Field season 2008
North Greenland Eemian Ice drilling (NEEM) 2007-2011: NEEM camp construction and beginning of deep ice core drilling

Prepared by Ice and Climate Group, NBI

for

The NEEM Steering Committee and Danish and Greenlandic authorities.

Picture 1: NEEM camp and skiway, August 2007.

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NEEM 2008 introduction.

In the last 45 years deep ice coring projects have been recurring roughly every ten years. The drilling at Camp Century (1963-1966) was conducted as part of a U.S. Army engineering experiment during the Cold War. When the 1370 m long Camp Century ice core was analysed for stable isotope composition the first ice core based climate record into the last glacial period was revealed in 1969-1972. In the seventies the science community saw much controversy about in particular the very fast “jumps” in the isotope record from the last glacial period.

GISP (Greenland Ice Sheet Program), a collaboration of scientists from the U.S., Switzerland and Denmark, resulted in a 2037 m long deep ice core drilled at Dye-3 in South Greenland (1979-1981). The Dye-3 record confirmed the fast “jumps” from Camp Century as being a result of fast climatic oscillations during the last glacial period. The climate oscillations have later been called “Dansgaard-Oeschger cycles” or “Interstadials”.

To obtain the longest climatic record a deep ice coring was planned at the summit of the Greenland Ice Sheet. Due to political difficulties, the planned drilling was conducted by a European team at the very summit of the ice sheet in1989-1992 (GRIP, GReenland Ice core Project) and a US team some 30 km West of the summit in 1989-1993 (GISP2) in two parallel drillings. As a result, scientists got two ice core records, GRIP was 3027 m long and GISP2 3065 m long, which could be compared in great detail. Much to the dismay of both ice coring teams, it turned out that although both the GRIP and the GISP2 record contained ice from the previous interglacial, the Eemian, they also had disturbed layer structures in ice older than 80,000 years, well before the Eemian was reached. The old GISP2 site is today the permanent US Summit station.

To obtain an undisturbed record of the early glacial, the Eemian and beyond, NGRIP (North GReenland Ice core Project) was formed as a Danish led international ice drilling project on the ice crest some 300 km NNW of summit. The project started in 1996 and ran in parallel with the two European ice core drillings in Antarctica, the EPICA project. Due to set-backs caused by a lost drill and warm ice at the base, NGRIP did not reach bedrock at 3090 m before 2004. The NGRIP ice core turned out to contain both a curse and a blessing. Due to basal melting caused by geothermal heat, the oldest ice, including the first half of the Eemian. Thus the climate record could only be extended to 125,000 years back in time. On the other hand however, basal melting insured undisturbed stratigraphy along the whole ice core length and insured an unparalleled temporal resolution which has allowed for an annually counted ice core time scale 60,000 years back in time.

With the present discussion about global warming the Eemian period has attracted a lot of attention. In Europe the Eemian was about 5 degrees C warmer than today and sea levels were some 5 m higher. The Eemian serves as a Nature’s parallel to a future with global warming. Therefore NEEM (North Greenland Eemian ice drilling) has as a goal to obtain a complete ice core record from the Eemian for a thorough comparison with our present climate in the Holocene. NEEM is the sixth deep ice coring in Greenland.

The main goal of NEEM in 2008 is to construct a fully operational ice drilling camp and the begin drilling with a new and modified ice drill to about 400 m. Science and ice core processing will occur in full scale in 2009 and 2010. NEEM 2008 camp will also be a platform for four associated projects: British Antarctic Survey radar tests, a seismic station, firn gas pumping and CReSIS from Kansas radar survey.

The main transport between NEEM camp and Kangerlussuaq will be by ski equipped LC-130 aeroplanes from the U.S. Air Force, 109th Tactical Air Group, Scotia, N.Y. The planes are provided as part of the logistical contribution to NEEM from the U.S. National Science Foundation.

This report provides the participants with information on the conditions in Kangerlussuaq, Thule AB and the NEEM camp. It includes a summary of all individual travel dates and information on science programs. It also contains information and rules on environmental issues, work safety and disaster preparedness. All participants are assumed to be familiar with the content of this report.

