. Today it is an important tool to ensure common knowledge about safety equipment and safety procedures when undertaking fieldwork in Greenland

The GEUS administration in Copenhagen is the home base for all GEUS expeditions. GEUS may be contacted by phone, or e-mail, between 7.30 and 14.00 UTC (except weekends). See chapter 6.

Guidelines to GEUS fieldwork

The guidelines to GEUS fieldwork were established in the autumn of 1994 by a working group within GEUS' safety organisation in agreement with GEUS' management. The purpose of these guidelines is to ensure that fieldwork is carried out in a safe, responsible and flexible way. However, safety precautions and procedures of geological expeditions in Greenland have been in focus from the very start, and the guidelines presented are developed from these experiences.

A group of five to six persons in GEUS officially deals with safety during GEUS fieldwork. They invite comments and suggestions from all fieldwork participants. Please contact Kristine Thrane (kt@geus.dk) or Marianne Vestergaard (mve@geus.dk).

The following guidelines are valid for all expeditions run by GEUS:

The expedition/project leader has the responsibility for safety and for ensuring that all participants are aware of GEUS' safety guidelines.

New expedition participants must be thoroughly instructed in all relevant safety aspects of fieldwork, if possible before departure.

For expeditions with 10 or more participants the expedition leader must appoint a colleague as safety officer.

The safety officer must be briefed on all safety aspects during planning of the expedition, but is not otherwise involved in planning.

Rules and regulations

Being a so-called § 14 institution and having special obligations towards the Ministry of Industry and Mineral Resources of Greenland, GEUS is not required to obtain permission from the Government of Greenland in order to carry out fieldwork in Greenland. However, this is not always the case for expeditions and/or expedition members from other institutions or cooperating partners, whether Danish or from other countries – even when taking part in a

Kong Oscars Fjord
Photo: Jakob Lautrup

GEUS expedition. From February 2010 the Executive Order on Access to and Conditions for Travelling in Certain Parts of Greenland sets out the conditions valid for most travel activities going to the area of the National Park and the inland ice. The rules are administered by the Expedition Office in Nuuk under the Ministry of Domestic Affairs, Nature and Environment, read more:

http://naalakkersuisut.gl/en/About-government-of-greenland/travel-activities-in-remote-parts-of-greenland

Prior to the beginning of the fieldwork season GEUS will inform the Ministry of Industry and Mineral Resources of Greenland about all GEUS fieldwork planned to take place in Greenland the following year. Non-GEUS participants in GEUS fieldwork must make sure to obtain all necessary permissions in due time before departure. No later than 14 days prior to departure GEUS has an obligation to send a list with the names of the participants of all planned scientific expeditions, stating dates of arrival and departure, to the Expedition Office in Nuuk. This list will be forwarded to the Marine Rescue Coordination Center (MRCC), Nuuk, who will coordinate a rescue operation anywhere in the country. Details regarding expeditions must be sent in due time to the logistic coordinator at GEUS.

Other permits required of GEUS are

- Radio licence permit
- Firearm permit (required for expeditions in the National Park, otherwise when applicable)
- Export permit to bring out samples from Greenland (when applicable)

Application forms for the permits mentioned above can be found at GEUS' intranet: Intranet > Retningslinjer og arbejdsgange > Feltarbejde
Expedition and project leaders are responsible for obtaining all necessary permits.

Confidentiality

Participants in GEUS fieldwork, whether or not associated to GEUS by contract, are subject to provisions on confidentiality, and fully accept to observe the contents of GEUS' 'Declaration of professional secrecy' cited below.

"During my stay [with GEUS] I may obtain knowledge of confidential information. I hereby undertake not to make any unwarranted transfer or use of such confidential information neither at GEUS nor outside GEUS. Information is confidential when by law or any other legal provision it is named as such or when it otherwise is necessary to keep the information confidential in order to consider substantial governmental or private interests. Reference is made to the Danish criminal code (borgerlig straffelov) §§ 152-152ff and the Danish administrative code (forvaltningsloven) § 27.

I am aware that, according to legal provisions, a confidentiality period of 5 years applies to all reported data on the oil and gas fields.

Furthermore, I undertake, during my stay at GEUS, to follow the instructions which apply to GEUS' employees, including safety instructions and instructions regarding the safegarding and handling of GEUS' data.

The obligations determined in this statement do not cease at the end of my stay with GEUS."

Professional secrecy and confidentiality is especially important when external parties participate in the GEUS fieldwork, or in other ways are involved (e.g., external research teams using the GEUS logistics platform, subcontractors, and exploration and mining companies). Consider what you say and to whom. As a principle, no new observations and findings are to be discussed before they are published. Professional secrecy and confidentiality should also be considered while travelling and during radio communication.

Logistics

Logistics in Greenland are often complex and require detailed planning, planning that often has to be changed due to weather conditions or other circumstances.

In some cases fieldwork will be operated out of a base camp. Large expeditions often set up their own GEUS operated base camps with communication, emergency, kitchen and accommodation facilities. Base camp can also be located on a ship. The base camp can be operated by GEUS or by external contractors. When dealing with smaller expeditions, 'base camp' can simply be a local contact or partner in a town or settlement.

Daily transportation and logistics may often be supported by helicopter. In some areas of Greenland fieldwork can be carried out from cutters or zodiacs.

Travel expences

Tickets from Copenhagen to Greenland are usually booked by GEUS. Participants from abroad usually book their own return ticket to/from Copenhagen. Unless otherwise agreed GEUS pays travel expenses against documentation. Public transport should be used when possible (e.g. airport bus).

Overnight hotel expenses are paid by GEUS. Normally the project leader will pay the bill. However, you must be prepared to pay for hotel accommodation and meals and get receipts.

Settling of accounts

After the field season you are requested to settle the account by sending in original documentation for all expenses incured in connection with fieldwork to the relevant GEUS secretary. Please remember to retain your tickets and boarding passes. Apart from having your expenses refunded the settling of accounts may also be payment of daily allowances, cf. contract.

Employment with GEUS

GEUS co-operates with individuals, companies and surveys from both Denmark and other countries. Persons participating in GEUS' expeditions in Greenland that do not have permanent employment within GEUS, must have a contract outlining rights and duties in connection with participation in the fieldwork.

Some fieldwork participants sign a contract with GEUS as associated consultants or as post doc. scientists. These persons must take out their own travel

insurance covering the full period of the fieldwork.

There may be participants who co-operate with GEUS sharing our logistics - without a contract. GEUS has no responsibility for these participants' security with respect to insurance coverage.

Paperwork before leaving

As a GEUS employee or if you have signed a contract with GEUS, information regarding your health condition, next of kin, etc. is required. Below is a list of formalities and forms that must be filled out and submitted before departure.

- insurance
  (if associated consultant), see below
- Personal Information Form
- Declaration of Health
- Statement on the use of field equipment

GEUS employees must apply for compensation related to fieldwork (merarbejde) before they leave using the following form:

- Udbetaling af merarbejde

Upon return to Denmark, GEUS employees will have disbursed all allowances and compensations after delivering a neatly written or "typewritten" copy of their log book (field diary) and/or files with their digital captured data and the form below properly filled out.

- Udbetaling af resultatløn og merarbejde

All forms (except for contracts) mentioned in this section can be found at the Intranet following the path: Intranet > Retningslinier og arbejdsgange > Feltarbejde.

Courses

Courses aimed to improve security during fieldwork in Greenland are compulsory and must be renewed every third year. Some courses are only necessary in some areas of Greenland and some only under certain circumstances.

- First aid course (compulsory)
- Security in the high Arctic course (compulsory from 2013)
- Firearms course (theory and practice) – if fieldwork
  implies the risk of meeting polar bears (compulsory)
- Glacier security – if fieldwork implies working on glacier(s) (compulsory)
- Zodiac training (theory and practice) – if fieldwork implies working from zodiacs (compulsory).
- Security at sea – if fieldwork is carried out mainly from a ship or vessel (compulsory).

Principally all participants in GEUS fieldwork should meet the requirements with respect to having the necessary security education. However, it is not always practically possible for external participants to attend the GEUS courses.

It is the responsibility of the expedition or project leader to evaluate and decide if participants have the relevant 'security background' and to ensure that all participants have a thorough introduction to all safety aspects at the beginning of the field season.

Personal field equipment

GEUS refunds expenses for personal equipment against documentation, to a maximum amount (ask your responsible GEUS project leader). The form 'Statement on the use of field equipment' should be signed by the relevant department's leader before purchasing field equipment. The reimbursement can only be given to personal equipment that is bought for use during GEUS fieldwork.

A list of recommended personal equipment can be found at page 19.

Insurance

GEUS employees are covered by 'Statens tjenesterejseforsikring'. A travel insurance card can be obtained from the accounts department (Budget og Regnskab). Participants in GEUS fieldwork, having signed a temporary employment contract with GEUS, are essentially covered under the same conditions as GEUS employees. Further information can be found at GEUS' Intranet.

It is recommended that you also check out any private injury insurances you already hold.

Associated consultants, post doc. scientists participating in GEUS fieldwork must take out their own travel insurance covering the full period of fieldwork. GEUS has no responsibility for the security of participants in fieldwork without a contract with respect to insurance coverage.

In case of an accident

If an accident occurs, all persons involved are responsible for taking action. Depending on the situation, this may initially involve first aid, emergency calls, and notification to the police. Carefully study the line of communication in case of emergency at page 37.

Serious injury to any participant in GEUS fieldwork must be reported to daily security leader at GEUS, Uli Heyden, phone: +45 91 33 34 53, as soon as possible.

It is the responsibility of the expedition or project leader that a short report is written, describing what happened, where and when it happened, who was involved, what kind of damage occurred, and what action was taken. This information should also be part of the general evaluation of the field season to prevent a similar situation from occurring again.

See first aid emergency action principles at p. 40
See Radio Emergency Action at p. 40
See Emergency procedures in the back of this booklet.

1 Equipment

Equipment for fieldwork should aim at giving the maximum security possible while working and camping in sparsely inhabited or completely isolated areas. Fieldwork in Greenland requires extra of materiel and equipment due to its harsh and variable climate. GEUS (and before that GGU, Geological Survey of Greenland) has many years of experience of sending fieldwork expeditions off in a safe and well-organised manner to all parts of Greenland. The equipment and procedures are evaluated every year and improved where necessary. Please hand in comments to the expedition leader if you have suggestions for improvements.

1.1. Standard field equipment

GEUS' equipment section supplies all field expeditions with field equipment. Field equipment should be ordered as soon as possible and at least one month before leaving for fieldwork. Communication equipment — described in chapter 3 – must also be ordered from GEUS' equipment section in due time.

GEUS' equipment section endeavours to deliver first class, reusable camping supplies and encourages users to look after it well. Broken or lost equipment should be listed, and a report sent to the equipment section as soon as possible after the field season. Please mark damaged equipment clearly, to avoid the possibility of it being redistributed without repair.

GEUS' equipment section delivers the equipment according to a filled 'equipment order form'. The equipment order form can be found at an internal GEUS-drive: Z:/Udrust_bestilling. Contrary to previous years, camp equipment is no longer delivered as a 'standard package' but according to specific needs.

Expedition leaders, project leaders and field expedition members responsible for ordering of the field equipment are encouraged to arrange a meeting with GEUS' equipment section at Valhøjs Allé, Rødovre (phone: +45 29 13 04 45) in order to ensure that they have the field equipment best suited for their purposes. Remember that each team is responsible for selecting its own hammers and chisels.

Basic equipment for a two-person camp consists of:

- GEUS basic equipment
- Office box
- Kitchen box
- Provisions
- GEUS special equipment (if required)
- Private equipment (see list of Recommended personal equipment on page 18).

1.2 The solar panels

In 2009 GEUS purchased 15 new solar panel sets with chargeable batteries that support the use of electrical devices in the field, such as the Iridium satellite phone, the VHF radio, laptops, etc. The battery supplies a selectable range of voltages from 5V to 19V. The specifica-

GPS reading in West Greenland

Photo: Jochen Kolb

GEUS basic equipment (two person team)

- 2 lightweight tents
- 2 sleeping bags
- 2 sheet sleeping bags
- 2 rucksacks
- 1 radio with accessories (antenna, batteries)
- 2 lightweight insulation mattresses
- 1 tarpaulin (plastic)
- 1 water container or plastic bucket
- 2 pieces of flourescent signal cloth
- 1 medical box (see below)
- 10-15 l of kerosene/ paraffin/JP1 jet fuel*
- Newspapers for packing rock samples
- 1 kitchen box (see below)
- 1 office box (see below)
- 1 kitchen tent

Office box *(contents)*

- Crayons, set
- Field notebooks
- Various paper pads
- Transparent paper pad
- Wulff stereo nets
- 2 pencil cases (including commonly used colours)
- 3 Sample docket books
- Spare battery pack (4x1.5 v. AA)
- 1 folding ruler (2 m)
- Duct tape (Danish: gaffatape)
- Araldite epoxy glue
- 2 heliographs
- Various

Kitchen box *(contents)*

- 2 primus stoves Optimus 111
- Set of cooking pots
- Frying pan
- Plates, mugs and cutlery
- Dish washing equipment
- Small plastic bags
- 10 black plastic sacs
- 2 thermos flasks
- Various

tions and how to operate the solar panels are provided along with the boxes in which they are delivered.

1.2.1 Transport and storage
The battery's switch should be placed on OFF. This is important, otherwise the batteries will discharge and be ruined.

1.2.2 Recharging
Place the solar panels so that they get as much sunlight as possible on the panels. Turn the battery's switch to ON. The light on the charging regulator shows red, while the cell charges, and turns green, when the batteries are fully charged. (A few charging regulators are without lights.) The inverter should be turned OFF, when not in use.

The cell can be used, while it charges.

1.2.3 Voltage
12 volt DC: The battery's switch is placed on ON. Connect the charger/equipment to the cigarette lighter socket.

220 volt AC: The battery's switch is placed on ON. Switch on the inverter. There is now 220 volt AC in the triple socket.

1.2.4 Good advice and comments
The solar panel system is a compromise between capacity and weight/volume, so

GEUS reco-package (two person team)

- 1 lightweight tent
- Sheet sleeping bags
- 2 sleeping bags
- 2 aluminium blankets
- Coffee, tea and juice
- Soup and 2 freeze dried meals
- 2 sets of meal kits (plate, cup, knife etc)
- 1 inflatable water container
- Set of cooking pots
- 1 primus stove Optimus 111
- Esbit fuel tablets
- 1 box of matches
- 1 bottle for kerosene/ paraffin/JP1 jet fuel
- 1 roll of toilet paper
- 2 wind-proof sacks
- 1 heliograph

there is a limited output. 220 volt inverter uses 4 watt (0.35 Ampere-hour) as soon as it is switched on. This means that it uses 4 watts more than it provides. If you avoid turning it on, e.g. by charging from 12 volt, then you can save power. If you forget to turn off the inverter, it will use 1 Ampere-hour in 3 hours without you getting any power.

1.2.5 Battery status
Use the digital multimeter, adjust to the 20 volt DC range.

13.8 volt	Battery is charged (under charging)
13.2 volt	Battery is charged (not under charging)
12.0 volt	Battery is half charged
10.8 volt	Battery is flat
10.5 volt	Stop use and charge as soon as possible
<10.0 volt	You are about to ruin the battery.

1.3 Special equipment (firearms and dangerous goods)

Teams with special equipment requirements (cameras, geiger counters, firearms, mountaineering equipment etc.) must make advance arrangements with GEUS. Expedition members are invited to bring their own equipment if they prefer to do so, but do avoid ordering or having unwanted doublets.

Firearms are provided for teams working in areas with dangerous animals (musc-ox and polar bears). Firearms for field-work can be ordered from GEUS' equipment section.

Dangerous goods such as acids, explosives, ammunition, high/low pressure tanks, etc. must be transported by specialised carriers. Please contact GEUS' equipment section, if you plan to bring any kind of dangerous goods into the field. Special permits are required for the transportation of such goods and must be applied for well in advance before the field season. Please also note, that special regulations regarding transportation of dangerous goods also applies for the helicopters that are used in the field.

1.4 Emergency field equipment

A personal first aid kit is provided for each participant working in the terrain as well as the medical box for field teams (see page 16). The medical box has to be kept in a central place in the team's camp.

The first aid kit has to be with all expedition members at all times when field-

work is carried out. At the beginning of the season put the first aid kit and the signal pencil into your rucksack (or in a pocket) together with other safety equipment such as wind sack, signal cloth, heliograph, waterproofs, and a box of matches.

When doing reconnaissance in the field it is recommended that each field team brings along a reco-package in order to be able to cope with an unplanned/prolonged stay in the field due to bad weather or other unexpected circumstances. Reco-packages can be ordered at GEUS' equipment section.

Box of matches. An open fire is regarded as an emergency signal.

Heliograph. A heliograph is used to attract the attention of a helicopter by flashes of sunlight. If the sun is in a suitable position you may signal for many miles by means of a heliograph.

Wind-proof sack. A wind-proof sack is a piece of watertight material, big enough to sleep or sit in. A wind-proof sack can be life-saving if you loose your tent in a storm.

Brightly coloured outer garments. It is generally difficult to locate people in the field. Therefore participants must wear brightly coloured outer garments during fieldwork (e.g. orange, yellow or red), that cover a major part of the body, i.e. trousers and/or anorak/jacket (see page 10). Brightly coloured patches are not sufficient.

1.4.1 Safety equipment in relation to small boat operations

Life-jackets. Officially approved life-jackets must always be used during fieldwork from all small boats. GEUS supplies approved inflatable life-jackets; individual requests for alternative types of life-jackets can be accommo dated (but allow the equipment section time for purchase!). See further instructions in paragraph 4.4.1 (p. 47).

Life-line. A lifeline is placed in the buoy that comes with zodiacs ordered from the equipment section

Survival suits. Survival suits are required (mandatory) whenever working from zodiacs or smaller boats in Greenland. See further instructions in paragraph 4.4.1 (p. 47).

1.4.2 Other safety equipment

Firearms. Firearms are provided for teams working in areas with dangerous animals. See paragraph 4.10 (p. 54).

Crash helmets. Crash helmets must be used at all times when riding; private use of motorbikes is not allowed. Crash helmets must be individually purchased, so it should be established before departure from Copenhagen who may use the motorbikes during fieldwork. It is recommended that crash helmets are also used when motorcycling in base camps.

Safety helmets ('hardhats'). Safety helmets must be used during drilling and sling operations (by cranes or helicopters). Safety helmets are recommended during fieldwork when there is a risk of falling stones. In contrast to crash helmets, safety helmets may be adjusted to size.

Safety shoes/boots. It is suggested to wear safety shoes or boots when handling large amounts of heavy goods or equipment.

Safety goggles. Collecting and trimming rock samples is potentially dangerous to the eyes. GEUS recommends use of the goggles supplied as part of GEUS's standard equipment.

Medical gloves. It is recommended that everyone makes use of the medical gloves supplied with the medical box when dealing with incidents where blood or other body liquids (which may carry HIV virus) could be transferred from one person to another.

1.5 Medical Box

GEUS has two types of medical boxes, a larger for the base camp and a lighter version for field teams. Each field team's medical box contains two personal first aid kits (complete list on page 16-17). The medical boxes have been assembled according to medical advice from Hans Ole Bisgaard-Frantzen, military doctor for the Sirius patrol and GEUS' medical consultant. The contents of all medical boxes are revised once a year. The contents of a field team's medical box consist of two small first aid booklets and the following drugs and dressings.

PAINKILLERS (LISTED BY INCREASING STRENGTH)

Drug	Purpose	Dosage	Comments
Pamol® 500 mg tablets ***Paracetamol***	Ordinary painkiller	1-2 tablets for weak to moderate pain. May be repeated after 2-3 hours.	
Temgesic® * 0.2 mg tablets ***Buprenorphin*** *	For severe (unbearable) pain	1 tablet dissolved under the tongue. May be repeated after 3-4 hours.	* Morphine — requires medical prescription **Δ** Induces drowsiness. **Δ** May induce nausea and vomiting. Included in the emergency pack.

ANTIBIOTICS

Ciprofloxacin Hexal® 500 mg tablets ***Ciprofloxacin***	To treat serious infection, e.g. pneumonia, appendicitis, diarrhoea (coli)	1 tablet a day for at least 5 days, even if symptoms have subsided.	Requires medical prescription Can be taken even if allergic to penicillin.

SKIN OINTMENT

Diproderm® 0.05 % cream ***Bethamethason-dipropionat***	To treat irritated red skin or rash (eczema) or allergy to mosquito bites	Apply a thin layer twice a day	NOT to be used as a precaution, only as a treatment.
Flamazine® cream 1 %. ***Silver sulfadiazine***	To treat burns	Apply a thin layer	For severe burns, e.g. of the hands, apply and cover with a plastic bag.
Rescue creme *bl.a. Klorhexidin*	For disinfection and cleaning of smaller wounds		

STOMACH PAINS

Imodium® 2 mg tablets ***Lobromid***	Astringent, to treat diarrhoea	2 tablets immediately, 1 tablet per defecation	
Dulcolax® 5 mg tablets ***Bisacodyl***	Laxative, purging	1 tablet in the evening. Works next morning.	
Kuracid® 200 mg tablets ***Ranitidin***	To treat acid stomach, symptoms of stomach ulcer.	1 tablet, up to twice daily	

EYE, EAR AND NOSE TREATMENT

Oxyprocain® 0.4 % Eye ointment	To treat snow blindness or a foreign body in the eye	Apply inside the lower eyelid if you feel pain	Local anaesthetic. The eye must be protected against dust etc.
Fucithalmic® 1 % Eye ointment	To treat infection of the eye	Apply inside the lower eyelid two times a day	Also for local infection, e.g. in the external ear

MISCELLANEOUS

Drug	Purpose	Dosage	Comments
Burana® 600 mg tablets ***Ibuprofen***	To treat swollen joints	1 tablet 3 times a day for minimum 4 days, even if symptoms subside	May give stomach pains – if so, stop the treatment and consider contacting a doctor.
Δ Tavegyl® 1 mg tablets ***Clemastin***	To treat allergic reactions, hay fever etc.	1-2 tablets as required	**Δ** Induces drowsiness **Δ**
EpiPen® 0,3 mg autoinjector	To treat severe allergic reactions (anaphylactic shock)	Intramuscular injection into the lateral thigh	May be repeated as required

DRESSING AND INSTRUMENTS

Instruments
2 sets of medical gloves
1 Surgical scissor
1 Splinter tweezer
1 Thermometer

Dressings
1 packet compression bandages
1 packet adhesive bandages (20 pieces)
1 roll Elastic tape 1,25 cm x 5 m
1 roll gauze bandage 8 cm x 4 m
1 roll elastic bandage 8 cm x 5 m
Safety pins (big)
2 finger bandages

TWO PERSONAL FIRST AID KITS

Adhesive bandages (individually wrapped)	
1 Elastic bandage	
1 HMAK 15 X 15 cm compression bandage	
Temgesic® * 0.2 mg tablets For severe (unbearable) pain. ***Buprenorphin****	* Morphine — requires medical prescription 1 tablet dissolved under the tongue. May be repeated after 3-4 hours. **Δ** Induces drowsiness. **Δ** May induce nausea and vomiting.
Aluminium blanket	

** Any use of or irregularity in connection with this drug must be reported to GEUS. It is the expedition leader or project leader's responsibility to inform about this in the evaluation report after fieldwork.*

*Text in **bold** and **italics** = active substances*

Δ WARNING

1.6 Provisions

GEUS pays for your accommodation during the field season. Provisions in the field consist of two different standard rations (A and B) of canned and freeze-dried meals, rice, spaghetti, etc. – in order to ensure a reasonably varied diet.

Each ration pack is intended to provide food for two persons for 5 days. Each team will also be provided with a 'starter box' containing detergent, soap powder, spices, ketchup, candles, alufoil, grease-proof paper, etc. The 'starter box' is delivered with the camp equipment.

Provisions may be supplemented according to requirements at helicopter visits. When available, eggs, bacon, fresh fruit, onions, potatoes, butter and white bread will be supplied on request. Please be aware, that it is the teams responsibility always to have/order enough food so that the team has provisions for at least five days ahead.

1.7 Recommended personal equipment

Participants whose equipment is sent by ship to Greenland have no restrictions within reasonable limits on the weight of personal luggage. 20 kg + 8 kg hand luggage is allowed on the plane to Greenland but only 20 kg in total is allowed on domestic flights within Greenland, so excess of 20 kg must be delivered to GEUS before the season in time to be shipped to Greenland. The equipment section can inform about the date of shipment.

Participants whose equipment is flown directly to Greenland (mainly East and North Greenland) are allowed a total of no more than 30 kg of personal equipment.

Tobacco, spirits, radios, cameras, souvenirs etc. should not be sent in boxes or duffel bags on a GEUS bill of lading. Such articles must be taken personally to and from Greenland.

Note the currently allowed supply of tobacco, alcoholic beverages etc. when travelling in and out Greenland. Note also that you need an export declaration from the Self Government Administration if you want to take more expensive items out of Greenland.

Field parties liable to be moved by helicopter can take up to 30 kilos per person of private luggage into the field. Spare boots, clothes etc., can be left at the base and forwarded during the season. It is usally possible to send personal equipment to Greenland together with the expedition gear. The deadline for delivery of such equipment to GEUS can be obtained from the project leader.

On the next page you will find a list of recommended personal field equipment. Each participant should of course take into account personal needs and preferences when selecting equipment for personal use. If in doubt you can always contact one of GEUS' many experienced fieldwork participants, please ask your expedition or project leader.

FOOTWEAR AND RAIN GEAR

Durable leather boots with solid sole, extra boot laces and wax	1-2 pair(s)
Rubber boots (optional) – especially useful if working with dinghies	1 pair
Sneakers – nice to have dry shoes to use in the camp	1 pair
Water- and windproof outer-trousers (preferably Gore Tex or alternative membrane/coating), bright coloured: orange, yellow, red	1 pair
Water- and windproof jacket (preferably Gore Tex or alternative membrane/coating), bright coloured: orange, yellow, red	1

CLOTHING

Long underwear (shirts and tights – polyethylene or woollen inner layer)	2-3	Down or fibre jacket (off-season or high altitude, bright coloured: orange, red, yellow)	1
T-shirts, long sleeves	3	Light socks	5 pairs
Underpants – short	5 pairs	Hiking socks, thick woollen	5 pairs
Underpants – long	1-2 pair(s)	Pyjamas or t-shirt for sleeping	1
Working trousers (durable outer layer)	2-3 pairs	Fleece or Powerstretch (light but warm middle layer)	2-3
Durable working shirts	3	Hiking gaiters	1 pair
Belt	1	Sweaters, at least one woollen	2

MISCELLANEOUS

Toiletries including lip balm, suntan lotion, 2 towels, knife, sewing kit (needle and thread), sunglasses, camera with extra batteries, passport, 1 pair of camp trousers, field hat, warm cap or sun hat with broad brim, extra glasses, warm gloves, alarm clock, literature.

2 The camp

Fieldwork in Greenland is often carried out by expeditions operating a base camp and despatching smaller teams to field camps in the areas being surveyed. This section provides basic information on how to properly set up and run a field camp so that it offers a safe, effective and comfortable support for the field parties.

2.1 Types of GEUS camps

GEUS expeditions operate with two types of camps: large expeditions with a base camp which supports several field camps, mostly through helicopter services, and small to medium sized field campaigns without service from a base camp.

Larger GEUS expeditions rely on a base camp to provide supplies and coordination to the field camps. The selection of the site and layout of the base camp is under the responsibility of the expedition leader and is not discussed in detail in this manual.

Field camps are normally used by a two person field team. Selecting the site, setting up, running and dismantling a field camp is the responsibility of each field team. The field camp must be in a safe location close to the area being surveyed. It is most often established and removed by helicopter.

2.2 Selecting a camp site

Select your camp site carefully. Coming in with a helicopter and spotting a good site takes experience, but aerial photo studies prior to the field camp can be useful.

A good camp site should be more or less flat, near water, sheltered and have a nearby supply of moderate sized boulders. These are useful when positioned – carefully, not thrown – on the stoneflap for holding down the tent in high winds. Tent pegs are rarely useful in Greenland.

A supply of drinking water is pivotal for running a camp: it is essential that good water resources are identified at a potential camp site before unloading the helicopter. Most lakes and rivers in Greenland contain perfectly good drinking water. However, in the direct vicinity of glaciers, water derived from melting of glacial ice usually contains suspended clay particles (appears unclear and 'milky') and such water is unsuitable (unhealthy) for drinking. Often a trained helicopter pilot can help in spotting a good camp site, also in terms of accessible drinking water.

The most even camp site one can find often turns into a swamp or even a small lake in wet weather. Hard snow or even ice can be used for camping.

Near the Inland Ice and in narrow valleys some shelter from the force of the wind is highly desirable. Again: boulders are nearly always necessary to anchor the tents.

Camp at Warming Land 1984

Photo: Jakob Lautrup

Along the margin of the Inland Ice, ice-dammed lakes are common. Many of them empty catastrophically every summer, or sometimes at longer intervals. Their presence can usually be detected from a study of aerial photographs. It is wise to avoid camping in the bottom of valleys which drain such lakes.

Be sure to avoid spots that may be dangerous due to rock falls.

If possible, avoid sites with clear evidences of trails or frequent visits by dangerous wildlife such as musk ox.

Try to find a spot well exposed to sunlight but still sheltered from wind, especially when selecting a camp in cloudy weather.

2.3 Camp layout

Lay out your camp so that the cooking place, food and any other smelly item which may attract polar bears are well away from the sleeping tents and clearly visible both from the tent and from the usual approach path to the camp.

Avoid creating enclosed spaces surrounded by e.g. tents and boxes, where polar bears may feel trapped and shooting safely may be difficult.

In the surroundings of the helicopter landing spot, make sure no item can break loose or get blown away.

2.4 Running the camp

Make regular checks that tents are ready for bad weather. Arrange stones round the tent and boxes so that they will not chafe the canvas in case of windy conditions.

Sewn-in groundsheets in some tents are thin and easily damaged. Use an extra tarpulin under the tent as protection from sharp stones and moisture.

Keep smells that might attract a bear's interest to a minimum. Keep food smells away from your clothing and camp essentials such as sleeping bags. Burn garbage completely in a hot fire and remove the remains.

GEUS wants to help keep Greenland clean. The individual participants must cooperate! Teams serviced from a base camp may send back waste (thoroughly packed). Otherwise burn and bury waste. Bury it well – preferable beneath boulders heavy enough to withstand the energetic work of hungry foxes or bears.

Cook away from your tent. Store all food away from the sleeping quarters. Keep your camp clean and immediately wash dirty dishes. Avoid food with strong odour.

Keep the camp as light as possible – return all unnecessary equipment and food.

Teams lifted out by helicopter or travelling across water by boat should bring along gear for a light weight camp (incl. radio telephone) in the event of an emergency camp (see chapter 1, paragraph 1.4).

The risk of fire can be greatly reduced by heating up the primus burner properly before the primus is started (study carefully the priming instructions supplied), and by not leaving lighted primuses unattended. Do not light a fire for fun, it is regarded as an emergency signal.

Please do not put stickers on GEUS equipment. Also, do not write with a felt tipped pen directly on boxes and sacks.

All containers with liquids must have a clear label stating the contents. Two examples will emphasise the importance:

- It is possible to fuel kerosene (paraffin) primuses and Radius lamps with petrol, but this may cause explosions. There have been occasions when people have been in danger because petrol had been filled into a container marked "petroleum". In Danish "petroleum" means kerosene or paraffin. Petrol is "benzin" in Danish.
- On one occasion GEUS's equipment section discovered by chance that some unlabelled plastic bottles for mosquito repellent contained HCl for testing of limestone.

2.5 Dismantling a field camp

All garbage must be removed or burned and buried, and all surplus supplies must be shipped back to base camp. It must be avoided that wildlife may view a camp, either active or dismantled, as a possible source of food.

When packing the kitchen box for transport, some types of primuses and lamps need to be emptied to avoid leakage during transport. Make sure other primuses are properly turned off.

Lids for bottles containing ketchup, detergents, etc. should be kept intact for the same reason. Do not cut off screw lid tips.

Tents, sleeping bags etc. must be thoroughly dry before being packed when the camp is dismantled and flown back to base camp. When this is not possible, make sure to unpack and dry them at the first opportunity to avoid them being ruined.

Unload any firearm and signal pistol.

When packing materials in a sling net, make sure that no item can break loose during the flight, especially strings, ropes, tarpaulins, or other items which may become entangled with any moving part of the helicopter.

Equipment may only be deposited in Greenland in an emergency, or when GEUS has given prior permission. Depots must be reported to GEUS with clear instructions about the location plus complete and detailed depot inventories.

Note that equipment may not be checked back in Copenhagen right away, so all dry batteries must be removed from radios, electric torches and other equipment before they are packed for despatch home. Remember to remove cartridges from firearm magazines and chambers!

2.6 Camping in the cold

Dependable shelter is critical when you camp in the cold. The GEUS equipment section can provide adequate tents and sleeping bags. Avoid camping in valleys where cold accumulates. Bring one (or preferably more) thick full-length closed cell-foam pads. Raising up your sleeping area, if only by an inch, keeps you warmer in your shelter.

Moisture control is critical to staying warm. A bivy sack over your sleeping bag can help, as can unzipping the tent

door several inches near the top. Remember to air out the sleeping bag at every opportunity in order to sleep warm and go to bed warm. Before going to bed, move or exercise briskly. Then dress warmly including a hat, gloves, and socks. A water bottle filled with hot water, then wrapped in a sock, is an ideal sleeping bag companion. Nibble on high calorie snacks and sip tea or warm water to help fight the cold. Keep extra clothes at the bottom of your sleeping bag. Bring smaller battery powered items, such as the satellite phone and camera with you in your sleeping bag to extend their battery life. Expect to use up to three times as much stove fuel as you would in the summer, especially if you're melting snow for water.

Bring a tent staking system appropriate to the expected environment conditions. In the snow, a deadman picket system or bamboo stakes may be best. Ice screws, are better staking tools for glaciers or sea ice. Poles and fabric are brittle in the cold so assemble the tent gently. If the shock cord in the poles does not have any spring, warm the poles in your parka. When the bungee warms up, the spring will return. In snowy areas with strong winds, build a snow wall before erecting the tent. A snow wall can keep a tent from blowing away in gale force winds, decrease wind chill, and reduce tent flapping noise.

To minimise ice and frost build up, set up the tent with adequate ventilation in mind. Place the back end of the tent into the wind. Keep the downwind (front) door and fly ventilation holes slightly open to draw air through.

In windy conditions, stake out the tent's leading edge first, then insert poles and erect the tent. If the tent has snow flaps or a valance, weight the flaps with snow, ice blocks, gear or boulders. Keep tight all tent support lines. Use "slippery" knots that can be re-tightened and won't require a knife when it's time to take down the tent.

Because of the danger of carbon monoxide poisoning, do not cook in tents except in emergencies. If it is necessary to cook in the tent, preheat the stove outside the tent. Make sure there is fresh airflow into the tent that will not be blocked by falling snow or the tent fly.

Camp on stony ground. *Photo: Jakob Lautrup*

3 Communication

Field communication in Greenland usually involves one or more of the following communication systems:

(1) radio telephony on the HF RACAL field radio
(2) handheld VHF radios
(3) satellite telephony (Iridium)
(4) e-mails

Principally, all these means of communication are available from GEUS's equipment section but have to be ordered for each field team by the project leader. Instructions on how to operate the electrical communication devices are given in the sections below, including how to act in case of emergency.

NOTE: Always try and test that all means of communication work before going in the field. In the case of e-mail via satellite telephone and laptop it is essential that software is installed and the e-mail program tested well in advance.

When fieldwork implies operating from a base camp communication procedures are established for both daily and emergency communication. This plays a critical role in carrying out fieldwork successfully and all participants must adhere to these procedures. Carefully study the lines of communication at p. 36-37.

NOTE: For your own safety, make sure that you ALWAYS carry your satellite telephone, including a pre-fabricated list of important telephone numbers, and the VHF radio along with you in the field.

3.1 Radio communication in Greenland

Communication by radio telephony on the RACAL or the VHF band with base camps or official coast radio stations may only be performed by personnel with a radio telephony certificate, or by special arrangement with the expedition leader. Field radio stations should be aware that most radio telephone traffic is to/from or between ships, and that ongoing conversations have the 'right of way'. Furthermore they must respect the master station's guidelines. While on the 'air' speak clearly and slowly, and in a load and clear voice (don't shout!). Only one person speaks at a time! For simple and standardised voice procedures see p. 35.

Prior to camp mobilisation or other scheduled helicopter traffic in the area where you are working, the operational base will call you for information on weather conditions such as visibility, sky base, fog etc. On the hour is a standard time for establishing radio contact.

NOTE: It is important that all field personnel are made familiar with the basic principles for operating the radios, not least in case of emergency.

3.2 The HF RACAL field radio

The HF RACAL field radio (along with the Iridium satellite telephone) represents the backbone of communication for GEUS field expeditions. Daily fixed radio

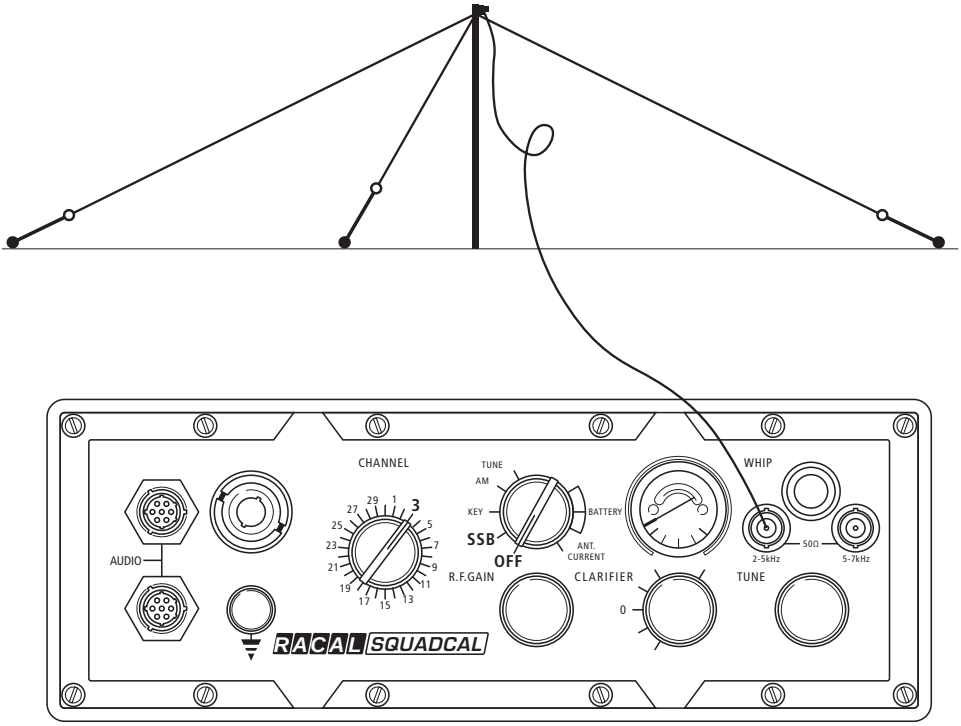


Figure 3.1. The Racal field radio, showing the front panel of the unit and of how to connect the antenna.

time is arranged by base over the RACAL field radio, usually at 08:00 and 20:00* base camp time. One important aspect of such fixed radio times is to ensure the safety of all field teams. More generally, communication over the RACAL has the advantage - over for example telephony - that more persons are able to share information broadly, including geological observations. This is particularly useful for the logistical planning, such as coordinated camp moves or joint recos, as such operations often will have to be adjusted according to changing weather conditions.

The radio has to be open throughout the traffic with all teams in an expedition and should only be turned off when base camp closes the radio session. Further, the satellite telephone should be open 15 minutes before and 15 minutes after any agreed radio time in order for base camp to be able to get in contact with all teams in case of poor or no radio contact with one or more of the teams.

3.2.1 Setting up and using the RACAL field radio

This section gives practical advice on how to set up the RACAL radio, i.e., how to connect batteries, how to tune the set, and how to establish general communication. Further instructions are provided with each radio set.

The antenna should be erected well clear of the ground (often centred above the tent) and extended perpendicular to the direction of the receiving radio station

(usually the base camp). The antenna is connected to the socket marked "2-5kHz" which is correct for frequencies 2182, 2784, 3345, 3350 and 3815 kHz. The socket "5-7kHz" is only used for frequencies in the range of 5000-7000 kHz.

Connect the hand set to one of the two audio outputs to the left of the radio front panel (Figure 3.1) and select the frequency on the channel selector. The available frequencies are indicated on the inside rim of the radio. GEUS field teams use 3350 kHz which on the RACAL corresponds to channel 3.

Tune the radio to match the length and characteristics of the antenna by turning the on/off button clockwise all the way to the mark 'TUNE'. The radio is now transmitting a strong tone. Then turn the tune button until maximum showing on the instrument (that is when the indicator needle swings towards the right). Switch the on/off button to SSB and activate the sender via the button on the earphone. The functions selector should be set on SSB during communication. Remember to turn off the radio when not in use.

NOTE: Tune the radio prior to scheduled radio time, as tuning during radio transmission effectively blocks all communication.

NOTE: Never tune without an antenna connected as it may damage the radio.

3.2.2 Trouble shooting

Typical reasons for not receiving a signal on the RACAL are: (1) a faulty battery contact – try to stretch the springs, but do not over-stretch them; (2) a broken fuse – a spare fuse is situated next to the original fuse next to the batteries inside the radio; (3) bad signal reception due to weather or local conditions – most likely a transitional problem, but it's always a good idea to check the antenna (polar foxes like to chew up the wire!); (4) incorrect operation of the radio – check the installation procedures once more; (5) check that the right frequency and channel have been selected, remember to fold out the antenna completely.

3.2.3 Operating frequencies

On the RACAL MF field radio there are at least four frequencies: 3345, 3350, 3815 and 2182 kHz.

- 3345, 3350 and 3815 kHz are normal working frequencies.
- 3350 is GEUS' primary expedition frequency.
- 2182 is an emergency frequency and must only be used in emergency situations.

NOTE: Since 2009 the frequency 2182 kHz is no longer officially serviced by Aasiaat radio, but may still be used by others.

Some radios have frequencies for specific purposes. 5526 kHz is supplied with many radio sets, and is used for aircraft control. However, only the aircraft and its master station are allowed to transmit on it (except in life-or-death situations).