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

Copenhagen, April 6th, 2008

Lars Berg Larsen, Simon Sheldon, Michael Strand, J.P.Steffensen

North Greenland Eemian Ice Drilling (NEEM) 2007-2011: Season 2008.

Construction of fully operational NEEM drilling camp and begining of deep ice core drilling.

Purpose:
To layout and construct all infrastructure necessary for a fully operational ice core drilling and ice core processing camp at NEEM (pos: N 77 deg. 26 min. 54.93 sec., W 51 deg. 03 min. 19.89 sec. Altitude: 2484 m a.s.l. or 8140 feet).
To support associated programs, such as firn gas pumping from two shallow coring holes, operation of a seismic station and radar measurements.
To perform a traverse from NEEM to NGRIP to pickup remaining assets at NGRIP (pos: 75.1 N, 42.3 W, 2918 m a.s.l.)

Background:
The International ice coring community (IPICS) has stated that an ice core drilling through the Greenland ice sheet at NEEM is the most important ice coring project in the Northern Hemisphere in conjunction with the International Polar Year. The NEEM drilling project is part of the recommendations from the international IPY committee and it is part of the proposals adopted by the Danish National IPY Committee.

By December 2006 / January 2007 the NEEM proposal had secured funding from the Danish Government IPY funds (50 %) and the US NSF (30%). With 80% funding secured, international partners were called to Copenhagen for the first NEEM Steering Committee meeting in March 2007. At the meeting representatives from 14 nations expressed interest in participating. Several nations have already secured IPY related funding and other nations have IPY applications in review. At the steering committee meeting it became clear that NEEM would be fully funded. Thus NEEM started its activities in the summer 2007. NEEM is a Danish led international IPY-project. The other participating nations are: Belgium, Canada, China, France, Germany, Holland, Iceland, Japan, South Korea, Sweden, Switzerland, U.K. and USA.

The NEEM site has been selected through analysis of available surface elevation data, ice thickness data and ice radar data as the most promising site on the Greenland Ice Sheet for obtaining an undisturbed ice core record of the Eemian period and the previous glacial. (Fig. 1)

In the summer of 2007 a surface traverse from NGRIP reached NEEM, and after GPS based survey the NEEM site was selected on the local ice divide. A skiway area was laid out with the skiway pointing into the prevailing wind. A “seed” camp was constructed consisting of a 20 by 12 feet weatherport on a small snow hill, two heavy tracked vehicles, three snowmobiles and four heavy sleds with supplies.

Figur 1: One of the two traverse trains enroute from NGRIP to NEEM July 2007.

During the traverse, three ices cores were drilled to 60m, 60 m and 80 m depth, and a surface strainnet was established. The planned surface radar survey was not so successful. The radar failed to collect data of sufficient quality to evaluate the basal conditions at NEEM. This means that we have to rely on the existing information and begin the deep drilling at the site selected.