Other frequencies and their use are:

- 2784 for internal communication (poor over long distances).
- 3345 for internal communication, alternative to 3350 if heavy traffic.
- 3815 for internal communication, alternative to 3350 if heavy traffic. Also used e.g. for news in East Greenland.
- 4050 - colloquial frequency for East Greenland.

- 4451.5 for internal communication, alternative to 3350. Only in East Greenland.
- 5448.5 for internal communication, alternative to 3350. Only in East Greenland. Aircraft control frequency (FIC, Flight Information Control). FIC is ONLY for LISTENING. NO CALLS may be made on this frequency, except to get help in life threatening emergencies.

3.2.4 Procedures during regular radio time

For GEUS field teams, daily call-time and frequency used between the base and the field teams will be arranged, using the RACAL field radio. Usually, this is at 08:00 and 20:00 base camp time, i.e. at the beginning and end of each field day.

In case you plan not to be in your camp at the scheduled radio time, please inform the operation base ahead. During the daily scheduled radio time, the base will call each field team in numerical order.

NOTE: Except for emergency situations it is always the base that calls the teams. Typically base will ask about, (1) the local weather, i.e. visibility, sky base, fog situation etc., (2) your planned activities for the day, and (3) any special requests for the base, which may include e.g. booking the helicopter for a camp move or recoflying; ordering extra equipment or food supplies from base (in which case it is a good idea to prepare a 'shopping list'). A team can also ask base to have communication with other teams via RACAL after the normal radio schedule which will then be arranged by the base.

NOTE: In principle the entire world can receive and listen to the radio traffic: therefore you should always consider what you are transmitting. Confidential matters should never be discussed on the RACAL radio.

Sometimes you may hear the base camp reasonably well, whereas they have difficulty in understanding you clearly. The base camp radio operator may then pick up affirmative or negative answers to his questions by means of simple and prearranged "tune signals"; i.e. "M" (--) for YES and "T" (-) for NO. In some cases where a field team is only faintly received by base, but can be heard by a second field team, this second field team may relay the communication between the first team and base.

If a team does not answer a call from the operation base (e.g.due to a bad radio transmission) the field team will be contacted via the satellite telephone immediately after the regular radio procedures, i.e., when all field teams have been called. Therefore, keep the satellite telephone open and close at hand during regular radio hours and for at least 15 minutes before and after radio time. If a satellite telephone is not reachable, the base will continue to call the field team for the next hour and after that every half hour via the RACAL. In such case the field team should have the radio open every full and half hour as these will be the most likely times that base camp will try to establish contact.

If base camp fails to establish contact to a team, a helicopter will be sent out to check, either the same day, or latest after the second regular radio time that a team is missing.

NOTE: It is extremely important that all field teams keep strict times around the regular radio sessions, as the consequence of not answering the base may eventually be that a costly helicopter rescue operation is activated.

3.2.5 Communication outside regular radio time

If a team has an important communication to make outside radio schedules, the a priori means is via the satellite telephone (Iridium). Alternatively, the team may attempt the RACAL on 3350 kHz (or 3345 or 3815), but be aware that usually no one in the base will be listening in outside the scheduled radio hour. If the camp is close to base, an attempt can be made by VHF on channel 6 or channel 16 (see below).

NOTE: In emergency situations, all possible means of communication should be considered. Usually the satellite telephone will be the first choice, either calling the base, GEUS contacts or local authorities, another field team, or GEUS' doctor, Søren Kristensen at telephone +45 20 60 00 07). (24h) – from 14th of July to 24th of August 2014.

3.3 The VHF radio

A VHF radio telephone should be considered as part of the basic personal safety equipment for all GEUS field participants in Greenland. The VHF radio works as a "walkie talkie" and is practical for internal communication at sea, and on land over shorter distances, e.g. when two team partners work apart during the day. When you work away from other field members, be sure that you make proper arrangements for scheduled calling times, and remember to state where you are located, when you intend to go, and

The VHF radio

when you expect to return to camp. Information about helicopter working VHF channels on location in Greenland should be agreed with the pilot.

NOTE: The Marine VHF system requires line-of-sight between transmitter and receiver.

NOTE: A preselected channel is the working channel for the expedition. Channel 6 is often preferred, but ask the expedition leader/base camp.

NOTE: For emergency calls and for establishing initial contact with another station, use distress channel 16 and the calling procedure outlined below. All VHF radios (e.g. on boats) listen for emergency calls twice an hour, from XX.00 to XX.05 and XX.30 and XX.35.

3.3.1 Operating instructions for the VHF

1. CAUTION: Transmitting without an antenna may damage the transceiver, so make sure you connect the antenna before switching on the power.

2. Rotate [VOL] clockwise to turn power ON.
3. Turn [SQL] clockwise to mute any audio noise if necessary.

4. Push [%]/[&] to select the desired channel.

5. Push [H/L] to select the output power if necessary. Choose low power to conserve battery power, choose high power for longer distance communication.

6. Push and hold [PTT] to transmit, and then speak into the microphone.

IMPORTANT: To maximise the readability of your transmitted signal, pause a few seconds after pushing [PTT], hold the microphone 10 to 15 cm from your mouth and speak at a normal voice level.

7. Push [H/L•LOCK] for 1 second to turn lock function ON and OFF.
   This function electronically locks all keys and switches to prevent accidental frequency changes and function access.

8. Push any key except for [PTT] to turn the backlighting ON.

9. Dual watch key - monitors channel 16 while you are receiving another channel.

3.3.2 Calling procedure for external communication by VHF in Greenland

1. Turn the power on and enter channel 16. NEVER USE CHANNEL 16 BETWEEN XX.00 and XX.05 OR BETWEEN XX.30 and XX.35 hours (these periods are reserved for emergency calls).
2. Call the nearest ship radio (e.g. Coast radio Aasiaat), and tell that it is GEUS XX calling. The operator will ask you to switch to another channel, when the connection is established.

3. Enter the new channel number, and call the radio station again. Then ask for the phone number you want.

4. Wait for the operator after the conversation. He or she will tell you how long you talked and ask how to account the bill. You must answer GEUS, call sign:

   _____

3.3.3 Sending a distress message

In case of an accident during the day or if you need help, call the operation base on channel 6, and if the base does not answer, switch to emergency channel 16 and follow the procedure outlined below:

A. MAYDAY, MAYDAY, MADAY (international emergency signal)

B. This is GEUS TEAM _____, GEUS TEAM _____, GEUS TEAM_____

C. WE ARE AT _____; ____; ____ SITUATED_____;

_____;_____;

D. WE NEED (say what kind of help is needed) AND ASK THE STATION TO CONTACT THE OPERATION BASE AT_____

Steps A-C in this procedure should be repeated until communication with another station has been established. If no communication can be made, repeat the en-

tire procedure slowly several times - you may be heard even if you can't receive the answer.

3.4 The satellite telephone (Iridium)

Most GEUS expeditions now have one or several hand-held satellite telephones that can be used on the Iridium global satellite network. A satellite telephone principally operates like a normal cell phone.

The satellite phones are personally protected with ID and PIN codes! The satellite telephone will be billed charges for all outgoing and incoming calls, so only pass on the codes to 'trusted' persons, such as family members, who may call you.

GEUS has signed a service contract to access the Polarsat service (via Polaris Electronics A/S), making it possible to make calls at significantly lower charges via intermediate earth stations, see paragraph 3.4.2. and 3.4.3 For Iridium-to-Iridium calls, no special service exists, meaning that the direct number to the recipient should be dialed.

NOTE: While in the field make a habit of carrying the satellite phone with you along with a list of telephone numbers (plastic coated water-proof style) in case of emergency. Relevant telephone numbers can further be found on the last pages of this field guide.

3.4.1 Power requirements

The satellite telephone batteries may be drained relatively quickly, especially in cold weather. All field teams relying on satellite telephones for communications should therefore consider the various options for recharging batteries. Depending on the type of fieldwork and the logistic framework, it may be necessary to bring a solar cell charging system (see section 1.2), a portable petrol-driven generator or a large lead battery.

The Iridium telephone

3.4.2 Calling from a telephone ashore to an Iridium phone via Polarsat

- If family members or other "trusted" persons want to call a person in the field via his/her Iridium they should call via Polarsat following these procedures:
- Call 9631 7910 (remember +45, if you are calling from another country than DK)
- Dial customer ID 10372
- Dial PIN-code (if required) 1475
- Dial the last eight digits of the Iridium telephone no., e.g. if you want to call 00 8816 314 49626 you only dial 314 49626.

3.4.3 Calling from an Iridium phone to a telephone ashore or a mobile phone via Polarsat

- Call 0 00 8816 214 34 555 #
- Dial customer ID 10372
- Dial PIN-code (if required) 1475

- Dial the number you wish to call, e.g. 20 60 00 07 for Dr. Søren Kristensen

3.4.4 Call charges
The cost of communication between a satellite telephone (Iridium) and a regular telephone (not mobile) is dependant of the telephone company of the regular telephone. TDC for instance charges 43,75 DKK per minute (2014 rates). By contrast calling via Polaris as described above, the charge for calls are less than 1/10 the price.

Examples of Polarsat per-minute charges (as of spring 2013):
Iridium to Denmark via Polarsat:
USD 0.65 ~3.65 DKK
Denmark to Iridium via Polarsat:
USD 0.75 ~4.21 DKK

3.4.5 Sending and receiving text messages (SMS)
Text messages (sms) can be sent and received to and from Iridium telephones - with the exception of traffic between ordinary mobile telephones and Iridium telephones, see below. Notice: If you send a sms from a mail-program to an Iridium telephone, the receiver will not able to see text written in the Subject line. Instead you may consider starting your sms-text with a heading that indicates the subject of the sms. Also notice that the telephone number of the receiving Iridium telephone must be written WITHOUT + or 00 when sending text messages.

Below are the options for sending and receiving text messages to/from Iridium telephones.

- **From Iridium to Iridium**

1. Start the Main Menu
2. Select Message (can also/may only be selected from the Phonebook)
3. Select Create message
4. Write your message
5. Press Send
6. You can either write the Iridium telephone no. you wish to reach or choose a number from your Phonebook.

- **From an ordinary mobile telephone to Iridium telephone and vice versa - is NOT possible!**

- **From a smartphone or computer to Iridium telephones**

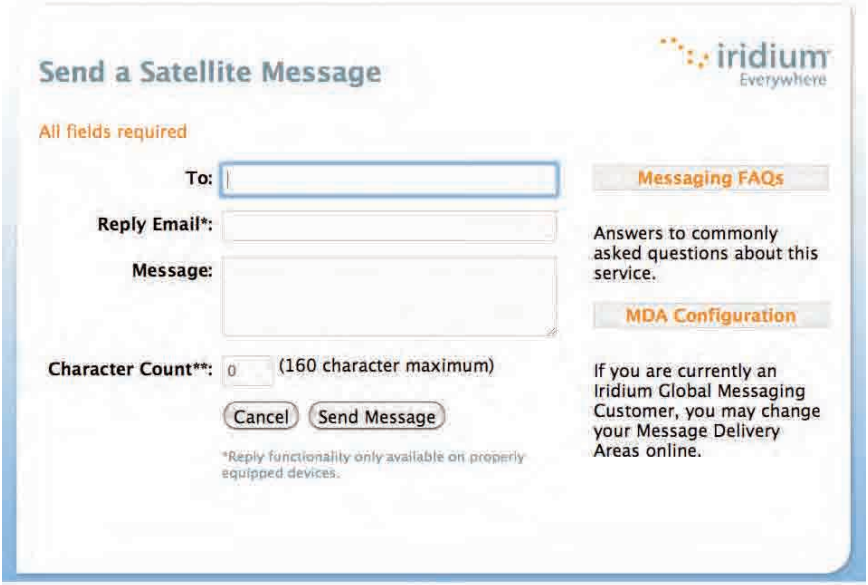
- **Use any mail-program.** Write the Iridium telephone no.
+@msg.iridium. com
Example:
881631426749@msg.iridium.com

- **Use a browser**

Write http://messaging.iridium.com/
The following text box comes up. Write the Iridium telephone number you wish to reach in the 'To:field', and write your message in the message box. Notice the maximum of characters of 160.

It is free of charge to send SMS's to any Iridium satellite telephone from the website www.iridium.com

A user manual is provided together with the Iridium telephone you get from GEUS. Digital user manuals to any of the Iridium telephones that GEUS is using can be downloaded from the Polaris website:
http://www.polaris-as.dk/Default.asp?Action=Details&Item=511



3.5 Sending and receiving e-mails in the field

Satellite telephony can be used to send a receive e-mails while in the field. This can be a very practical means of communication if for instance you need to send specific data or a long shopping list for base camp. In general you can only send text messages with this system. No graphics, photos or attachments should be sent by e-mail via satellite telephone, and neither should friends, colleagues and family send anything else than text to a satellite-driven e-mail address.

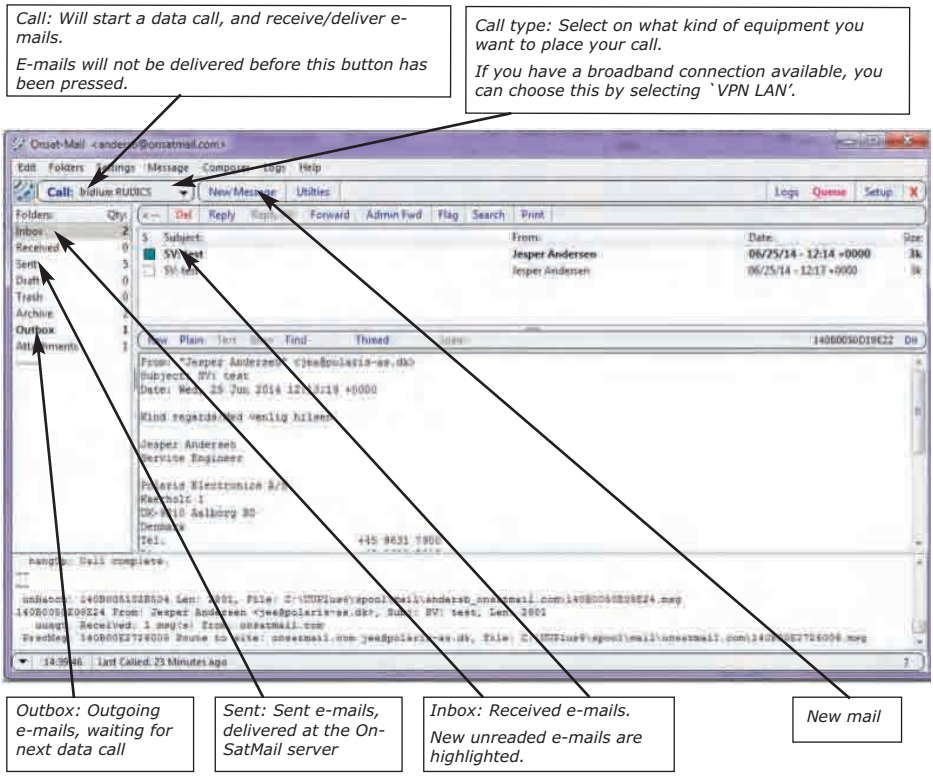
Special software (OnSatMail) is required on the computer you want to be able to send e-mails from via your satellite telephone. The OnSatMail software is a Windows application developed to transfer e-mails between mobile and fixed users over Inmarsat, Iridium and Thuraya using CSD (circuit-switched data) or TCP/IP connections. The software is optimized for the special characteristics of satellite connections, such as propagation delay, speed and error rate.

Do check that the software is working before you go to the field, preferably before you leave for fieldwork!

3.5.1 How does OnSatMail work?

The Iridium satellite network is a global communication network consisting of 66 satellites in a low orbit around the Earth. When you use OnSatMail, a data call is routed from the Iridium telephone to the nearest satellite, from here to the next and the next until eventually it can reach the earth station in Arizona, USA. From the earth station the call is routed to the OnSatMail server.

You log on to the OnSatMail server with your username and password (you will get it from GEUS' equipment section together with the telephone). On the OnSatMail server content is delivered in the outbox and received in the inbox of the OnSatMail program. This proces will only



start when you push the 'Call' button in the OnSatMail program. The process takes approximately 10 seconds if nothing is to be sent or received, and longer if e-mails are transferred.

3.5.2 Use of the OnSatMail

OnSatMail basically offers the same functions as other mail programs as Outlook Express, see below.

The OnSatMail program needs a COM port (= a USB entrance) to communicate with the Iridium phone. When the software is installed a COM port for the OnSatMail program is selected and you will get instructions about which port to use. A lead for the telephone with a USB-plug to be used with the computer is provided together with the telephone.

For older models of the telephone the lead may have an adapter.

Send and receive procedure:

1. Open the OnSatMail program.
2. Write your e-mail text (whether you select New message, or respond to an e-mail, you've already received).
3. Plug in the lead between Iridium tele phone and computer.
4. Check on the telephone the strength of the signal.
5. Press Call.
6. The transmitting via satellite starts. However, as you will experience, the signal is not always strong enough to carry a message through. Be patient. You may have to try again several times, or await a moment with a stronger signal.

3.6 Morse code and phonetic alphabet

If urgent information is transmitted under particularly poor conditions it is advisable to spell out the individual words on the basis of the phonetic alphabet.

Under particularly poor conditions the "tune signal" or transmitting noise of the radio may be used as a Morse signal.

MORSE		PHONETIC	MORSE		PHONETIC	MORSE		PHONETIC
A	·—	Alfa	K	—·—	Kilo	U	··—	Uniform
B	—···	Bravo	L	·—··	Lima	V	···—	Victor
C	—·—·	Charlie	M	——	Mike	W	·——	Whiskey
D	—··	Delta	N	—·	November	X	—··—	X-ray
E	·	Echo	O	———	Oscar	Y	—·——	Yankee
F	··—·	Foxtrot	P	·——·	Papa	Z	——··	Zulu
G	——·	Golf	Q	——·—	Quebec	Æ	·—·—	Ægir
H	····	Hotel	R	·—·	Romeo	Ø	———·	Ødis
I	··	India	S	···	Sierra	Å	——·——	Åse
J	·———	Juliet	T	—	Tango			

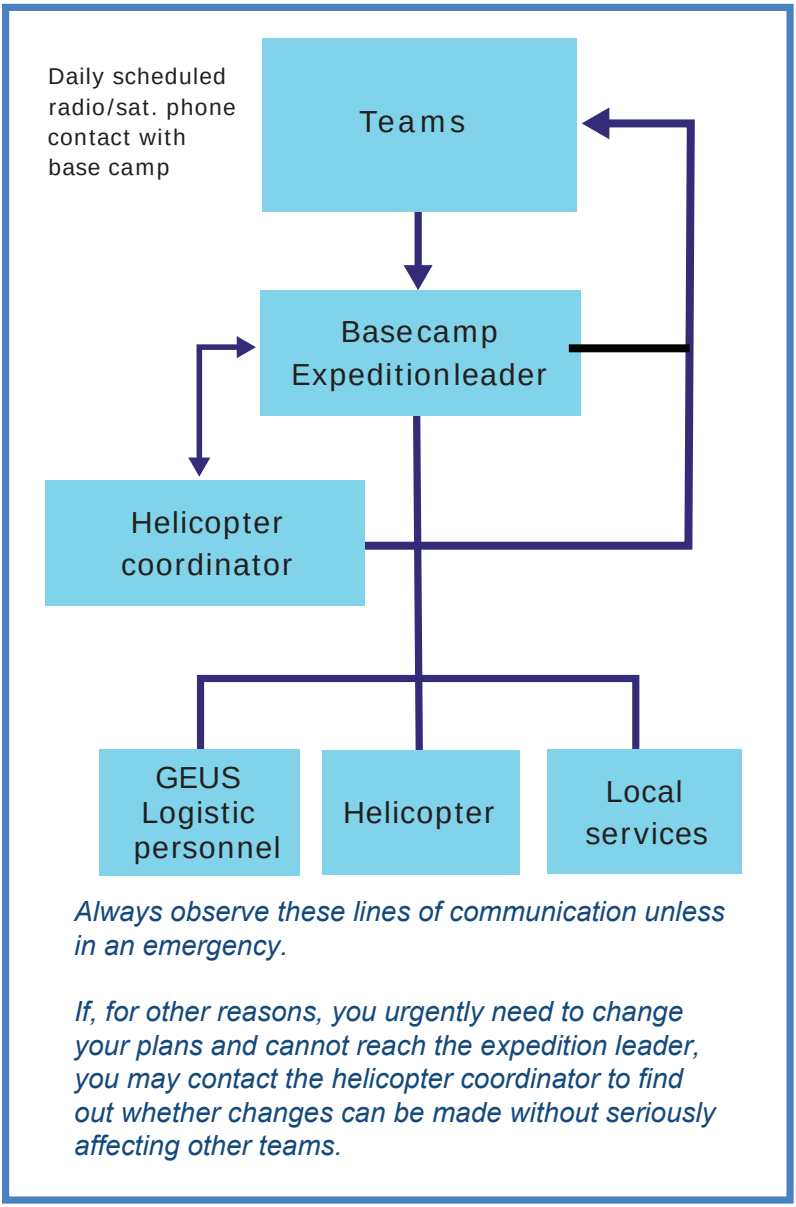
3.7 Voice procedure for radio communication

Voice procedure techniques used to clarify, simplify, and standardise spoken communication.

Words in voice procedure

Affirmative	Yes
Negative	No
Reading you five/ loud and clear	I fully understand what you say; I can understand everything and it is very clear.
Reading you .., four, three, two, one	I understand you ... varying degree of understanding. (1 can just hear you, but do not understand you)
Over	I have finished talking and i am listening for your reply, short for "over to you".
Come in	You may begin speaking now.
Out	I have finished talking to you and do not expect reply.
Wait	I do not have the answer or information to hand, i will attempt to source the answer or information requested shortly until then i have finished talking and do not expect a reply.
Roger	(also roger that) I understand what you just said; ok; all right.
Copy	I heard what you just said; ok; all right.
Go ahead or send your traffic	Send your transmission.
Repeat/Say again	Please repeat your last message.
Standby	Pause for next transmission. This does not usally entail staying off the air until the operator returns as they have used the word 'out' which indicates the transmission has ended. The net is now free for other traffic to flow but users should be aware that the previous C/S may re-initiate a Call as per their 'Wait out'.
pan-pan	Maritime/avation urgency call. Repeated three times. Has priority over safety calls.
Mayday	Maritime/avation urgency call. Repeated three times and at beginning of every following transmission relating to the current distress situation. Has priority over urgency and safety calls.

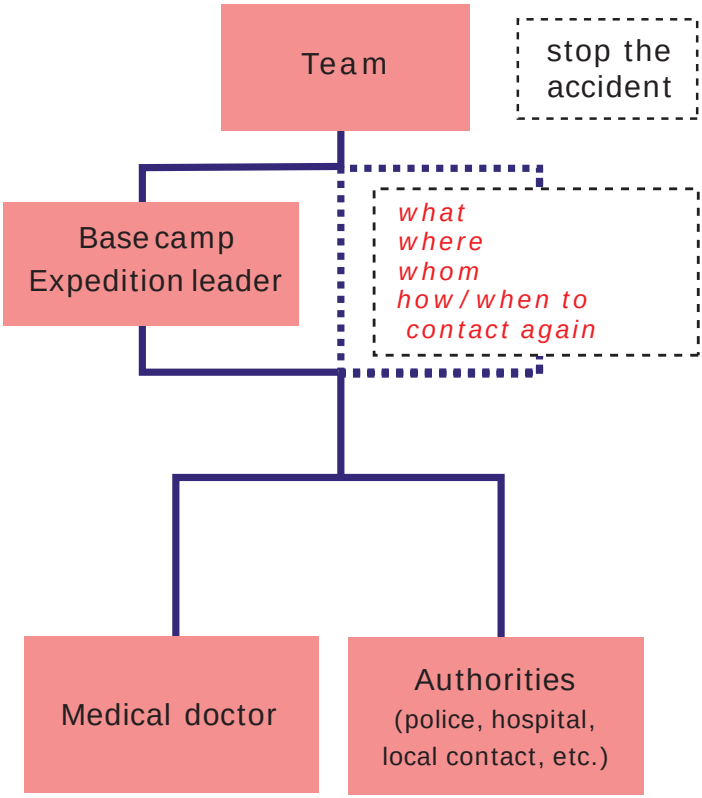
Daily use (normal setup)



Always observe these lines of communication unless in an emergency.

If, for other reasons, you urgently need to change your plans and cannot reach the expedition leader, you may contact the helicopter coordinator to find out whether changes can be made without seriously affecting other teams.

Emergency



Choose the line of communication that is appropriate for the situation.

Remember: In case of a life threatening emergency, call the number on your project's prioritised emergency telephone list until you reach someone!

4 Safety in the field

More or less serious incidents occur every year during fieldwork in Greenland, and in many cases, these could have been avoided by conducting a proper field practice. It is therefore important that all field participants are familiar with the safety regulations before embarking on the Fieldwork, principally to prevent accidents in the field, in addition to knowing how to act if accidents occur.

Safety in the field: BE SAFE, USE YOUR COMMON SENSE, ALWAYS THINK AHEAD.

This section provides guidelines for carrying out fieldwork in Greenland in a safe manner. Be aware that the section is not exhaustive — common sense and proper equipment are your main safety kit! GEUS supplies good quality field and emergency equipment, including satellite telephones and field radios. Field personnel should ensure that their personal clothing and footwear are adequate for a full field season.

It is generally very difficult to locate people in the field, so it is essential that everyone wears bright clothing (vest, trousers and/or coat) in bright or flourscent colours like ORANGE, RED or YELLOW. In snow conditions red or black is recommended

4.1 Emergency equipment

GEUS supplies each camp with a first aid box. Instructions for medicines etc. are included with the box (see section 1.4). Read these instructions carefully at the beginning of the season, and when medicines are required. Any use of strong medicine should be reported to the expedition leader and the project leader in all cases.

All field personnel are also supplied with a personal first aid kit. This first aid package is part of the field equipment that you must carry in the field at all times.

The first aid kit contains an aluminium foil blanket which will keep an incapacitated person lying on the ground warm until help arrives.

Emergency flares, a signal mirror (heliograph) and a fluorescent cloth will be made available to all field personnel by GEUS. These items can be used to attract the attention of other persons and helicopters and should be part of the daily equipment along with the first aid kit carried in the field at all times. Additional safety and emergency equipment are in some cases also part of the equipment that is made available by GEUS.

Firearms are provided for teams working in areas with dangerous animals (see section 4.9 and 4.10).

Teams lifted out by helicopter or travelling across water by boat should bring along gear for a lightweight emergency camp (incl. a satellite telephone) to minimise the effort needed in the event of rescue.

Polarbear

Photo: Jakob Lautrup

4.2 Emergency situations

In case of accident or illness requiring assistance, your satellite telephone, VHF radio or RACAL radio are the usual and best means of obtaining help (see chapter 3).

Heliographs to signal helicopters and fluorescent cloth can be used to attract attention in the field or in the camp. Fire is also regarded as an emergency signal, especially when smoking. Do not signal ships or aircraft if you do not need help, unless they are looking for you for other reasons. A human figure is best seen from a distance when moving and on a background of snow or sky. When the sun is low, large letters or arrows trodden into soft snow can be seen at great distance.

The small emergency flares are of limited use, but can be used as a short distance signal, notably in poor weather. They are also said to be effective when fired directly in front of an attacking or excessively curious polar bear or musk ox. Remember that the RED FLARES ARE ONLY TO BE USED IN EMERGENCY SITIATIONS.

A small booklet with first aid instructions are included in the medical box.

4.2.1 First aid emergency action principles

1. Survey the scene
   - Is the scene safe?
   - Stop the accident!
   - What happened?
   - How many people are injured?
   - Are there companions that can help?

2. Do a primary survey of the victim (ABCs)
   - Check the **A**irway (head-tilt/chin lift).
   - Check the **B**reathing (observe, feel, listen).
   - Check **C**irculation (carotid pulse).

3. Radio for rescue
   - See Radio Emergency Action below.

4. Do a secondary survey of the victim
   - Interview the victim and/or companions.
   - Check the victim's vital signs.
   - Do a head-to-toe exam.

Also see the inside of the back cover.

4.2.2 Radio emergency action
Sending a Distress Message

In an emergency, stay calm, assess the situation, and use the following steps to call for help (see also Section 3.3.3):

1. Select the correct frequency (e.g., VHF channel 16)
2. Speak clearly. Take your time.
3. Call: "MAYDAY, MAYDAY, MAYDAY."
4. Listen for a reply.
5. When a reply is received, tell them who you are, where you are, and the nature of your emergency. Give any information that may assist the rescue.
6. If no reply is received:
   - Check your equipment
   - Repeat your call at regular intervals – allow listening periods between calls.

4.2.3 Action on receipt of a distress message

1. Listen carefully. Write down the message(s) and the time.
2. Listen for an acknowledgement from a major station.
3. If another station does not acknowledge the distress call, acknowledge the distress call and

retransmit the distress message to the closest permanent station in your area, using the words: "MAY DAY Relay, MAYDAY Relay, MAYDAY Relay. This is …" (repeat your station call sign three times).
4. Give distress message as broadcast by station in distress.
5. Give assistance to station in distress if possible. Advice your base camp of what you are / are not doing.
6. Continue to listen in.

4.2.4 Cancellation of MAYDAY messages
If help is no longer required, don't forget to announce cancellation of your distress or urgency call!

Avoid unnecessary traffic at all times!

4.2.5 Traumas
A trauma patient is someone who has suffered serious and life-threatening physical injury with the potential for secondary complications such as shock, respiratory failure and death. Trauma patients may require specialised care, including surgery and blood transfusion. Normally, medical personnel operate with the so-called golden hour of emergency medicine, which is the importance of accessing medical treatment within the first sixty minutes after trauma occurs. This is not a strict deadline, but recognises that many deaths could have been prevented by a more prompt medical treatment after injury. For obvious logistic reasons, evacuation of an injured person out of a field area in Greenland will usually take more than one hour.

Nonetheless, exhibiting proper conduct and following the procedures outlined for emergency situations might be life-saving, as this will minimise the time period for bringing a traumatised person under medical treatment.

4.2.6 Wet-cold exposure
Clothing soaked by rain and exposed to the wind may lead to hypothermia, i.e. the body losing heat faster than it can be generated. Even for physically fit persons, this condition may result in a fall in body temperature, tiredness, and col-

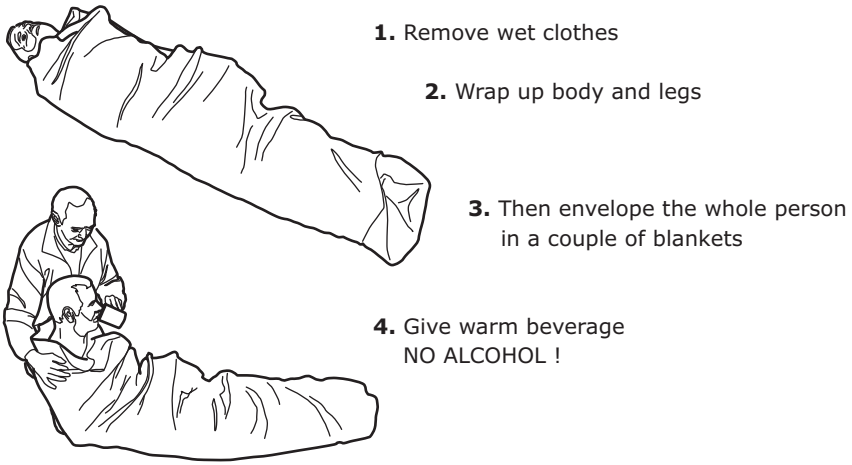


Figure 4.1 Cold water accident

Wind-chill factor

Temp. in °C ->			25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
Km/h	**m/s**	**knots**																
0	0	0	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50
7	2	4	25	20	15	9	5	-1	-6	-11	-16	-21	-26	-31	-36	-41	-46	-51
14	4	8	23	17	12	5	0	-6	-12	-18	-24	-30	-36	-42	-48	-54	-60	-66
22	6	12	23	16	10	3	-3	-10	-16	-23	-29	-36	-42	-49	-55	-62	-68	-75
29	8	16	22	15	8	1	-6	-13	-19	-26	-33	-40	-47	-54	-61	-68	-75	-82
36	10	19	21	14	7	0	-7	-15	-22	-29	-36	-43	-50	-58	-65	-72	-79	-86
43	12	23		14	6	-1	-9	-16	-23	-31	-38	-46	-53	-61	-68	-75	-83	-90
50	14	27		13	6	-2	-10	-17	-25	-32	-40	-47	-55	-63	-70	-78	-85	
58	16	31			5	-3	-10	-18	-26	-33	-41	-49	-57	-64	-72	-80	-87	
65	18	35					-11	-19	-26	-34	-42	-50	-58	-65	-73	-81	-89	
72	20	39							-27	-35	-43	-50	-59	-66	-74	-82	-90	

Cold index	Effect from prolonged exposure, correctly equipped
0°C to -20°C	Minimal risk, but false sense of security at prolonged stay
-20°C to -40°C	Increased risk level, lighter frostbites of exposed skin
-40°C to -60°C	Danger, frostbite of exposed skin within short time
under -60°C	**Great danger, immediate frost bite of exposed skin**

Table 4.1 The wind-chill factor describes the virtual effect on exposed skin as a result of both air temperature and wind speed. E.g. for air temperature of -5°C and wind-speed of 6 m/s the actual effect of exposed skin will correspond to air at -16°C. Source DMI.

lapse in a few hours. In case of hypothermia, remove all wet clothing and wrap the person in blankets, sleeping bags, etc. This will not warm the person, but will reduce the heat loss. If the treatment is successful, the internal heat produced by the body will warm the body by ca. 1°C per hour. A person suffering from hypothermia should be given something warm and sweet, like cocoa or lemonade with sugar, to drink - NEVER ALCOHOL. Be aware that persons suffering badly from hypothermia may act irrationally and often undress themselves, for unknown reasons.

The danger of hypothermia can be largely avoided by always carrying waterproofs and a spare sweater, wearing warm underclothes and warm thick trousers and by not undertaking ambitious excursions in dubious weather.

4.2.7 Drowning

When rescuing a drowning person be aware of your own safety. Is the person conscious, throw a lifebuoy, or an alternative floating device to the person. If the person is unconscious, the person must be brought on land for life-saving first aid.

1. Evaluate the temperature of the water. In Greenland water temperatures are normally below 5ºC, under which conditions a person will only remain conscious for a few minutes.

2. Estimate your own strength. You must be able to swim the distance necessary to rescue the drowning person back onto land.

3. Be aware if the drowning person is panicking, as this can cause a life-threatening situation for the rescuer. In this case bring a lifebuoy or alternative floating device if possible.

4. If several persons are helping with the rescue, tie a rope around the waist of the rescuer to possibly

retrieve the person if case of problems.

4.2.8 Frostbite

Skin tissue freezes below -1.6°C. Frostbite occurs when ice crystal growth between the tissue cells and the cells dehydrate. A dehydrated cell dies after some time. The seriousness of frostbite depends on how quickly the cells freeze. Cells do not dehydrate completely during quick freezing, in which case there is a good chance of saving the frozen parts. The ice crystals between the cells are the first to thaw. The dehydration of the cells therefore continues while thawing, but stops when all ice crystals have disappeared. It is important to notice that the thawing process is just as dangerous as the freezing.

There is a danger of frostbite when you lose feeling in your hands or feet due to cold. In this case keep moving, e.g. clap your hands, and feeling will slowly return – but this hurts.

Frostbite in the face occurs quickly in cold weather, even without wind, below -20°C. With increasing wind speed the risk of frostbite increases, see Table 4.1 showing the so-called ”wind chill factor”. To prevent frostbite (and reduce body heat loss) it is therefore essential to wear a ”windbreaker”, i.e. wind tight outer garment and avoid exposing large areas of skin. Frostbite in the face is easily recognised by white spots in the otherwise red skin. The treatment is simply to avoid further cooling. Frostbite in the face is seldom deep or dangerous.

Frostbite is not deep if the skin can be moved over the frozen place. The immediate treatment of surface frostbite is to warm the frozen part, e.g. place the frozen foot on the stomach of another person until the foot warms up - then seek help but avoid using the foot. Frostbite is deep if the thawing method described above is not successful after 20 minutes of treatment. In this case, seek help immediately because the only way to thaw the frost-bitten parts is in a 40-44°C warm water bath.

After successful treatment, the affected skin is treated like an open wound (like a burn) or covered with dry sterile bandage.

Blisters may form (this is a positive sign), but do not puncture the blisters as this may cause infection.

Always contact a doctor or a hospital after frostbite.

4.2.9 Carbon monoxide poisoning

You must ventilate the tent frequently if the stoves burn for long periods, especially if the tent is wet, snow covered, and/or sealed. This is to prevent carbon monoxide poisoning.

Carbon monoxide is seldom recognised as such, although the victim may experience headache, dizziness, confusion or heavy limbs. The victim must get fresh air right away and preferably oxygen.

In serious cases, artificial respiration is necessary.

4.2.10 The use of signals

In situations where contact is wanted, any method may be applied. However, some signals have special meanings and should be used appropriately. Don’t exaggerate.

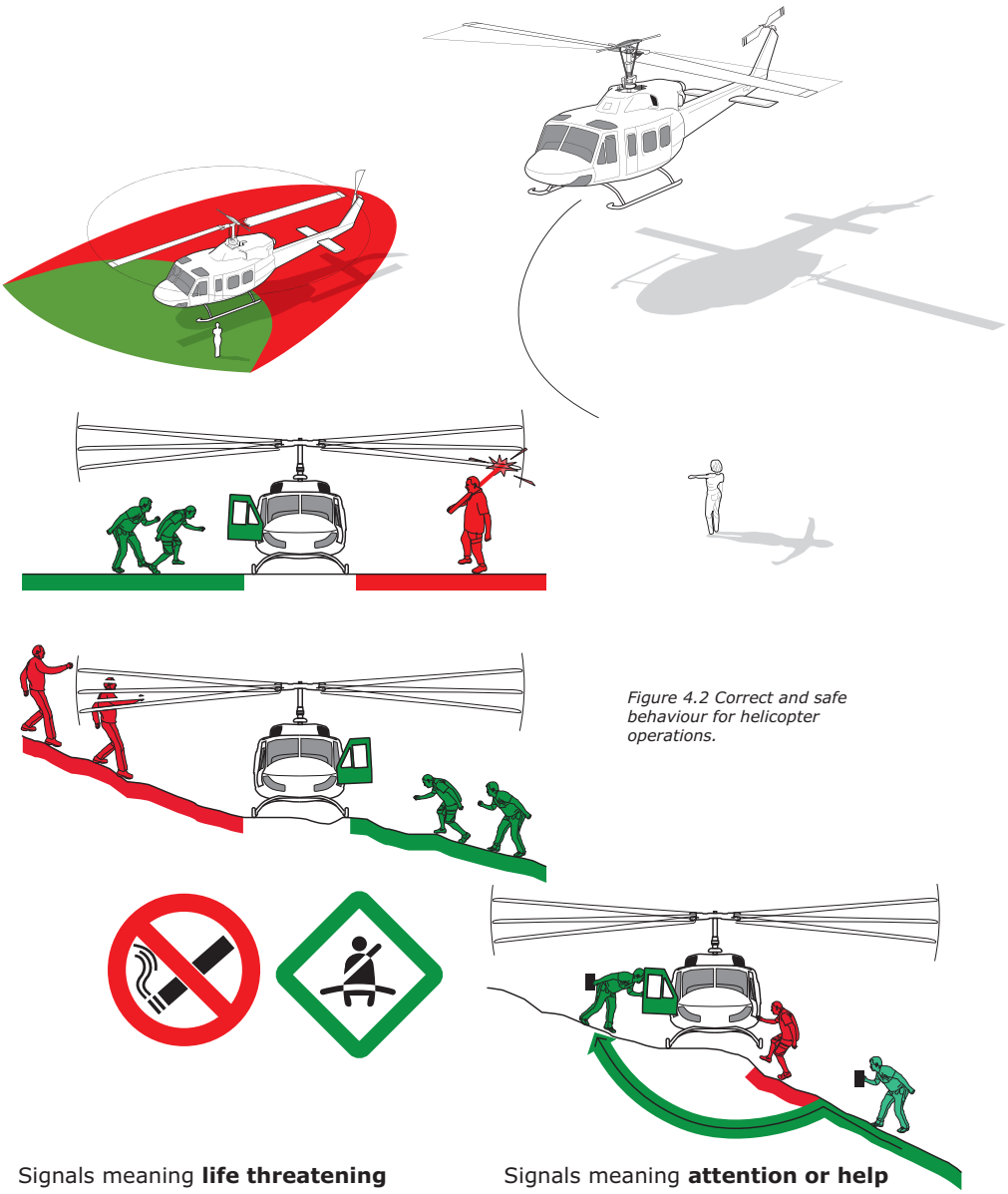


Figure 4.2 Correct and safe behaviour for helicopter operations.

Signals meaning **life threatening situation:**

- Red rockets/flares/light balls
- Mayday/SOS radio calls (at sea)
- Orange smoke

Signals meaning **attention or help needed:**

- Green rockets/flares/light balls
- Other radio calls
- Fire on the beach. In summer, smoke is more easily observable than flames.

4.3 Helicopter operations

It is important to develop good helicopter habits: The pilots know far too many stories of those who didn't. So follow the instructions from the pilot as well as the instructions below. The pilot is responsible for you, but you could still cause an accident.

- Always approach the helicopter from the front (bend down), or from the side, and make eye contact with the pilot. This is to avoid the almost invisible and deadly tail rotor, and to ensure that the pilot can see you.
- Always bend down when approaching or leaving a helicopter. This is to avoid the main rotor, which often droops to 'neck height' when it slows down during engine shutdown. When being dropped off with rotors running stay close to the helicopter within the pilots view until the helicopter has taken off.
- In uneven terrain, when the helicopter touches the ground with both floats, always leave the helicopter downhill, and approach uphill using the downhill door.
- In uneven terrain where the helicopter keeps one float in the air, approach the helicopter uphill, then go around the front to the hill side where the float is in contact with the ground, and use the door on this side.
- Follow the pilot's instructions when loading the helicopter (or another aircraft), to ensure an even weight distribution.
- Seat belts must be kept fastened during flight. Sit still, especially during take-off and landing.
- Pay attention to closing the doors properly and make sure that seat belts etc. don't get trapped in the door opening.
- Always carry long objects horizontally with both hands and a firm grip near the helicopter - beware of the main rotor! Never throw anything, light or heavy, when near a helicopter.
- Near an aircraft and especially near a helicopter, all light items must be weighed down very securely. It may be best to carry them away from the aircraft and sit on them.
  This includes all hammers. Remove hats and mosquito nets and place them securely away in a pocket or bag. This is to avoid damage to the helicopter or persons around it by flying objects whirled up into the air by the main rotor.
- Smoking is strictly prohibited.
- In the camp a wind cone should hang free in order to give the pilot a pre-landing check on the wind direction and wind force. Place the radio antenna (marked with flagging tape or strips of fluorescent cloth) and the wind cone in such a way as to leave a suitable landing site open for the helicopter.
- A person on the ground may show the wind direction to the pilot by turning his or her back to the wind, stretching out the arms to each side. Usually the pilot will then select a landing site himself.
- Be sure not to damage the floats, for example by stepping on them with crampons attached to boots.