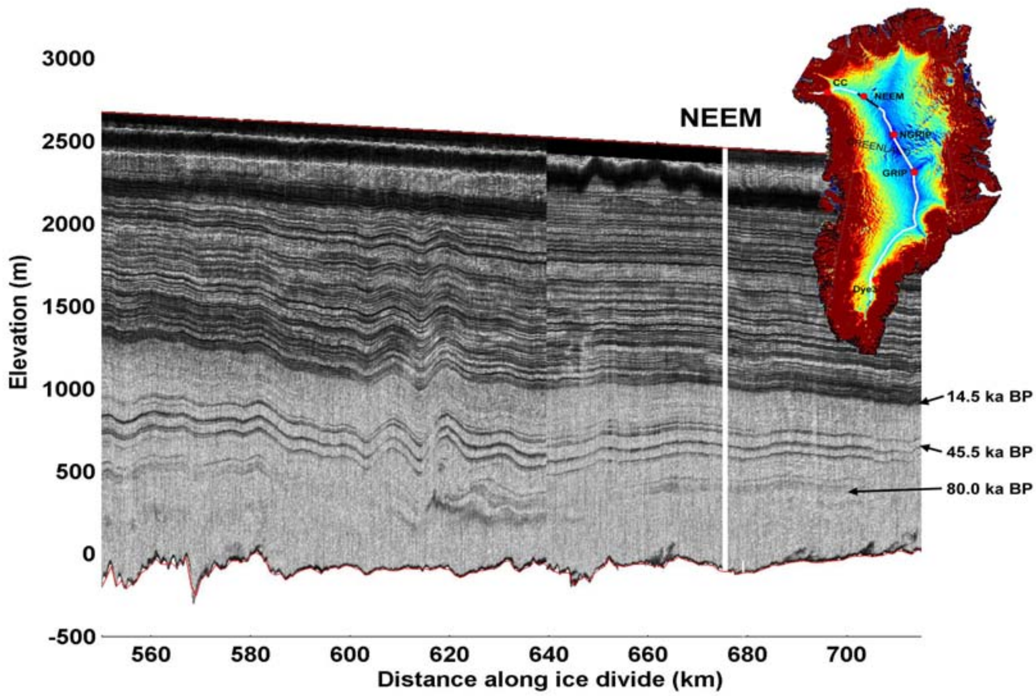


Fig. 1. Analysis of internal radar reflectors (isochrones). The NEEM site is indicated. The map over Greenland shows surface slope of the Ice Sheet (blue: flat and red: steep). The white line shows the ice divide from Dye-3 in the South to Camp Century (CC) in the North West. The radar image covers the black section of the ice divide.

Scientific plan for NEEM 2008.

Although NEEM 2008 season will be mostly construction of the drilling camp, there will be several scientific projects. It is planned to cut at least 12,000 samples from the NEEM main core at 2.5 cm resolution in the top 300m of the core. All ice core drilled will be logged and stored in a core storage waiting for full processing, including CFA in 2009. Two teams will perform firn gas pumping in the vicinity of NEEM in two shallow drill bore holes, down to pore close off depth at 80-100 m.

Logistic plan for NEEM 2008.

The NEEM drilling project is a multi-year operation. It is necessary to put up a semi-permanent camp and maintain a skiway at the site. This requires heavy equipment (tracked vehicles, bulldozers etc.) NEEM has purchased a Pistenbully 300W polar with a 10 ton*m crane as supplement for the aging two Flexmobiles and the Caterpiller loader. The Caterpillar loader and other useful equipment was left behind at NGRIP, and it is planned to perform a traverse to NGRIP to pickup these assets.

The logistic plan for NEEM 2008 can be broken down into the following highlights:

1. Finish construction of the skiway and apron by brining marking up to the full standards as defined by the NYANG and grooming and maintaining the skiway to allow for maximum landing weight of LC-130s.
2. Setting up weatherport garages for maintenance and repair of heavy vehicles, storage and workshops.
3. Assembly of the Pistenbully on site.
4. Erecting weatherports for accommodation of 40 persons.
5. Excavation and construction of underground drill trench, science trench and core storage.
6. Setting up tables and lighting in the trenches and processing equipment in logging area and science trench.
7. Setting up shelves for ice core storage.
8. Shallow drilling of the NEEM pilot hole to 120 m. Reaming of pilot hole to large diameter.
9. Casing of the pilot hole.
10. Installing all infrastructure for the deep drilling operation: Winch, tower, control cabin, ventilation and fluid handling system.
11. Construction of modular insulated buildings: Drill operators cabin, heated drillers workshop and main generator hut.
12. Construction of a three floor main dome with dining area, bath room, laundry, kitchen, radio room, office space/lounge and quarters for 8 persons.
13. Electrical wiring from main generator to all tents, garages and the main dome.
14. Electrical infrastructure in main dome. Central heating in main dome. Plumbing and water supply, toilets, sinks, laundry machine, dishwasher and drinking water.
15. Run-in of wet-drilling routine, drilling to >400 m.
16. Perform drilling of two shallow holes for firn gas pumping.
17. Perform a surface traverse to NGRIP to pick up equipment.
18. Receive a Visit for Distinguished Visitors.