Helicopters make a lot of noise, which increases the stress level. It is important to remain calm, think straight, and not to rush when working with helicopters.

NOTE: Bring equipment for an emergency camp for all persons participating in a reconnaissance.

Be aware that a helicopter, during a sling operation, will move to its right or right of load (facing front) in case of engine failure or other emergency requiring an immediate landing.

4.3.1 Firearms and ammunition in helicopters

Safety while operating with helicopters is essentially the responsibility of the pilot and the company he/she is working for. This is particularly true when handling dangerous goods such as firearms and ammunition. Participants in GEUS operations must always follow the instructions of the pilot, who will follow the regulations that apply for transportation of weapons.

Weapons shall be stowed in a place which is inaccessible to passengers during flight unless the Authority has determined that compliance is impracticable and has accepted that other procedures might apply. Firearms or other weapons that contain ammunition shall be unloaded and checked by the pilot.

Ammunition for weapons may be carried in passengers' checked baggage, subject to certain limitations, in accordance with the Technical Instructions for the Safe Transportation of Dangerous Goods by Air (ICAO Doc 9284-AN/905).

4.4 Boat operations

When working from rubber boats/dinghies, it is the project leader's responsibility that field participants follow the rules for safe operations at sea. If you are not familiar with operating the boat and the engine you should be instructed in how to use one by an experienced operator. Make yourself familiar with the engine as well as the boat. One of the biggest risks is having an engine failure. GEUS organises training courses which include instructions in how to make some basic repairs.

Figure 4.3 Operation from a ´dinghy´ (rubber boat), illustrating the use of proper safety equipment, including a survival suit, a life jacket and the ´dead-man button´(red wire attached to the wrist).

The danger of falling overboard into very cold water is frequently underestimated. In cold water of 0-5°C, it is possible to survive for about 2 hours before hypothermia causes death, but if you are not wearing a life-jacket you will probably lose consciousness and drown in less than 10 minutes.

The general rules that should be followed are:

- Never sail out alone
- Always wear a life jacket
- Always wear a survival suit (see below)
- Use the dead-man button (the feature on the engine that automatically stops the engine, if you need to bring the boat to an immidiate stop.
- Always bring your satellite phone + VHF radio.
- Bring a first aid kit + signal flares.

- Bring the necessary equipment for an emergency camp.
- Bring the necessary equipment for the boat – all boats are equipped with a small kit that enables basic repairs of the boat and the engine.
- Always have paddles (or similar) in the boat.
- Bring sufficient petrol for the trip.
- Icebergs should be given a very wide breth, as they are known to be unstable and to turn over from time to time.

4.4.1 Life-jackets and survival suits
Life-jackets are mandatory for participants working from zodiacs or small boats in Greenland. The use of life-jackets cannot under any circumstances be deviated from.

It is GEUS' official position that participants in such operations should also always wear survival suits.

In two instances participants can decide to refrain from using survival suits, if they consider it to be safe to make such decision. In both cases operations should be taking place at low speed, in good weather and under optimal sea and sailing conditions.

The two instances are:

- Operations taking place so close to the coast that the employee would be able to bring themselves to land, if they should fall overboard. Survival suits should be onboard the zodiac/ boat at all times and be ready for use.
- Assisting in transportation operations between base ship and the shore. However, operators of the zodiacs/ small boats in such operations must always as a minimum be wearing floatation suits.

Survival suits should ALWAYS be used correctly, i.e. fully zipped; falling into the water with an unzipped survival suits has the opposite effect of its purpose: it gets filled with water and you risk drowning.

4.4.2 Man overboard
The following rules are important in case of an accident:

- Avoid panic.
- Move around as little as possible in cold water to minimise heat loss.
- Turn the boat away from the wind (wind and sea coming in from the back).
- If possible, assign a person to only keep track of the person overboard.
- Turn the boat to face/into the wind, reduce speed, and place the boat 1-2 metres down wind of the person.
- Disengage the motor (idle). Help the person back on board. If practical, switch off the motor and use the propeller as a staircase.

Once out of the water:

- Victims with a body temperature below 30°C appear dead, but may be revived by warming them in a bathtub with water at 34°C for 5-10 minutes, then raise the water temperature to 40-45°C. If a bath tub and warm water are not available, remove the wet clothes and wrap blankets or dry clothes around the victim including his head, preferably with a layer of plastic innermost.
- Conscious victims should drink warm, sugary liquids - NOT ALCOHOL!

4.5 Safety when rock sampling

All persons collecting rock samples shall wear glasses or safety goggles (the latter is part of the provided field equipment). If more than one person at a sample site, observe carefully where the others are located and inform them if you are going to hammer a rock – flying rock fragments can hit anybody around you. Furthermore, when working and sampling on unstable slopes, be careful not to loosen or throw rocks that can hit others.

Persons carrying out channel sawing must wear hard hats, glasses or safety goggles, hard boots, hearing protection, mask and gloves. The safety equipment is all provided by GEUS.

Persons working at drill sites must wear hard hats and hearing protection (both provided by GEUS). Special instructions will be given on site.

4.6 Back troubles

Fieldwork can result in back trouble, and expedition members must note that all heavy goods must be handled carefully, preferably by two persons to avoid sudden strain on the back. Be especially careful during awkward and stressed working situations, as for instance when loading a helicopter in a hurry.

Try to avoid a cold back, during fieldwork as well as in the camp. Make sure you have adequate insulation under the sleeping bag at night. Bending/stretching exercises in the morning are useful. In the worst case muscles in the back may become tense and the condition may lead to cramp and severe pain. Warmth and relaxation may help, but it may also be necessary to use pain killing drugs to relax the muscles. When packing equipment and samples, due regard must be paid to the weight of the units. 0.05 m^3 of stone material packed in newspaper weighs about 50 kg. This is all that two persons may safely carry for short distances.

4.7 Safety on glaciers

Only few parts of Greenland require special skills in climbing or skiing but some experience is always useful. Walking, skiing or driving a snowmobile over a glacier is also required for glaciological work. Arrangements for supply of special equipment should be made in advance. Be somewhat less ambitious than you would be in more densely populated regions. Snow-covered glaciers should be treated with great respect, and so should dead ice moraines, which often conceal crevasses. These may be up to 25 metres deep and contain melt water streams. Bear in mind that it is almost impossible for one man to rescue another from a crevasse without proper training and equipment. Avoid fast running glacier streams; many of them end in pot holes. Bring along snow goggles if you are going to work on snow or on glaciers.

4.7.1 Snowmobiles

Most typical GEUS surveying operations are only carried out when the snow cover has melted, but glaciological work often requires the use of snowmobiles. Snow cover opens up the Arctic, allowing travel in areas difficult to reach in the summer months. Snowmobiles are an excellent tool for getting around in snow country. When arriving at a field camp location where snowmobiles are available, attend any hands-on operation and safety course provided by the camp staff if available. Carry emergency gear in case

of a breakdown. Carry a spare transmission belt and familiarise yourself with the procedure required to change a broken belt. Be sure that the engine is switched off and any mechanical parts have cooled before attempting to change a broken transmission belt. Always carry a snow shovel. Never consume alcohol before or during snowmobile operations. Dress appropriately with warm, windproof clothing. Always wear a helmet with goggles and a face shield, and pay special care that no naked skin remains exposed to the wind while driving, since it is very easy to get frostbites without realising it. A good idea is to keep an eye on each other's face masks after stops, to be sure that no naked skin remains exposed. In any case never travel outside the camp area with only one snowmobile, in case it breaks down. Make sure you have a snow shovel in case you need to dig out the snowmobile, a snow probe to check for crevasses if travelling over glaciers, a drill to check the thickness of sea ice if crossing or driving along fjords, and a rope.

Every person who operates a snowmobile is responsible for doing some basic checks to the machine before use. Check the suspension. Look for loose or broken idler wheels located in the snowmobile track. Check the springs and shocks. Inspect the track's adjustment and tension. Confirm that the skis and track are not frozen to the snow or ice. Lifting the front ski will break a frozen ski free. If the track is frozen in, break it loose by standing on the machine and gently rocking it from side to side. Be aware of loose trailing slings and ropes that can get entangled in the tracks and around axles. Most snowmobiles have two-stroke engines that require a gas and lubricating oil mixture. They may vary as to how this oil is mixed, and newer models often have an automatic oil injection system. In this case the oil reservoir tank must be filled frequently and the level maintained to provide continuous lubrication. Always check either the oil level (at least once every day or more depending on the distance travelled) or confirm the correct pre-mixed fuel is being used before operating. Operating a snowmobile without lubricating oil will cause engine failure. Four stroke engines tend to travel longer on a litre of fuel, but they are heavier and much more difficult to repair in the field.

Bring sufficient fuel and allow for higher consumption with changing snow conditions. Petrol is flammable and explosive under certain conditions. Always fuel in a well ventilated area. Do not smoke or allow open flames or sparks in the vicinity. Use gloves: wetting your hands with fuel will make the skin much more easily cracked in cold weather, and it can also result in frostbite because the fuel will remain liquid in very cold weather. If petrol fumes are noticed while driving, determine the cause and immediately correct the problem. When parking snowmobiles, point the front into the prevailing wind and free the undercarriage from accumulated snow. Always cover the machines to help prevent snow from accumulating under the engine cover. Once cooled, wrapping the engine in a large plastic bag under the hood is also effective, but don't forget to remove the bag before starting the engine!

Before starting the snowmobile, activate the throttle control lever several times to check for smooth operation and no freeze -up of the control cable. The throttle control lever must return to the idle position when released. Inspect fuel or gear oil

reservoirs for leaks. Inspect brake operation. Be easy on transmissions and shift gently. If gear(s) will not engage, turn off the engine, shift gears, and restart. Abusing gear shifting can cause mechanical problems that are not repairable in the field. Never shift the transmission unless the snowmobile is stopped. Never travel over longer stretches of bare ice since snowmobiles are designed for snow to provide some cooling. Minimise travel on bare ground or the skis and belt will be quickly damaged. When travelling with two or more machines, give adequate separation for unexpected stops or hazards. Ice spikes are useful when driving over ice stretches, and can be mounted manually on suitable belts. Be very cautious on terrain where solid obstacles may be hidden under a thin snow cover, such as stones or ice ridges.

Never drive in poor weather, and in general when visibility is reduced. When operating a snowmobile always keep speed to a safe, responsible and manageable level. Be aware that some speed and practice are required to attain the best control of the scooter on tricky terrain, e.g. along side slopes. Longer stopping distances are needed on snow and ice surfaces. A safe distance between drivers is 3 seconds, to be doubled between the leader and the second when travelling over dangerous terrain like sea ice. Constantly keep an eye on the drivers following you, and also on your sledge if you have one. If forced to drive in low visibility conditions out of absolute necessity, pack the scooters in a close formation so that drivers can keep in visual contact at all times with the scooter in front and to the side of them, and drive very slowly at a steady speed. The only task of the followers is then to keep their place in the formation and avoid crashing into each other. Agree beforehand on how to behave if anybody gets detached from the group: usually just keep the position in the trace and wait for the others to come back and find you.

Gain speed before ascending steep slopes, especially if towing a heavy sledge, and let the snowmobile drive down steep descents without using the brake. When driving over terrain sloping sideways to the direction of travel, shift your body weight upslope as counterbalance. Before setting off on a trip, agree on a common set of hand signals with the other drivers:

- stop (to signal your intention to stop)
- speed up (to signal that the terrain requires to keep a good speed to be crossed safely, such as slush ponds, bare ice stretches, and poor sea ice)
- break out (for the leader to signal that there is dangerous terrain ahead and all the group needs to immediately turn back to safe terrain without stopping)

These signals must be repeated by everybody so that they get down to the last driver.

If at all possible, never stop in dangerous terrain such as snow covered glaciers and sea ice, and make sure that any stop site is safe. On a glacier, use your expert judgement to spot and avoid areas more likely to be crevassed, like areas of flow divergence and other settings where tensile stresses in the ice can be expected. Typical crevasse areas are found along the sides of the glacier, at the edge of plateaus where ice flow accelerates downslope, around bumps in the bedrock, at confluences of two glaciers, near calving cliffs, at the headwall of the gla-

cier where the ice moves away from a rock face (bergschrund). Never step off the scooter before having ruled out the risk of snow-bridged crevasses using a snow probe. A snow bridge may be strong enough to support the weight of a snow scooter but not that of a standing person, because the pressure per unit surface is smaller for the scooter. On sea ice, have the drivers stopping at the same distances they were keeping during the drive and wait for the leader to check the thickness of the ice and signal to join him. Always consider that conditions may vary significantly over space and time: never assume that it is safe to follow a GPS track just because that route was found to be safe in a previous trip. Typical spots with dangerous sea ice are shallow waters, areas where strong currents could be expected, and spots where ice has been observed in the past to be thin.

Always seek advice from experienced locals, gain a wide overview of the stretch of sea ice to be crossed from an elevated position, and carefully study satellite imagery to assess the safety of the ice. If you start breaking through, speed up, signal to those behind you, and try to quickly get to safer ice. Always have ready at hand a pair of metal spikes suitable for pulling yourself out of the water.

4.7.2 Avalanche risk

The condition of snow stability is most readily inferred from direct examination of snow cover structure. However, even without doing instrumental investigations, just by observing certain features in the landscape, and following the meteorological situation, it is possible to avoid many potential avalanche risk situations. A number of field indications and general advice is listed below. Many of the field indications of avalanche danger require that you are able to make good visual observations of the landscape. Avalanche hazard is usually greatest during the first 24-48 hours following a storm or blizzard. The snowpack will tend to adjust to the weight of new snow with time. Take note of loose snow on steep surfaces. If steep surfaces (houses, rock steps, boulders, etc.) are still holding much loose snow after a storm, presumably neither has the snow on the ground compacted and settled.

Look for signs of previous and recent avalanche activity on slopes which represent a major clue to avalanche risk. Completely discharged slopes are safe, but new snow may make them dangerous again.

Avoid in particular slopes with an inclination of 30-45°, as the avalanche risk is especially high on such slopes. Watch out for such slopes above the area you are crossing, since avalanches initiated at higher elevations will propagate to lower elevations.

Be aware that avalanche risk increases during warm periods with temperatures at or above freezing. A smooth melting crust may develop during the night and under freezing conditions, which may become a sliding surface for later snow. Weak internal layers may also be produced by solid precipitation events at or above ca. -4°C. At such temperatures snow particles often attain a simple, round form giving rise to a snow deposit with little internal strength.

Very cold periods can also increase the avalanche danger by promoting the development of a weak layer of depth hoar at the bottom of the snowpack

Look out for signs of snow drift: snow

dunes, cornices, and erosional features. Snow drifting often begins at relatively low wind speeds, from about 4 m/s, and eroded snow will deposit in lee locations. This may result in an increase of the avalanche danger for such lee slopes even in clear weather.

Pay attention to snow surface collapse and whoomp sound. Travelling on a snowpack with an internal weak layer such as depth hoar or light density snow will cause the weakness to collapse, dropping the upper layer of snow a few centimetres. Carefully avoid any steep slope where this is observed, as the danger of a slab slide is very high. Hollow sounds from walking over hard snow slabs may also indicate that it is sitting on top of a weak layer.

Avoid snow slopes without penetrating objects. Snow covered slopes without penetrating bedrock, boulders or vegetation are potentially less stable, as such penetrating objects tend to lock the snow cover to the slope by locally increased surface roughness. However, protruding boulders or rock outcrops are not enough to assure that the slope is safe, and they may become the site of depth hoar formation under some circumstances.

Avoid mouth and confluence areas of valleys and ravines, and any other topographical trap where avalanches may be channelled.

Avoid convex slopes where increased tensional stresses in the snow pack can be expected. Avalanches will often begin at or shortly below such a convex shoulder. If you cannot avoid crossing such a snow covered slope, it should preferentially be attempted slightly above the convex shoulder.

4.7.3 Crevasses

If you are driving a snowmobile across an unfamiliar glacier, you should not stop until you finish crossing. When stopping on a glacier, you should probe the area with an avalanche search rod before you dismount from your snowmobile or dog sleigh, take off your skis or pitch a tent. Always bring a snow probe (lavinesonde in Danish) and rope with you. People are usually roped together in a team when travelling on skis or on foot across glaciers. When there are few fixed points of reference, orientation may be tricky. In bad weather, visibility might be almost nil, in which case travelling on a glacier is extremely dangerous.

It is imperative to realise that glaciers are constantly changing, that crevasses and melt-water channels keep opening and closing. Thus you should not count on a route being safe year after year. Proper training in safe route finding, and instruction on crevasse rescue techniques are required, an harness must be used by all persons in dangerous areas and rescue equipment needs to be readily available.

4.8 Crossing a river

River crossings can be dangerous, especially because rivers in Greenland are made from glacier melt-water that is close to 0º C. If you are in any doubt as to the safety of a river, you should not attempt a crossing.

If your planned route requires a river crossing, study weather reports and the forecast carefully. Has there been recent heavy rain in the catchment of the river, or is rain forecast? Plan your food supplies so that you can wait for a day on the bank if necessary, waiting for the river to subside.

Remember, if you plan to return the same day over a melt-water river, the height of the river can vary enormously over a 24 hour period; low in the morning, high in the evening.

Before crossing:
When you reach it, study the river carefully. Some of the dangers to look out for include:

- deep or fast-flowing water.
- 'strainers', such as unstable boulders or recently collapsed river banks which can catch things underwater (including you).
- submerged, sharp, or slippery rocks, and
- an uneven or unstable bottom.

Not all of these dangers will be visible upon a casual inspection.

If the river is too dangerous to cross at this point, look for a safer crossing point. Alternatively, be prepared to wait for the water to subside or water level to drop.

Every river is different, but some very general criteria for crossing or not crossing a river are:

- Very fast flowing, white water: unsafe, do not cross.
- Fast flowing: Cross if less than ankle-deep and you are able to see the bottom.
- Moderately fast flowing: cross if less than knee-deep and you can see the bottom.
- Flowing slowly: Cross if less than waist-deep.
- deeper than waist: Do not cross as this likely requires swimming in very cold water.

There are several things you should do before you start to cross the river:

- Make sure that your pack is securely waterproofed with a sturdy plastic liner.
- Unless there is a clear sandy bottom, you should wear light footwear in the water or you can wear your own boots, properly laced, without socks.
- Undo the waist and chest straps of your rucksack for a quick exit in case you fall over.
- If you can see obstructions in the river, plan a route through them before entering the water, but be prepared to change if things are not what you expected. Select a point on the opposite bank where you will exit the water.
- Ideally the two most competent expeditioners should be at each end of the party, ready to help other party members if necessary.
- If you intend to cross as a group, for example with everyone holding onto a long stick, make sure that every one knows what the plan is and what to do if someone falls over.
- A river might be easily crossed in the morning, but it might be impossible to cross the same river in the evening, because of extra melt water.

In the water:
If crossing individually, use a stick or an antenna or tentpole to test the water depth in front of you. It can also be used as a support, enabling you to keep two points of contact with the river bottom at all times. If the rocks are smallish, smooth and slippery, it is easier to step in the gaps between rocks rather than on top of them. In rivers where the bottom is sandy and the water flowing fast, you

may find that the sand is unstable and you sink into it if you stand still. Be prepared to either keep your balance or keep moving. Move quickly but carefully through the river and exit at the other side.

If you are carried away:
If you are carried away over rapids, obviously you should try to stay afloat by jetenising any rucksack. Attempt to manoeuvre yourself so that your feet point downstream and you are sitting up slightly. This presents your legs and bottom to oncoming obstacles.

Out of the water:
Dry off as much as possible before putting your footwear back on. Make sure that all members of the party are warm and dry before setting off.

4.9 Wildlife

Encounters with wildlife are common when working in Greenland. In general, if you ignore them they will ignore you. Most animals are very rarely aggressive when unprovoked. In North and East Greenland, rifles and revolvers are supplied for self-defence. In the field, weapons should be carried so that they are easily accessible, and they should be stored in the sleeping tents at night. If a muskox, polar bear, walrus, etc. is killed in self-defence, the nearest police station and the public authorities must be notified as soon as possible.

4.9.1 Polar bear and muskox
Experience with both polar bear and muskox suggests that if you ignore them they will ignore you. Very rarely both may be troublesome. Teams in these regions must be armed with at least two firearms. An attacking animal is probably best crippled by a shot in the shoulder, after which it can be finished off in safety - see fig 4.4 on the next page. Shooting against the head of a polar bear or musk ox can be ineffective, and even dangerous - for you!

Signal pistols are sometimes effective first steps against a curious bear, but a suitable weapon should always be present. (Information folders describing how to deal with polar bears are issued in Canada and in Svalbard, and GEUS makes an effort to supply them to teams working in North and East Greenland). For more information on polar bears also see GEUS' intranet.

4.9.2 Foxes
They are very friendly as a rule, but on rare occasions have been known to be carriers of rabies. Thus, if attacked and bitten by an infected fox, you should wash the wound with plenty of soap and see a doctor urgently. In some districts hungry foxes are a nuisance and call for precautions. Do not leave your boots outside to dry at night where foxes are known to be around.You may not have a boot in the morning

4.10 Firearms

Bringing firearms to Greenland require permits from both Danish and Greenlandic authorities. Project leaders must inform GEUS' equipment section well ahead of departure (minimum one month), if weapons are needed for fieldwork.

Field teams are provided with firearms when working in areas in Greenland where there is a risk of confrontations with potential dangerous animals, prima-

rily polar bears. Be sure to attend the GEUS shooting course both theory and practice in advance of the field season (compulsory, see p. 8). The expedition leader is responsible for instruction given to persons unfamiliar with the use of weapons.

Treat firearms with respect. GEUS firearms are of a robust and simple type and easy to handle. Firearms provided by GEUS are cleaned and checked, but make sure that they work at the beginning of the season.

Each field team normally consisting of two persons is - as a GEUS–standard – provided with:

- One "RUGER M77" rifle caliber 30-06 with 20 pcs. of ammunition
- Two "Smith &Wesson 629" revolvers caliber .44 magnum with 2 x 25 pcs. of ammunition
- One signal flare gun caliber 4 or 26.5 cm. with 10 shells (5 red, 3 green and 2 cracker shells).
- Two sets of "pencil flares" with red and green flares
- Holsters for all weapons
- Cleaning gear and gun oil

Additionally ammunition or other non standard items must be ordered before the field season.

4.10.1 Basic safety rules and procedures

There are four basic rules when handling firearms:

1. Always consider a firearm as loaded.
2. Never aim at something you don't want to shoot.
3. Keep fingers away from the trigger unless you want to shoot.
4. Background must be clear of anything that you don't want to hit or damage.

Figure 4.4 Polar bear from front angle, red circle indicate recommended target area.

When receiving or picking up a firearm always point it in a safe direction and conduct this three step procedure ("S-M-B").

S: Safety switch. (The safety switch should be in the backward safe position)
M: Magazine. (Open/release the magazine)
B: Bolt. (Open the bolt, and bring it into rear position. Safety switch in middle position).

After these three steps, the operator has to conduct a visual inspection first from the back of the chamber and then from the muzzle of the barrel to make sure that no cartridge or obstruction is pres-

ent. Finally the operator has to check that the safety switch works correctly. In the safe/rear position the trigger should be blocked. In the middle position the trigger is still blocked but the bolt can be operated. In fire/forward position the firing pin in the bolt should be released when the trigger is operated.

When unloading a firearm – remove all cartridges and check that no cartridge is left in the chamber by ensuring that it is possible for light to pass though the barrel and the chamber. The weapon is now ready to be loaded, inspected or cleaned.

NOTE. The revolver has no safety switch! This has been source to some concern about the safety regarding handling of the revolver in the field.

The Smith and Wesson is a "double action" type revolver.

Shots can be fired in two ways, either by a "heavy" pull to the trigger which will force the hammer back and release the shot, or by cocking the hammer with your thumb and release the shot with a light pull to the trigger.

The revolver has some "built in" safety features:

1. Heavy trigger function. Trigger must be directly activated with an extensive force of 3+ kilos to bring the shot to go off.
2. The revolver is constructed with a hammer block or hammer block safety that prevents activation of the firing pin by a strike to the hammer, or if the hammer is forced some way back by another method.
3. When the revolver is in the holster both trigger and hammer is totally covered, and branches or rocks can't reach the trigger or hammer.

Be sure to practice - with an unloaded revolver - the procedure to release the hammer after it has been cocked. This will enable you to un-cock the hammer if it has been cocked intentionally or accidentally.

When the hammer is cocked the trigger will release the shot by a short pull of a few hundred grams.

NEVER put a revolver in its holster with the hammer cocked.

4.10.2 Other safety rules
Do not ever play with the firearms.

Make sure before going to the field that the provided ammunition is of the right type for all your weapons (see paragraph 4.10.3 below). The caliber of the gun is printed on the barrel and in the bottom of the cartridges.

Make sure weapons are cleared of all cartridges (chamber and magazine) before cleaning.

If you are in doubt of the functional status of your firearms unload, inspect, clean and test them.

No firearms must be carried when GEUS-personnel comes into contact with towns or local population.

4.10.3 Weapons in the field
During the field season always keep your firearms within reach, clean and with a loaded magazine.

Revolver drum is made for six shots. With the safety features of the revolver

in mind (see the Note in paragraph 4.10.1) it is safe to carry the revolver in its holster with six cartridges in the drum. A rifle magazine contains 4 cartridges. When a rifle is carried on your daily field trips in or outside the holster it is GEUS' official policy that there is no cartridge in the chamber. That means that loading procedure must be conducted once before the rifle is ready to fire.

Revolvers, and if wanted (based on a personal decisions), rifles, should always be carried with you during fieldwork. Best practice is to have the revolver in its holster in your belt during fieldwork. Alternatively, if the revolver is hampering your mobility, it can be put in your ruck sack in its holster. In the field camps, the weapons should be placed in central places near you. Consider having one in the kitchen tent when you are here and take it with you to your sleeping tent when you plan to stay there.

Revolvers should be carried in the designated holster and stay there the entire field season unless they need to be used, checked, or cleaned. Rifles should be in their holster during transport. During fieldwork the rifles should either be carried by the sling or in their holsters. If you are not carrying the rifle with you during fieldwork consider to leave it in its holster a bit away from the camp at a visible/recognizable place (consider marking it with orange flagging tape or cloth); in the case a polar bear is within your camp when you return from the field.

Be aware that special rules apply in base camp, whether land-based or ship-based. In general you should not carry around weapons in places where several persons are gathered. In base camp there will most often be designated rifle posts, where loaded rifles are placed. Other weapons should be put away while you are in base camp. Field participants' unloaded firearms must either be placed in a locked cupboard or they should be placed in a safe position in their sleeping quarters (or tents) ready to be used in the event of a night visit by a polar bear. Ask the expedition leader or the persons responsible for the base camp about the rules and get instructions.

All weapons must be cleared of all cartridges when entering a helicopter, aircraft or ship (see paragraph 4.3.1). Be sure to have cartridges ready to load up after you have been left at your field location or camp site.

When operating from zodiacs it may be convenient to have a firearm ready when coming on shore

A field team or party practicing with the firearms in the field should take all possible precautions to ensure safety of the terrain behind the targets. Bullets fly a considerable distance! Be sure to inform members of your field party that you are practicing and be very sure that you are not aiming and firing in directions where there might be people. Do not fire over hills, or where full sight is not available. Remember to clean up after you.
Hunting is prohibited during fieldwork. Hunting in Greenland requires permission given by the Greenland Home Rule Administration. No hunting must take place in the National Park.

4.10.4 End of the field season
At the end of the field season before packing for shipping make sure that all weapons are cleared of cartridges in both

chamber and magazine/drum by conducting the "S-M-B" procedure (see paragraph 4.10.1).

Ammunition must be handed in separately as it may have to be packed in a specialized way as dangerous goods before shipment.

4.11 Explosives

According to the standard conditions for prospecting and exploration licences for minerals, blasting operations require specific approval by the mineral authorities before the activity commences.

For approval of blasting operations, an application must be forwarded to the mineral authorities. Blasting shall only be carried out by a responsible blaster holding a certificate.

4.12 Rolling Boulders "RulleMik"

This is a very popular pastime, but Greenland is not as thinly populated as you may think. If you are not 100% certain that there is nobody below, the only safe recommendation is DON'T DO IT!

Waterfall. North coast of Tunulliarfik east of Nunasarnaq

Photo: Henning Sørensen

5 Results: from field data to publications

5.1 Geographical positioning in Greenland

5.1.1 GPS in Greenland

The use of GPS in Greenland has accentuated the necessity of knowing about and reporting (for instance when delivering your sample locations to your GEUS department) the basis of the map on which (or from which) coordinates are plotted or read. Always set the GPS receiver to use the geodetic datum WGS84.

If you plan to use a computer and download data from the GPS in the field, GEUS has GPS communication software to download data from the receiver to the computer. Remember to request a serial GPS communication cable from your project leader.

NOTE: See how to convert geographical coordinates in appendix B, page 88.

5.1.2 The UTM system

The localisation in Greenland of samples and map information is a key problem, which should be addressed by using classical geographical coordinates in decimal degrees (and if desired also in UTM grid references).

The Universal Transverse Mercator grid is drawn on many of the maps intended for fieldwork, and can be used for sample dockets and in the field notes. The UTM grid cuts up the world from pole to pole in lens-shaped zones, from the N–S symmetry lines of which one reads a positive (to the E) or negative longitude, and from the E–W symmetry line of which (the equator) one reads a positive (to the N) or negative latitude. Each zone covers 15 degrees of latitude and has been numbered; for Greenland zones 18 to 28 are used (starting in the W). The zones have been subdivided in 100x100 km squares starting where the zone symmetry lines cut each other (at the equator).

The UTM net may be referred to in two ways: (1) using zone coordinates (for instance 27 E471100m N8898750m) or (2) using map references (for instance 27XVJ7110098750 for the same locality, namely Centrum Sø base camp in Kronprins Christian Land in eastern North Greenland). This kind of reference is used mostly in GEUS's work, and is conveniently used with GEUS produced maps. The maps in SW Greenland (between Buksefjorden and Tartoq area) are in UTM zone 22. Note that helicopter pilots may use a different UTM zone (e.g. zone 23).

Some parameters may be recognised in the two sets of UTM references above: the zone number – 27 – and the two figures 71100 and 98750 which are, respectively, easting (71100m) and northing (98750m) within the 100x100 km square and measured from its SW corner. The 100x100 km squares have, however, different designations using the two systems.

The zone coordinate 100x100 km square designation is obtained by (1) using a 'false easting' i.e. measuring E-wards from a line situated 500 km W of the N–S symmetry line of the zone (only to obtain positive eastings!) and (2) measur-

Installation of a mass balance station
Photo: Carl Egede Bøggild

ing the northing directly from the equator (i.e. positive northings on the northern hemisphere). In the above examples the locality is precise to within a metre, and the point is 8898750 metres N of the equator. The zone coordinate 100x100 km designations are stated – with a small print – along the edges of maps with UTM grid.

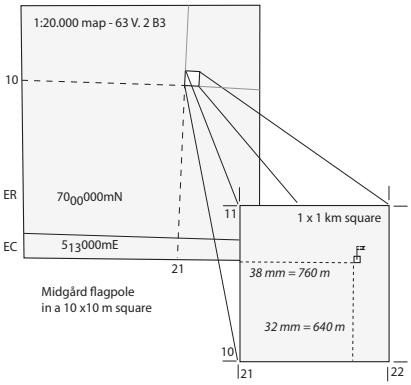
The map reference 100x100 km square designation uses letter 'names' for a number of E–W belts, 8 degrees wide, starting with A at the equator; thus V, W, X and Z are used for Greenland (X in the above example). Within these belts and zones 100x100 km squares have been given 2-letter map reference 'names', printed directly on maps with UTM grid (VJ above). Precision is map scale dependant, in the above example 1 m precision is based on a very detailed map. It is, however important to remember to state easting before northing and both with the same number of digits.

The following map reference example uses relatively detailed maps around the Survey's base camp Midgård near Fiskenæsset.

Midgård flagpole is here given within a 10 m square. If the accuracy is only required to within 100 m square 2 * 3 digits are used: 22VER218106. And if required to within a 1 km square, 2 * 2 digits are used: 22VER2211.

5.1.3 Magnetic variation

SW Greenland lies relatively close to the North magnetic pole. The deviation is large and varies from year to year. It is therefore necessary to adjust any compass to the local magnetic deviation so that all field measurements are automatically made with respect to true North.



Midgård flagpole (on the 1:20 000 map 63 V. 2 B3)

Grid zone designation	22V*
100 km square	ER*
Read easting from the 1 km grid square	21*
Measure easting in the grid square	76
(38 mm measured represents 760 m)	
Read northing from the 1 km grid square	10*
Measure northing in the grid square	64
(32 mm measured represents 640 m)	
Full map reference:	22VER21761064

(* = information printed on the map)

Figure 5.1 is an isogon map showing lines of equal magnetic declination for the year 2014. Note that positive values are measured clockwise from geographical north, eastern declinations are positive, western declinations are negative. For example, the magnetic declination Fiskenæsset in 2013 can be read from the map as approximately 27°W. Accordingly the red North arrow of a Silva compass should be turned anticlockwise with about 27°.

Figure 5.2 is a map that shows the change of the magnetic declination per year. For most of Greenland the annual change is well below the accuracy of our compasses, but in North–West Greenland the annual change is close to one degree.

It is also useful to remember that there may be a local declination due to bed

Grønland - magnetisk misvisning 2014

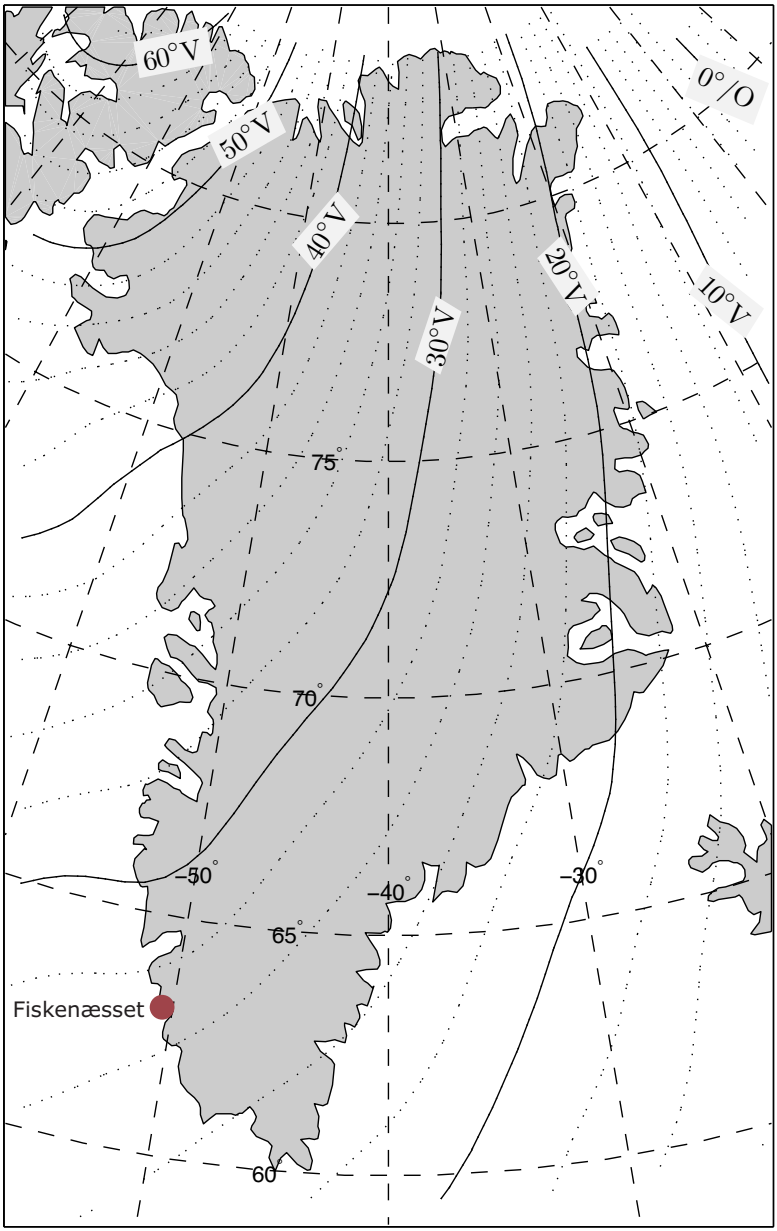


Figure 5.1. Isogon map showing lines of equal magnetic declination for the year 2014. Source: DTUSpace.

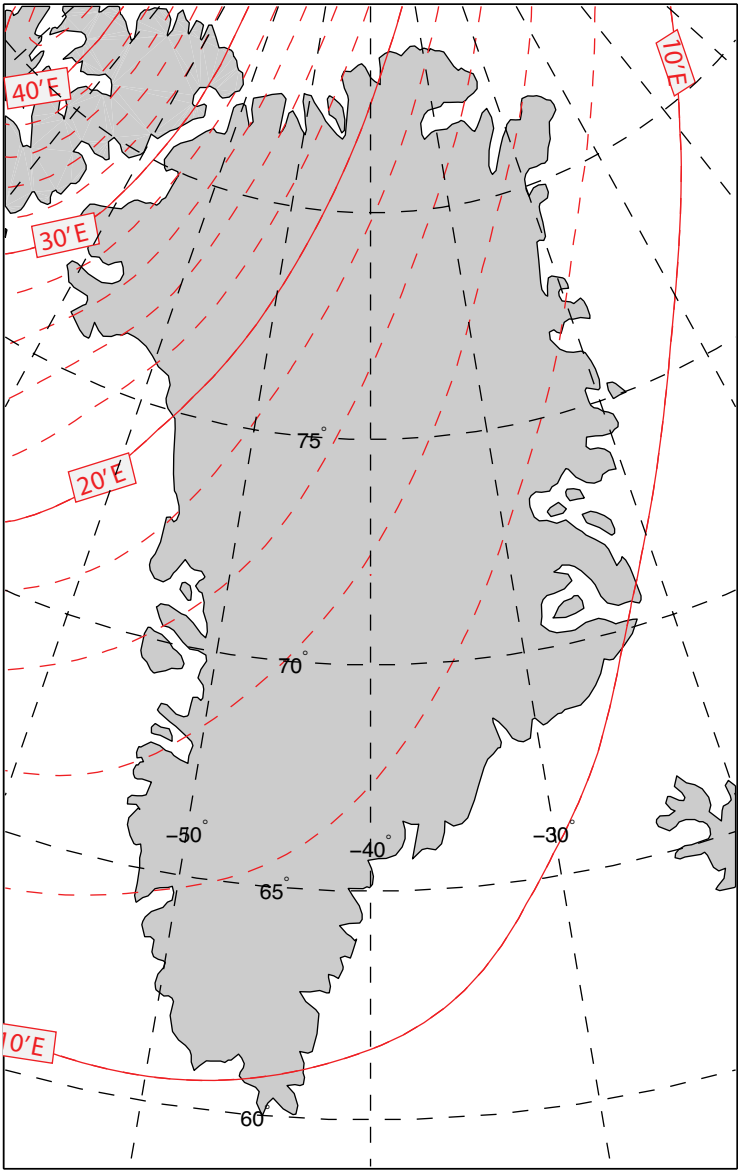


Figure 5.2. Map (from 2013) showing lines of equal magnetic declination change per year valid for 2013 and 2014. Source: DTUSpace

rock influence, which may vary as much as 1° over 50 metres. Also diurnal (daily) variations may shift the declination considerably, up to 9° in North Greenland and up to 2° in South Greenland. Furthermore, in North Greenland the magnetic vectors are very steep and the horizontal component of the magnetic field is weak. This renders a geological compass significantly less accurate.

5.2 Greenland samples

All samples collected during GEUS Greenland Fieldwork are the property of GEUS, and formally lent to the collector. Registration is therefore centralised in GEUS. After the end of the field season, sample numbers used by each geologist will be registered in GEUS by the department responsible for the fieldwork. Geologists may retain material on which they are working for as long as they wish, but as a routine will be sent a reminder every two years on which they can indicate whether the loan should be extended or terminated.

The first reminder is, however, not sent until five years after the field season. GEUS must formally approve manuscripts reporting research on the material before they are submitted for publication, and the borrower must not redistribute GEUS material without notifying GEUS.

Geologists may obtain permission to collect samples for other institutions, but these samples must be duplicated, so that GEUS always has a copy.

5.2.1 The sample number

Geologists are issued with sample docket books, each containing 99 double, numbered dockets.

One number must be used for each sample. This principle is basic to the final registration of all samples. People subdividing samples (during laboratory work) may add decimal-suffixes to the sample number. The survey places no limit on the number of samples geologists collect; extra docket books are always available at a GEUS base. An exception to the above mentioned principle is very large samples (collected for instance for age dating purposes), where "one sample" may consist of a number of individual pieces of the same rock type.

GEUS has made the sample number the key to the registration of each sample. The number is the means of identification from the moment the sample is taken in the field and until it is disposed of. Therefore it is absolutely necessary to use the correct number in the field notes, reports and publications. In publications and reports all sample numbers from Greenland should be prefixed with the letters GGU to distinguish them from other sampling systems used in GEUS and other institutions.

PRIVATE NUMBER SYSTEMS ARE NOT TO BE USED.

5.2.2 The docket book for Greenland samples

Each docket consists of a top copy and a second copy printed on self-copying paper, so before you fill in the docket, you should fold in the orange flap under the second copy. Some of the text boxes are framed with bold lines and must be filled in, the rest are mostly optional (see below). A sample description database has been established, and the docket book will be used for coding in information after the season. Mark the relevant text boxes with a distinct line, cross or tick. Each sample must have a docket

book number. Numbering without the relevant docket book leads to duplication of sample numbers. Extra docket books are available from base camp.

The lower part of the docket is for personal comments and some administrative information; the lower part of the top copy is torn off and packed down with the sample.

Note that all sample locations must be registered by your GEUS department (or the department responsible for the fieldwork), so they must be written in the docket book - or on a list - unless you deliver a sample map for digitisation to the relevant department.