NEEM 2008 camp logistics.

As the NEEM camp was closed in 2007, we left behind a temporary flagged skiway, a 12 x 20 foot weatherport on a hill, four heavy sledges with equipment and fuel, three pallets with cargo and three snowmobiles in a snow cave. Two Flexmobiles and a Toyota Landcruiser are parked on the snow. At NGRIP we left behind equipment in the Lucht castel, including the Caterpillar loader.

Fig. 2: NEEM camp at closure in August 2007

Timeline.
The project is planned to take place from 7th May to 18th August 2008. Thus we plan for 15 weeks of work on the ice. The ice cores will be stored at NEEM, but the cut isotope samples will be returned to Copenhagen.

Publications and out-reach.
The proposed camp construction work will be crucial for a very fast start of the drilling season 2009. If time permits, we plan to re-measure the GPS position network during the fast traverse to NGRIP. The data gathered by the proposed cutting of 12,000 isotope samples will give the NEEM community important information on the site and provide the isotope working group an important head start. To enhance public interest in our work, we plan to have a web log where the public may follow the progress on a day-to-day basis. Within the limits of logistical constraints some members of the press will also be invited to NEEM camp.

Details on NEEM camp.

The NEEM maps and construction drawings have been prepared by Simon Sheldon. The final position markers have been measured by Lars Berg Larsen. In 2008 we will erect two weatherport garages on snow hills. We will erect a 12 x 20, a 10 x 10 and two 10 x 15 weatherports in camp. We will also erect two 20 foot weatherport domes on hills. The main construction effort will be building the new main dome, excavating science and drill trenches and construction of a powerhouse on a heavy sled. The powerhouse will be a Viessmann hut with a 120 kVA generator and water systems. At NEEM we will introduce a new fuel storage system. Bulk fuel will be stored in three 15,000 liter steel tanks. Shipment of fuel will be done by the tanks of the LC-130. Transfer of fuel will be done by de-fueling the aircraft using a new 1200 liter per minute pump system. The pump system is outfitted with fuel filters so that LC-130 aircraft also can be fuelled in camp. This new pump system will significantly reduce handling and transport of 200 liter drums.

2One of the three 15,000 liter tanks for NEEM

The 2007 NGRIP to NEEM traverse route (also the 2008 route).

NGRIP position: 75.10N, 42.32W (decimal degrees), 2918 m a.s.l (9600 feet).
NEEM position: 77.45N, 51.06W (decimal degrees), 2484 m a.s.l. (8140 feet)

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

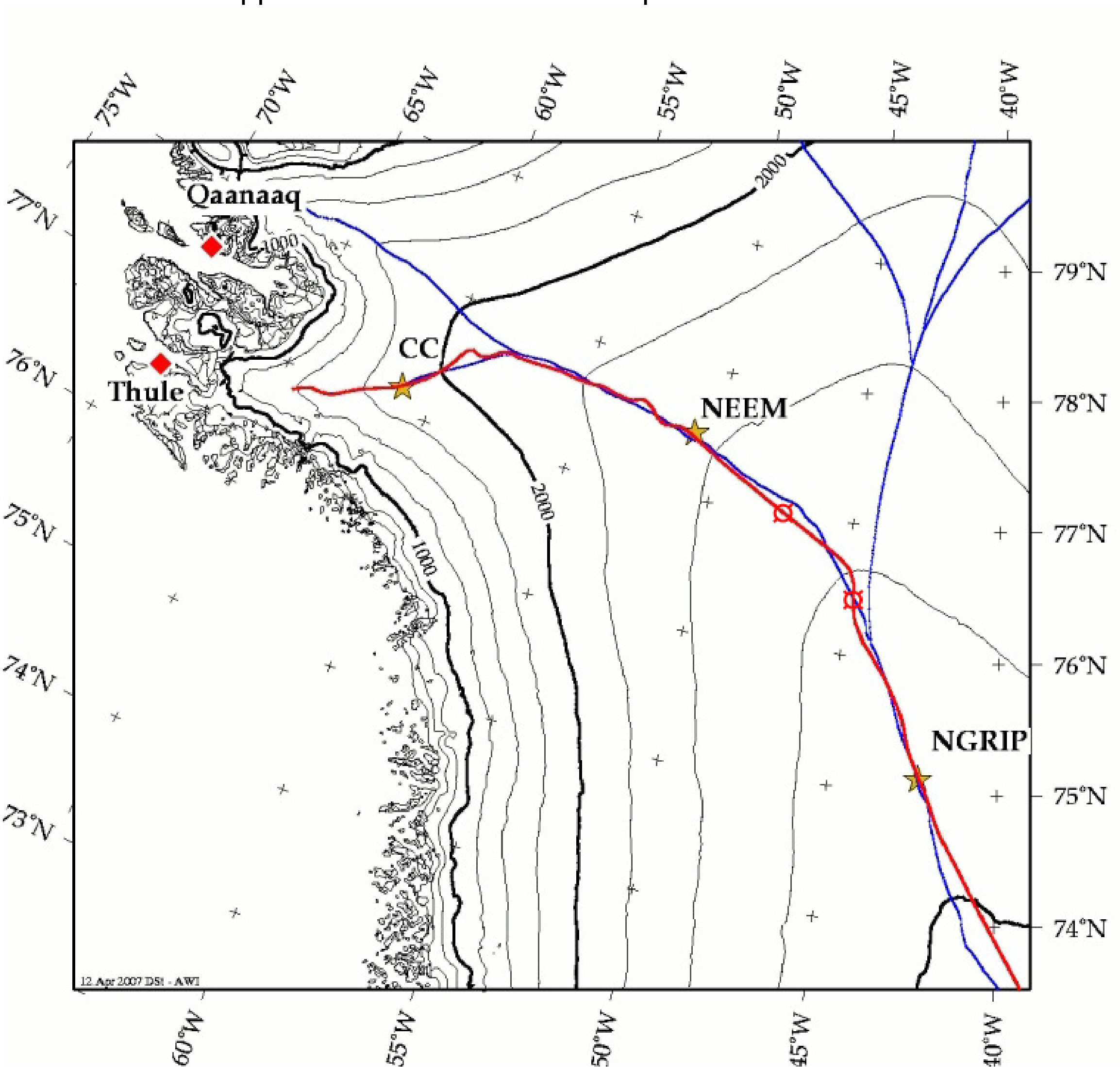


Fig. 5 1 The red line shows the route from NGRIP to NEEM. The two circles indicate the two shallow ice coring sites. The third shallow coring was done at NEEM.

List of waypoints.