If you use the GEUS Android application aFieldWork for capturing field data digitally it is essential that the Earth material section of the sampling system is filled out as completely as possible.

5.2.3 Labelling of the samples

Samples should be marked with the sample number and the geologist's initials. The standard office box contains sticking plaster (leucoplast) for this purpose (however see the paragraph on samples for organic chemistry further down!).

The sample and folded lower part of the docket are wrapped in newspaper, on which the sample number and the initials of the geologist are written clearly. Geologists receiving supplies from a GEUS base should return the packed and marked samples whenever possible in order to keep the camp as light as possible. At the base camp the samples will be packed in bags, or boxes for transport to Copenhagen.

Geologists from outside Denmark will have their samples sent to them by GEUS as soon as possible. First, however, the samples must be repacked by GEUS staff, and here the list of contents is of great importance.

Sample numbers must be given to specimens transferred to GEUS ownership but originally sampled by others.

5.3 Data delivery requirements

GEUS requires of its staff that they deliver a range of field data in digital format. For specifics of what is required, see a GEUS fieldwork contract relating to the current field project you are involved in and/or see your project leader for a copy of the template that outlines how and which data are required and in what format.

Typically the data required after the fieldwork is:

- A compiled field map (see section detailing this below)
- All field data input, preferably as an Excel spreadsheet, including geographic coordinates, locality numbers, rock unit names, descriptions of the rocks at this locality, structural data, mineral occurrences and photographic data.
- If an Android device is used for digital data capturing make sure that your project leader recieves a copy of your data.
- Digital copies of all field photographs including descriptions (standard part of the spread sheet).
- A summary field report (see below).
- A legible copy (preferably typed) of all field notes.

5.4 Field reports

Geologists working on GEUS field projects are required to submit a field report summarising the findings of their fieldwork. The purpose of this report is to provide an overview/summary of the geological findings, which is often not easily gleaned from reading field notes. Likewise, compiled field maps are much easier to interpret with the aid of a summary of the geological interpretations.

There is no fixed format for these field reports. However, they should be presented in a structured, simple, and concise manner that allows the reader to easily access the most important geological observations and interpretations. Observations should be clearly distinguished from interpretations.

The report should identify:

- field geologists contributing to the observations and interpretations
- when the fieldwork was carried out
- where the fieldwork was carried out
- the main geological observations and interpretations, including for example lithologies, descriptions, distribution, thicknesses, contacts, (tectono-) stratigraphic sequences, structures, metamorphic grade, intrusive relationships, mineralisations.

A good way of summarising your findings as you progress is to make summary notes of your findings and interpretations at the end of each field camp, before you move on to the next field area. This allows you to formulate your ideas as you go, and also gives you reference notes for the compilation of your complete report after the field season.

5.5 Internal reports

The agreement between GEUS and geologists working in Greenland requires that an internal geological report be delivered before the 1st of June in the year following the fieldwork.

The internal reports are to be presented on paper size A4 with a 21/2– 3 cm left margin, complete with all illustrations. The language of the reports should be English. They should include:

- A clear title including the locality name (NOT for example "Report on field work 2010")
- A table of contents
- A short summary or abstract in English
- If appropriate, a section on mineralisation or economic aspects, even if observations are negative.

GEUS compiles a database containing information about mineral deposits/occurrences in Greenland, for which information is taken from the internal reports. Therefore, be careful to give a full report on observed economic possibilities. Ornamental material, raw materials, ore – everything is of interest.

Theses and student dissertations must be delivered to GEUS and will be treated as internal reports. One copy is sufficient.
If not classified by GEUS (mainly reports with economic implications) the internal reports are freely available. They are circulated at GEUS and can subsequently be borrowed on application.

Published articles may replace the internal reports if they cover all relevant scientific aspects of the assignment.

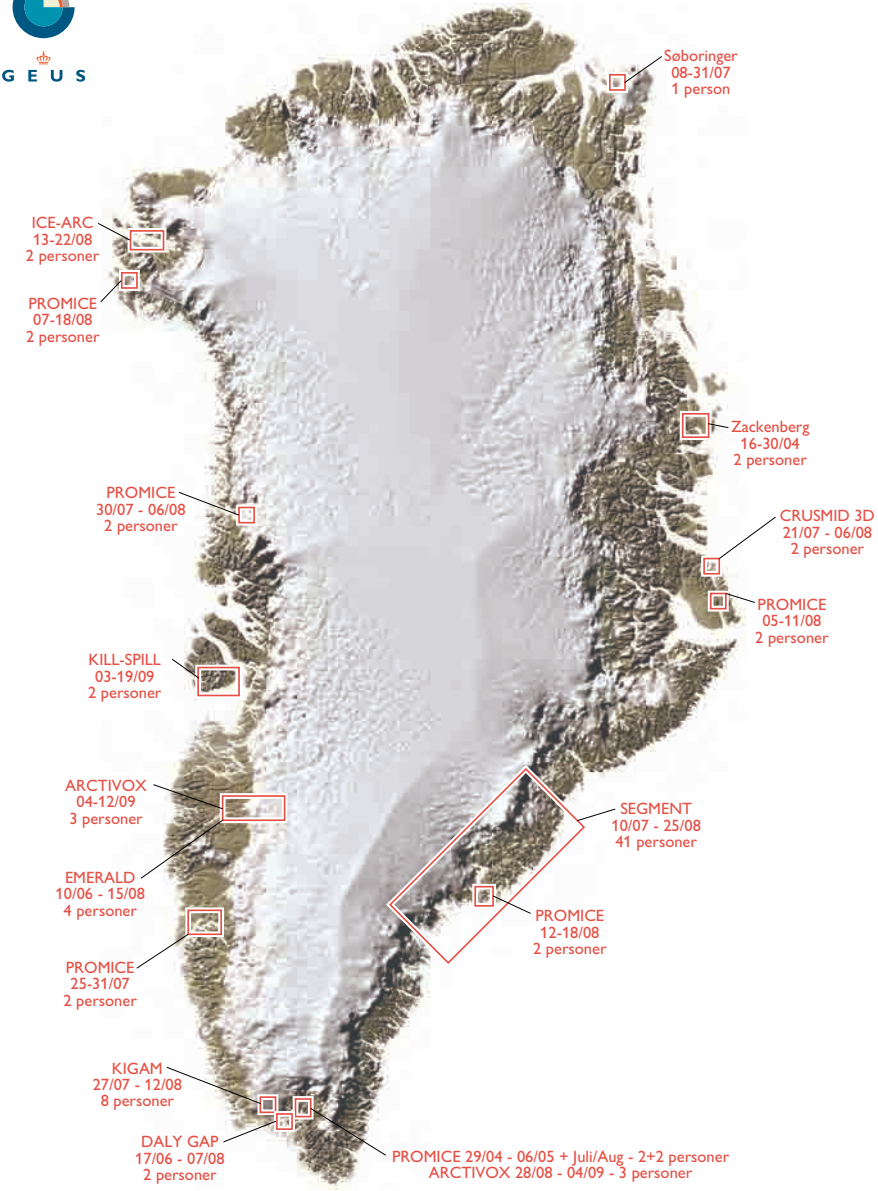
5.6 GEUS publication series

Geologists are encouraged to publish results of their investigations after the completion of each field assignment in Greenland. GEUS currently publishes two series – peer-reviewed Bulletins and an unedited report series of internally reviewed contributions. Please consult recent issues or the scientific editor about the style and suitability of manuscripts. Typescripts must be submitted to GEUS where they will be reviewed and considered for publication. If a geologist wishes to submit a paper for publication in another journal, she/he must first obtain the permission of GEUS, to whom a complete copy of the typescript (including all figures and tables) must be sent before sending it to the journal.

Notes on the presentation of papers in the GEUS publication series may be obtained from the scientific editor.

Glacier measurement in West Greenland
Photo: Dirk van As

GEUS


Søboringer
08-31/07
1 person
ICE-ARC
13-22/08
2 personer
PROMICE
07-18/08
2 personer
Zackenberg
16-30/04
2 personer
PROMICE
30/07 - 06/08
2 personer
CRUSMID 3D
21/07 - 06/08
2 personer
PROMICE
05-11/08
2 personer
KILL-SPILL
03-19/09
2 personer
ARCTIVOX
04-12/09
3 personer
SEGMENT
10/07 - 25/08
41 personer
EMERALD
10/06 - 15/08
4 personer
PROMICE
12-18/08
2 personer
PROMICE
25-31/07
2 personer
KIGAM
27/07 - 12/08
8 personer
DALY GAP
17/06 - 07/08
2 personer
PROMICE 29/04 - 06/05 + Juli/Aug - 2+2 personer
ARCTIVOX 28/08 - 04/09 - 3 personer

6 Contact points and telephone numbers

For the season 2014 field work is planned to be carried out at localities all over Greenland by geologists and other types of participants in one major (counting 41 participants) and a number of minor expeditions. One GEUS excursion is taking place in South-West Greenland, and GEUS employees are participating in scientific projects where fieldwork in Greenland is carried out in collaboration with other institutions. Below localities, dates of operation, participants, e-mail addresses and telephone numbers of part of these expeditions and excursions are listed, together with contact points of local authorities, hospitals, partners of co-operation, and other useful contacts. Contact points to be used in case of emergency situations and contact points of general interest are placed at the back of this booklet.

6.1 Expeditions to Greenland 2014

GlacioBasis *Zackenberg, North-East Greenland – 16.4 – 30.4-2014*

Contact person: Michele Citterio (GEUS) ..... T: +45 9133 3832
..... e-mail mcit@geus.dk
Contact point in Greenland: ..... Iridium +8816 2242 4880

Participants
Michele Citterio
Charalampos Charalampidis

PROMICE
Programme for Monitoring of the Greenland Ice Sheet – Spring – Summer 2014

Contact person: Signe B. Andersen, GEUS ..... T: +45 9133 3804
..... e-mail siba@geus.dk

Participants Narsasuaq *29.4 – 6.5-2014*
Robert Schjøtt Fausto - ..... Contact in Greenland: Iridium +8816-2242 4880
Martin Veicherts ..... PBL: 3 = 296E65BA56FFBFF (call sign: XGP4735)

Participants Narsasuaq *21.7 – 26.7-2014*
Jason Box .....
Martin Veicherts .....

Participants Nuuk: *25.7 – 31.7-2014*
William Colgan .....
Dirk van As .....

Participants Upernavik: *30.7 – 6.8-2014*
Andreas P. Ahlstrøm
Signe Hillerup Larsen

Participants Thule: *7.8 – 13.8-2014*
Signe Bech Andersen
Martin Veicherts

Participants Scoresbysund *5.8 – 11.8-2014*
Michele Citterio
Morten Langer Andersen

Participants Tasiilaq *12.8 – 18.8-2014*
Michele Citterio
Morten Langer Andersen

DARK SNOW + EMERALD *camp on the ice east of Kangerlussuaq 10.6 – 15.8-2014*

Coordinates: 67°3,964' N; 48°49,356' W

Contact persons: Jason Box (GEUS) T: +45 4114 5428
e-mail jeb@geus.dk
Marek Stibal T: +45 2134 2405
e-mail msti@geus.dk
Contact point in Greenland: 1) +8816 2143 3943
2) +8816 2143 3944

Participants
Marek Stibal (10.6 – 2.7)
Jason Box (10.6 – 2.7)
Karen Cameron (10.6 – 3.8)
Alia Khan (17.6 – 15.8)
Filippo Calì Quaglia (30.6 – 27.7)

Gardar Critic *South-West Greenland 17.6 – 7.8-2014*

Contact person: Samuel Weatherley (GEUS) T: +45 9133 3868
e-mail smw@geus.dk
Contact point in Greenland: +299 236 755;
e-mail: geus25@onsatmail.com

Participants
Samuel Weatherley and Henning Bohse

Sea drills at Station Nord *North-East Greenland 8.7 – 31.7-2014*

Contact person: Ole Bennike (GEUS) ..... T: +45 9133 3527
..... e-mail obe@geus.dk

Participants
Ole Bennike
Bernd Wagner (outside framework of GEUS fieldwork)

CRUSMID – 3D *Jameson Land, East Greenland 21.7 – 6.8-2014*
Shares logistic platform with Avannaa Logistics

Contact person: Pierpaolo Guarnieri (GEUS) ..... T: +45 9133 3878
..... e-mail pgua@geus.dk
Contact point in Greenland: ..... Iridium +8816 2143 3913
..... e-mail geus24@onsatmail.com

Participants
Pierpaolo Guarnieri and Anaïs Brethes

SEGMENT *base camp in Kuummiut: 10.7 – 25.8-2014*
Mineral Resources Assesment Program

Expedition leaders
Bo Møller Stensgaard ..... T:+45 9133 3858 (+45 4167 8040)
Kristine Thrane (GEUS) ..... T: +45 9133 3866
..... e-mail: bmst@geus.dk / kt@geus.dk

Contact point in Greenland: ..... Iridium +8816 2143 3942
..... e-mail geus16@onsatmail.com

Participants
Bo Møller Stensgaard
Kisser Thorsøe

Rune Hende (L1) ..... Iridium Sat: +8816 2143 3940
Jakob Lautrup (L1) ..... e-mail geus14@onsatmail.com

Michael Nielsen (L2) ..... Iridium Sat: +8816 2143 3941
..... e-mail geus15@onsatmail.com

Jochen Kolb (T1+T3) ..... Iridium Sat: +8816 2143 3916
Marco Fiorentini (T1+T8) ..... e-mail geus01@onsatmail.com
Anne B. Johannesen (T1+T9) .....

Annika Dziggel (T2) ..... Iridium Sat: +8816 2143 3917
Sascha Müller (T2+T13) ..... e-mail geus02@onsatmail.com

Leon Bagas (T3) ..... Iridium Sat: +8816 2143 3919
Nanna Rosing Schou (T3+T9) ..... e-mail geus03@onsatmail.com

Kristoffer Szilas (T4+T11) ..... Iridium Sat: +8816 2143 3920
Jonas Tusch (T4+T9+T10) ..... e-mail geus04@onsatmail.com

Martin B. Klausen (T5) ..... Iridium Sat: +8816 2143 3921
Riaan Bothma (T5+T13) ..... e-mail geus05@onsatmail.com
Matti N. Petersen (T5+T8+T10) .....

Majken D. Poulsen (T6+T12) ..... Iridium Sat: +8816 2143 3922
Vincent van Hinsberg (T6) ..... e-mail geus06@onsatmail.com
Lærke L. Thomsen (T6) .....

Christian Tegner (T7) ..... Iridium Sat: +8816 2143 3923
Charles E. Lesher (T7) ..... e-mail geus07@onsatmail.com

Benedicte D. Grøtner (T1+T8) ..... Iridium Sat: +8816 2143 3928
Trygvi Bech Arting (T1+T8) ..... e-mail geus08@onsatmail.com

Tomas Næraa (T10) ..... Iridium Sat: +8816 2143 3929
Kristine Thrane (T10) ..... e-mail geus09@onsatmail.com

Diogo Rosa (T11) ..... Iridium Sat: +8816 2143 3920
Nicolas Thebaud (T1+T11) ..... e-mail geus04@onsatmail.com

Holger Paulick (T12) ..... Iridium Sat: +8816 2143 3931
Jonas Petersen (T12) ..... e-mail geus10@onsatmail.com

Thomas Kokfelt (T7+T8+T13) ..... Iridium Sat: +8816 2143 3933
Thomas Ulrich (T7+T13) ..... e-mail geus12@onsatmail.com

Jakob Kløve Keiding (T14) ..... Iridium Sat: +8816 2143 3932
Samuel Weatherley (T4+T7+T14) ..... e-mail geus11@onsatmail.com

Björn Henning Heincke (T15) ..... Iridium Sat: +8816 2143 3923
Peter Riisager (T15) ..... e-mail geus07@onsatmail.com

Tapani Tukiainen (T15+T16) ..... Iridium Sat: +8816 2143 3922
Asta F. Jørgensen (T15+T16) ..... e-mail geus06@onsatmail.com

Peter Alsen (T17) ..... Iridium Sat: +8816 2143 3934
Jens Therkelsen (T17) ..... e-mail geus13@onsatmail.com

Extra contact options
Samuel Weatherley (T4,+T7+T14) ..... Iridium +8816 2143 3946
..... e-mail geus25@onsatmail.com

Pierpaolo Guarnieri (T5) (~6/8) ..... Iridium Sat: +8816 2143 3913
..... e-mail geus24@onsatmail.com

Geological excursion *Nanortalik region, South-West Greenland – 29.7 – 12.8-2014*

Contact person: Per Kalvig (GEUS) ..... T: +45 9133 3864
..... T: (+45 3026 1488)
..... e-mail pka@geus.dk
Contact point in Greenland: ..... Iridium +8816 2143 3914/2143 3915

Participants
Per Kalvig
Henning Bohse
Svend Joensen
SUNG WON PARK
YOUDONG KIM
SEUNG RYEOL LEE
SEOK JUN YANG
EUIJUN KIM

ICE-ARC – scientific cruise in the Qaanaaq area with "Knud Rasmussen"
13.8 – 22.8-2014

EU project; GEUS is one of more than 20 partners

Contact person: Naja Mikkelsen (GEUS) ..... T: +45 9133 3834
..... e-mail nm@geus.dk

Participants (GEUS)
Naja Mikkelsen and John Boserup

Glacial and periglacial erosion in a fjord landscape in southern Greenland
Fieldwork at sea with "Activ" in the area of Quaqortoq and Narsaq
10.8-17.8-2014

Project leader: Mads Faurschou Knudsen, University of Aarhus
One GEUS-participant: Niels Nørregaard-Pedersen

ARCTIVOX
– A study of the Arctic's role in the atmospheric organohalogen budget
Narsarssuaq: 28.8 – 4-5.9 2014 and Kangerlussuaq: 4.9-12.9-2014

Contact person: Ole Stig Jacobsen (GEUS) ..... T:+45 9133 3575
..... e-mail osj@geus.dk
Contact point in Greenland: ..... +45 2022 0570

Participants
Ole Stig Jacobsen (Narsarsuaq og Kangerlussuaq)
Anders Risbjerg Johnsen (Narsarsuaq og Kangerlussuaq)
Christian Nyrop Albers (Narsarsuaq 28/8-5/9)
Birgitte Kortegaard Danielsen (Kangerlussuaq 4-12/9)

Kill-Spill *Arctic Station Disko, West Greenland – 3.9-19.9-2014*

Contact person: Jens Aamand (GEUS) ..... T: +45 9133 3565
..... e-mail jeaa@geus.dk
Contact point in Greenland: +45 2047 5860

Participants
Jens Aamand
Louise Feld

6.2 Other useful contact points

Air Greenland Charter - Nuuk ***Telephone/e-mail***
Frederik Martin Lyberth ..... [+299] 34 31 41
..... e-mail pflybeth@airgreenland.gl
Annette Pind ..... [+299] 34 31 45
..... e-mail apind@airgreenland.gl

24h contact ..... Mobile **[+299] 55 24 89**

Bergur Gunnthorsson ..... Mobile [+299] 34 31 43
..... e-mail bg@airgreenland.gl
Hans Peter Hansen ..... [+299] 34 31 40
Director, Charter & Cargo ..... Mobile [+299] 55 12 66
..... e-mail hphansen@airgreenland.gl

Air Greenland – local offices and personnel

Telephone/e-mail

Air Greenland, Nuuk	[+299] 34 34 34
AG mechanic, Constable Point	[+299] 99 38 06
AG hangar	[+299] 99 38 58
Air Greenland, Kulusuk	[+299] 98 69 26
Air Greenland, Tasiilaq	[+299] 98 16 89 / 98 13 88

Norlandair (Akureyri)

Telephone/e-mail

Fridrik Adolfsson	[+354] 414 6961
Mobile	[+354] 894 5390
e-mail	frissi@nordlandair.is
Kristbjörg Björnsdottir	[+354] 414 6960
Mobile	[+354] 860 1208
e-mail	kibba@nordlandair.is

Airports

Telephone/e-mail

Mittafeqarfiit (Greenland Airports)	[+299] 98 69 88
Website	flyinfo.gl
Aaasiaat Airport (JEG)	[+299] 89 17 99
Constable Point (CNP)	[+299] 99 38 54
Ilulissat Airport (JAV)	[+299] 94 41 40
Kangerlussuaq Airport (SFJ)	[+299] 84 13 00
Kulusuk Airport (KUS)	[+299] 98 69 88
Maniitsoq (JSU)	[+299] 81 25 66
Mestersvig, Tower (BGMV)	[+871] 762 215 337
Narsarsuaq (UAK)	[+299] 66 54 30
Nuuk Airport (GOH)	[+299] 32 60 05
Nuuk, AFIS operator	[+299] 32 71 19
Paamiut Airport (JFR)	[+299] 68 40 95
Qaanaq Airport (NAQ)	[+299] 97 13 35
Qaarsut (Uumamanaq) Airport (JQA)	[+299] 95 76 99
Sisimiut Airport (JHS)	[+299] 86 54 99
Tasiilaq Airport (AGM)	[+299] 98 16 89
Thule Air Base (THU)	[+299] 97 65 85
Upernavik Airport JUV)	[+299] 96 11 99

Royal Arctic Line (RAL)

Telephone/e-mail

Aalborg, HQ	[+45] 99 33 32 32
Jan Nedergaard	[+45] 99 30 32 15
Nuuk Operations	[+299] 34 91 00

Authorities

Telephone/e-mail

Mineral Licence and Safety Authority (MLSA)	[+299] 34 68 00
e-mail	mlsa@nanoq.gl

Department of Housing, Nature, and Environment
(Expedition office), Nuuk ..... [+299] 34 67 32
..... e-mail ipan@nanoq.gl

The police authority in Greenland, Nuuk ..... [+299] 32 14 48
Chief Constable Office ..... e-mail grpoliti@greennet.gl

Joint Arctic Command (Nuuk)
Maritime Rescue Coordination Centre (MRCC) ..... [+299] 36 40 00
Duty officer ..... e-mail mrcc-nuuk@mil.dk

Rescue Coordination Centre (RCC) ..... [+299] 84 12 01
..... [+299] 84 11 35
..... [+299] 84 10 34
..... e-mail rcc@naviair.dk

Greenland Travel

Telephone/e-mail

Copenhagen ..... [+45] 33 13 10 11
..... e-mail info@grb.dk

Tina Mogensen ..... [+45] 33 76 62 26
..... e-mail tm@grb.dk
Nuuk ..... [+299] 34 95 95
..... e-mail nuuk@grb.gl
Ilulissat ..... [+299] 94 75 40
..... e-mail ilulissat@grb.gl

Sisimiut ..... [+299] 86 75 38
..... e-mail sisimiut@grb.gl

Help desk (Mon-Fri: 8:00 - 15:45) ..... [+299] 34 34 34
Outside office hours ..... [+45] 32 46 22 40
24h emergency telephone* ..... [+299] 55 22 93

*Please note, there is a surcharge of DKK 500 for using this phone no. outside normal office hours

Hospitals and Nursing Stations

Name	Sanitary region	Telephone no.
Aasiaat Hospital	Disko	[+299] 89 22 11
Ilulissat Hospital	Avannaa	[+299] 94 32 11
Upernavik Health Care Center	Avannaa	[+299] 96 12 11
Kulusuk Nursing station	Sermersooq	[+299] 98 69 11
Maniitsoq Health Care Center	Qeqqa	[+299] 81 32 11
Qaqortoq Hospital	Kujata	[+299] 64 22 11
Queen Ingrids Health Care Center, Nuuk	Sermersooq	[+299] 34 44 00
Ittoqqortoormiit (Scoresbysund)	Sermersooq	[+299] 99 10 11
Tasiilaq Hospital	Sermersooq	[+299] 98 12 11
Queen Ingrid's Hospital, Nuuk	**National hospital**	**[+299] 34 40 00**

Contact to all health care units ..... www.peqqik.gl/kontakt

Hotels and Hostels

	Telephone/e-mail
Hotel Kulusuk	[+299] 98 69 93
Kulusuk Youth Hostel	[+299] 98 68 88
Hotel Narsarsuaq	[+299] 66 52 53
Hotel Hans Egede, Nuuk	[+299] 32 42 22
Sømandshjemmet, Nuuk	[+299] 32 10 29
Ammagssalik Hotel, Tasiilaq	[+299] 98 12 93
	e-mail arcwon@greennet.gl
Det Grønne Hus, Tasiilaq	[+299] 98 17 48
Hotel Nansen, Tasiilaq	[+299] 98 21 01
Hotel The Red House, Tasiilaq	[+299] 98 16 50
Roberts Hotellejligheder, Tasiilaq	[+299] 98 10 52

Police Stations

	Telephone/e-mail
Kangerlussuaq	[+299] 84 12 22
	[+299] 52 12 22
Narsarsuaq	[+299] 66 52 22
	[+299] 49 74 14
Nuuk	**[+299] 32 14 48**
	e-mail politi@politi.gl
Scoresbysund	[+299] 99 10 22
Tasiilaq	[+299] 98 14 48
	[+299] 59 81 48

Radio and Weather Report Services

	Telephone/e-mail
Aasiaat Radio, Aasiaat	[+299] 89 22 55
Ammassalik Radio, Tasiilaq	[+299] 98 12 55
Radio Administration, Qaqortoq	[+299] 64 31 22
Radioforvaltningen	radioforvaltningen@nanoq.gl
Tele Greenland, Nuuk	[+299] 34 12 55

	Telephone/e-mail
Søndre Strømfjord Weather Report Services, Kangerlussuaq	[+299] 84 10 22
Danmarks Meteorologiske Institut, DMI	[+45] 39 15 75 00
Copenhagen	www.dmi.dk
Meteorologisk Institut/NRK	www.yr.no

Taxis

	Telephone
Nuuk Taxi	[+299] 36 36 36
Info Taxi - Nuuk	[+299] 36 18 18
Taxi Tasiilaq	[+299] 98 23 13
Taxi Tasiilaq	[+299] 49 65 22
Taxi Tasiilaq	[+299] 59 83 13

Partners and Companies

Telephone/e-mail

Danmarkshavn [+299] 19 91 60
e-mail stationsleder@danmarkshavn.gl

Constable Point Airport [+299] 99 38 50
e-mail cnp@mit.gl
Henrik Rosing Søltoft (airport manager) e-mail hero@mit.gl
Robert Larsen (assistant airport manager) e-mail rola@mit.gl

Joint Arctic Command, Nuuk [+299] 36 40 00
Joint Arctic Command, H. C. Have (AAL) [+45] 98 19 65 52

Polog, Constable Point [+299] 99 38 03
e-mail polog@greennet.gl
Aka Lynge Iridium [+881] 641 424 070

PolarOil, SW Greenland (fuel) [+299] 35 99 27
Jens Bonfils, Færingehavn e-mail jbf@kni.gl

Sirius, Daneborg (IP) [+45] 45 67 63 37
(IP) [+45] 45 67 63 36
(IP) [+45] 45 67 63 38
Iridium [+881] 651 466 780
e-mail sirius@mil.dk

Zackenberg Research Station e-mail logistics@zackenberg.com
Iridium [+881] 651 463 189
[+870] 761 282 913
[+870] 762 586 080
Henrik Spanggaard e-mail hsp@dmu.dk
Jørgen Skafte e-mail jska@dmu.dk

Station Nord Satellite [+881] 677 741 282
e-mail stationnord@stn.onsatmail.com

6.1.1 Emergency numbers

Dr. Søren Kristensen (GEUS Medical Advisor/Doctor): [+45] 20 60 00 07
Can be reached 24h a day from 14 July to 24 August

Poison Control Hotline - Giftlinjen (24h) [+45] 82 12 12 12

Police Nuuk [+299] 32 14 48

Dr. Ingrid's Health Care Center, Nuuk (24h Rescue services) [+299] 34 44 00
E-mail laegeklinikken@peqqik.gl
Queen Ingrid's Hospital, Nuuk [+299] 34 40 00

6.2 Iridium phone calls

It is possible to obtain cheaper call charges when using the Iridium phones by following the procedure below.Also see paragraph 3.4.

6.2.1 Calling from a telephone ashore to an Iridium phone via Polarsat

If family members or other "trusted" persons want to call a person in the field via his/her Iridium they should follow these procedures:

- Call 9631 7910 (remember +45, if you are calling from another country than DK)
- Dial customer ID 10372
- Dial PIN-code (if required) 1475
- Dial the last eight digits to the Iridium phone, e.g. if you want to call 00 8816 314 49626 you only dial 314 49626.

6.2.2 Calling from an Iridium phone to a telephone ashore or a mobile phone via Polarsat

- Call 0 00 8816 214 34 555 #
- Dial customer ID 10372
- Dial PIN-code (if required) 1475
- Dial the number you wish to call, e.g. 38 14 20 00 for GEUS.

Appendix A: Transportation of equipment

On the following pages volume and weight of GEUS standard boxes, outboard engine and rubber boat is given. This information is used in cases where it not is possible to give the exact weight and volume of goods prepared for transportation on the expedition or return to GEUS. Be sure not to underestimate the weight, especially in case of helicopter transportation.

Bundle:

			m^3
Rubberboat 404M	- bundled		0.30
Rubberboat 404M	- boards		0.10
Rubberboat 504M	- bundled		0.33
Rubberboat 504M	- boards		0.17

Box type:	**m^3**		**kg**
Plyfa	(small) 0.07	59x39x30 cm	7.2
Plyfa	(large) 0.12	70x44x41 cm	11.1
Plyfa	(X-large) 0.14	78x44x41 cm	12.4
Plyfa	(F-type) 0.18	71x40x28 cm	10.2
Aluminium box:	small 0.09	58x40x39 cm	4.7
Aluminium box:	large 0.18	78x58x40 cm	9.3
Outboard engine (20 hp)	0.3	120x60x40 cm	45

Weight average for expedition equipment:
15 kg per 0.05 m^3
i.e. ca. 300 kg per m^3

A.1. DUTY-FREE IMPORT AND EXPORT

GEUS has obtained a permission from the Danish customs and tax authority to export and re-import field equipment without customs clearance. A paper copy of the permission is normally given to the expedition or project leader.

The permission covers export of expedition equipment from Denmark and import back into Denmark from areas outside the European Union. Note that the permission only covers equipment, but not other items such as food and private equipment, and neither firearms and dangerous goods.

The permission is used every time expedition equipment is sent to areas outside the European Union. Note that local customs conditions may apply in the receiving country. Each shipment must be accompanied by a list of contents the following including information:

- Name and address of GEUS
- Number and kind of equipment items. Each item must be listed
- Destination
- Date of export
- Expected period of remanence outside the European Union
- The reference number and date of the permission

Some general conditions:

- The equipment must be reimported within three year
- The equipment must be in the same condition as when it was exported, except for wear and tear
- The list of equipment and the permission from (SKAT) must be available to be shown on request (a copy of the original permission is acceptable)

A copy of the permission is shown on the following pages.

SKAT

Kundeservice
Told

Sluseholmen 8B
2450 København SV

Telefon 72 22 18 18
E-mail via www.skat.dk/kontakt
www.skat.dk

26. juni 2013

J.nr. 13-0207369, W07883
CVR-nr. 55 14 50 16
Fax 72 22 19 19

De Nationale Geologiske Undersøgelser for Danmark og Grønland
Øster Voldgade 10
1350 København K

Tilladelse

Midlertidig udførsel og genindførsel

Lovgrundlag

Udførsel
Toldkodeksen (Rådets forordning (EØF) nr. 2913/92 af 12. oktober 1992 om indførelse af en EF-Toldkodeks) artikel 182a, stk. 2.

Gennemførelsesbestemmelserne (Kommissionens forordning (EØF) nr. 2454/93 af 2. juli 1993 om gennemførelsesbestemmelser til toldkodeksen) artikel 231, litra d og artikel 592a, litra e.

Indførsel
Toldkodeksen (Rådets forordning (EØF) nr. 2913/92 af 12. oktober 1992 om indførelse af en EF-Toldkodeks) artikel 61, litra c.

Gennemførelsesbestemmelserne (Kommissionens forordning (EØF) nr. 2454/93 af 2. juli 1993 om gennemførelsesbestemmelser til toldkodeksen) artikel 181c, litra e og artikel 230, litra d.

Tilladelsens omfang

Ved midlertidig udførsel
Fritagelse for afgivelse af udførselsangivelse og summarisk udgangsangivelse.

Ved genindførsel
Fritagelse for afgivelse af fortoldningsangivelse og summarisk indgangsangivelse.

Varer omfattet af ordningen
Tilladelsen gælder for:

Ekspeditionsudstyr til Grønland

Gyldighed
Tilladelsen er gyldig fra den 1. juli 2013 til og med den 30. juni 2016.

Er tilladelsen givet på grundlag af urigtige eller ufuldstændige oplysninger kan den annulleres, jf. toldkodeksens artikel 8.

Derudover kan tilladelsen tilbagekaldes eller ændres, hvis en eller flere af betingelserne for at den blev givet ikke var eller ikke længere er opfyldt, herunder ved overtrædelse af tilladelsens lovgrundlag og dens forpligtelser, jf. toldkodeksens artikel 9.

Betingelser
Ved midlertidig udførsel
Der skal ved hver enkelt udførsel udarbejdes en fortegnelse over varerne med oplysning om

- Virksomhedens navn
- Mængde og art af udstyret
- Bestemmelsesland
- Udførselsdato
- Den forventede periode for udstyrets forbliven uden for EU
- Denne tilladelses journal nr. og dato, samt påtegningen "Fritaget for afgivelse af summariske udgangs- og indgangsangivelser"
- At varerne ikke er omfattet af udførselstilladelser eller varebestemmelser

Fortegnelsen skal indeholde virksomhedens erklæring om, at udstyret er i fri omsætning. Fortegnelsen skal ledsage varerne.

Denne tilladelse eller en kopi heraf samt fortegnelsen skal på forlangende forevises SKAT ved varernes udførsel.

Virksomheden skal før udførslen underrette SKAT. Dette sker ved at maile en kopi af fortegnelsen til toldadministration.middelfart@skat.dk.

Ved genindførsel

- Genindførslen skal finde sted senest 3 år efter udførslen
- Udstyret skal genindføres i uforandret stand. Almindelig slitage samt nødvendige reparationer som følge af en uforudsigelig begivenhed anses ikke som forandringer.
- Den fortegnelse, der blev udfærdiget ved udførslen, skal sammen med denne tilladelse eller en kopi heraf på forlangende forevises SKAT.

Virksomheden skal før indførslen underrette SKAT. Dette sker ved at maile en kopi af fortegnelsen til toldadministration.middelfart@skat.dk.

Hver fortegnelse skal opbevares i virksomheden i mindst 3 år efter varernes genindførsel.

Kontrol

Virksomheden er underlagt SKATs kontrol. SKAT har ret til at foretage kontrol i virksomheden i overensstemmelse med toldkodeksens og toldlovens bestemmelser herom.

Med venlig hilsen

Lisbeth Jensen
E-mail: Lisbeth.Jensen@Skat.dk
Direkte telefon 72 38 13 08

Appendix B: Conversion Tables

Distance/length

1 Centimeter (cm)	=	10 Millimeters (mm)
1 Inch	=	2.54 Centimeters
1 Foot	=	0.3048 Meters (m)
1 Foot	=	12 Inches
1 Yard	=	3 Feet
1 Meter	=	100 Centimeters
1 Meter	=	3.280839895 Feet
1 Furlong	=	660 Feet
1 Kilometer	=	1000 Meters
1 Kilometer	=	0.62137119 Miles
1 Mile	=	5280 Feet
1 Mile	=	1.609344 Kilometers
1 Nautical Mile	=	1.852 Kilometers

Speed

1 kilometer per hour (km/h) = 0.2777 meters per second (m/s) = 0.539956803892 knots = 0.62137 miles per hour (mph)

1 knot (kn) = 1 nautical mile per hour (nm/h) = 1.852 kilometers per hour (km/h) = 1.150779 miles per hour (mph)

1 mile per hour (mph) = 0.868976241908 knots (kn) = 0.44704 meters per second (m/s) = 1.609344 kilometers per hour (km/h)

Geographic coordinates

Informally, specifying a geographical location usually means giving the location's latitude and longitude. The numerical values for latitude and longitude can occur in a number of different formats:

- degrees minutes seconds: .....40° 26′ 46″ N 79° 58′ 56″ W
- degrees decimal minutes: .....40° 26.767′ N 79° 58.933′ W
- decimal degrees: .....40.446° N 79.982° W

Please note that geographic coordinates given during internal communication (via RACAL MF radio, VHF, satellite telephone, or email via satellite telephone) between field teams and a GEUS base camp normally are given by degrees decimal minutes (this is also what the helicopter pilots normally prefer).

There are 60 minutes in a degree and 60 seconds in a minute. To convert from a 'degrees minutes seconds' format to a 'decimal degrees' format, one may use the formula

decimal degrees = degrees + minutes/60 + seconds/3600

To convert back from 'decimal degrees' format to 'degrees minutes seconds' format,

degrees = [decimal degrees]
minutes = [60 ∗ (decimal degrees – degrees]
seconds = [3600 ∗ (decimal degrees – degrees – minutes/60]

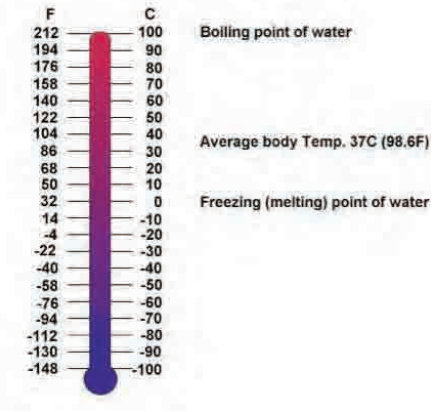
where the notation [χ] means take the integer part of χ.

Kilde: http://en.wikipedia.org/wiki/Geographic_coordinate_conversion

Conversion of temperatures – Celsius / Fahrenheit

C=(F-32)∗5/9 F: Fahrenheit C: Celcius

F=(C∗ 9/5) +32 C: Celcius F: Fahrenheit



Beaufort wind force scale

Specifications and equivalent speeds									
Beaufort wind scale	Mean Wind Speed		Limits of wind speed		Wind descriptive terms	Probable wave height in metres*	Probable maximum wave height in metres*	Seastate	Sea descriptive terms
	Knots	ms^{-1}	Knots	ms^{-1}					
0	0	0	<1	<1	Calm	-	-	**0**	Calm (glassy)
1	2	1	1–3	1-2	Light air	0.1	0.1	**1**	Calm (rippled)
2	5	3	4–6	2-3	Light breeze	0.2	0.3	**2**	Smooth (wavelets)
3	9	5	7–10	4-5	Gentle breeze	0.6	1.0	**3**	Slight
4	13	7	11–16	6-8	Moderate breeze	1.0	1.5	**3–4**	Slight–Moderate
5	19	10	17–21	9-11	Fresh breeze	2.0	2.5	**4**	Moderate
6	24	12	22–27	11-14	Strong breeze	3.0	4.0	**5**	Rough
7	30	15	28–33	14-17	Near gale	4.0	5.5	**5–6**	Rough–Very rough
8	37	19	34–40	17-21	Gale	5.5	7.5	**6–7**	Very rough–High
9	44	23	41–47	21-24	Severe gale	7.0	10.0	**7**	High
10	52	27	48–55	25-28	Storm	9.0	12.5	**8**	Very High
11	60	31	56–63	29-32	Violent storm	11.5	16.0	**8**	Very High
12	-	-	64+	33+	Hurricane	14+	-	**9**	Phenomenal

Kilde: http://www.metoffice.gov.uk/weather/marine/guide/beaufortscale.html

Personal notes

EMERGENCY PROCEDURES

Principal Procedures for Life Support - ACCIDENT

Stop the Accident	– What happened? Quick survey – Is the site of injury safe for the medical examiner and the injured person? – Is the injured person conscious and alert? – Is emergency evacuation needed?
A Airways	– In-line-stabilization: the position of the head is secured – Secure free airways
B Breathing	– Assess breathing ability (observe-listen-feel)
C Circulation	– Do you feel a pulse? Frequency and quality? – Examine the capillary response – Assess the skin colour and temperature – Check for haemorrhage – Re-assess ABC – Contact Expedition Leader/Base Camp or Medical Consultant
D Disability	– Assess the level of consciousness – Examine pupil reaction to light (close and re-open eyelid) – Assess if treatment can continue on the site of injury
E Expose	– Possibly a top-to-toe examination on the site of injury – Fixation in a stretcher – if possible – Transfer to safe/protected place
Protected place	– Re-assess ABC – Monitor the patient objectively – Contact Expedition Leader/Base Camp or Medical Consultant – Continue observations and standard First Aid – Follow prescription from Expedition Leader/Base Camp or Medical Consultant – Write a short report about the course of events of the injury and your observations

NORMAL VALUES FOR ADULTS
Pulse: 60 – 80 /minute
Breathing: 12 – 16 /minute
Capillary response: less than 2 seconds

QUEEN INGRID'S HOSPITAL:		[+299] 34 40 00
Dr. Søren Kristensen	Medical Consultant	[+45] 20 60 00 07

GEUS
Oester Voldgade 10 ..... +45 38 14 20 00
DK-1350 Copenhagen
Denmark
Office hours: 8:30 - 16:00 (Monday to Friday)
Udrustningen, Rødovre ..... + 45 38 14 25 90

GEUS STAND BY in case of an emergency

Karen Hanghøj *(Head of department, Petrology and Economic Geology) .....*
.....+45 20 18 33 66

Flemming Getreuer Christiansen *(Deputy director) +45 20 10 83 90*

Karen Edelvang (Head of department, Marine Geology and Glaciology) .....
.....+45 30 31 90 75

Anne Merete Koefoed (head of HR) .....+45 20 75 78 31
Uli Heyden (Daily work environment leader) .....+45 91 33 34 53
Marianne Vestergaard (Logistic coordinator) .....+45 31 10 30 38

EMERGENCY – EMERGENCY - EMERGENCY
Dr. Søren Kristensen .....+45 20 60 00 07
(14.07 – 24.08-2014)

Poison Control Hotline - Giftlinjen (24h).....+45 82 12 12 12

POLICE, Nuuk .....+299 32 14 48
HOSPITAL (Sana Nuuk) .....+299 34 40 00
RESCUE SERVICE, Nuuk .....+299 34 44 00

INSURANCE
Europæiske Rejseforsikring
Frederiksberg Allé 3
DK-1790 Copenhagen V
Denmark, (24 h – alarm centre) .....+ 45 70 10 90 30
(call centre – office hrs) ..... + 45 33 25 25 25

GEUS policy no. 008 314 169
GEUS CVR no. 5514 5016