Way point	route distance	long.	lat.	altitude	Way point	route distance	long.	lat.	altitude
	Km	dec. deg	dec.deg	m		Km	dec. deg	dec.deg	m
	NGRIP (0)	**75.111**	**-42.309**	**2916.7**	38	190	76.66	-45.004	2740.3
1	5	75.152	-42.387	2913.1	39	195	76.691	-45.147	2732.5
2	10	75.192	-42.462	2909.5	40	200	76.721	-45.291	2724.7
3	15	75.233	-42.537	2906	41	205	76.747	-45.452	2716.8
4	20	75.274	-42.607	2902.5	42	210	76.772	-45.616	2709
5	25	75.316	-42.67	2899	43	215	76.797	-45.779	2701.2
6	30	75.359	-42.725	2895.6	44	220	76.821	-45.944	2693.4
7	35	75.402	-42.77	2892.3	45	225	76.844	-46.114	2685.3
8	40	75.446	-42.812	2888.8	46	230	76.867	-46.284	2677.2
9	45	75.49	-42.854	2885.3	47	235	76.89	-46.454	2669.1
10	50	75.533	-42.904	2881.5	48	240	76.913	-46.624	2661.1
11	55	75.575	-42.964	2877.7	49	245	76.936	-46.794	2652.9
12	60	75.617	-43.036	2873.6	50	250	76.96	-46.965	2644.5
13	65	75.657	-43.115	2869.5	51	255	76.983	-47.137	2636.2
14	70	75.697	-43.198	2865.2	52	260	77.006	-47.308	2627.8
15	75	75.736	-43.286	2860.7	**53**	**Drilling (265)**	**77.029**	**-47.479**	**2619.5**
16	80	75.776	-43.374	2856.2	54	270	77.052	-47.651	2611.1
17	85	75.815	-43.46	2851.6	55	275	77.075	-47.824	2602.6
18	90	75.855	-43.547	2846.8	56	280	77.097	-47.999	2594.1
19	95	75.891	-43.655	2841.6	57	285	77.12	-48.174	2585.6
20	100	75.928	-43.763	2836.3	58	290	77.142	-48.349	2577.1
21	105	75.965	-43.868	2831	59	295	77.165	-48.524	2568.6
22	110	76.002	-43.971	2825.6	60	300	77.187	-48.699	2560.1
23	115	76.038	-44.085	2820.2	61	305	77.21	-48.874	2551.6
24	120	76.073	-44.203	2814.8	62	310	77.232	-49.051	2542.9
25	125	76.109	-44.313	2809.5	63	315	77.254	-49.228	2534.2
26	130	76.15	-44.391	2804.7	64	320	77.277	-49.405	2525.5
27	135	76.19	-44.472	2799.9	65	325	77.299	-49.582	2516.8
28	140	76.23	-44.559	2795	66	330	77.321	-49.759	2508.1
29	145	76.271	-44.631	2790.2	67	335	77.344	-49.936	2499.1
30	150	76.315	-44.676	2785.7	68	340	77.367	-50.114	2490.1
31	155	76.359	-44.706	2781.2	69	345	77.39	-50.291	2481.1
32	160	76.403	-44.75	2776.1	70	350	77.413	-50.468	2472.1
33	**Drilling (165)**	**76.448**	**-44.771**	**2771**	71	355	77.437	-50.643	2463
34	170	76.493	-44.765	2766.1	72	360	77.461	-50.817	2453.9
35	175	76.537	-44.782	2760.5	**73**	**365(NEEM)**	**77.485**	**-50.992**	**2444.8**
36	180	76.581	-44.834	2754.2	74	370	77.505	-51.178	2435.6
37	185	76.622	-44.905	2747.5					

Waypoint 73 is 3 km NE of NEEM

Details on drilling and sampling.

The top part of the pilot hole for deep drilling will begin from the surface at the selected spot before excavation of the drill trench. The pilot hole will be drilled to a depth of 25 m. Excavation of drill trench and inclined sub-floor trench will then begin. A set of surface markers to fix the “true undisturbed 2008 surface” will be placed in the vicinity of the drill hole before excavations begin.
After the arrival of wet drilling equipment by ship in the beginning of July, wet drilling to about 400 m will continue until the end of the season.
All cores, including the two cores from firn air pumping (see below) will be logged, documented and stored in the core storage. A top slice of the main core will be cut by band saw for sampling of 2.5 cm stable isotope samples. At least the top 300 m should be sampled this way (12,000 samples) to give the isotope working group a head start in their analyses.

Firn air pumping.

Two teams, a US led team and a Swiss/DK led team will conduct firn air pumping in two shallow coring holes in the vicinity of NEEM. The DK shallow drill will perform pendulum drilling between the two holes. Two Viesmann heated cabins for CFA and physical properties in 2009 will be temporary erected on the snow to serve as firn air pumping laboratories. They will be dismantled and stored in the science trench at the end of the season.

Details on CReSIS plans for the Kansas depth sounder.

In the final flight period of 2008 the CreSIS team will perform radar mapping in a grid around NEEM. There are several options:
A 10 km x 10 km grid with 500 m or 1 km grid spacing.
A 20 km x 20 km grid with 1 km or 2 km grid spacing overlaid with a 5 km x 5 km grid at 500 m spacing.

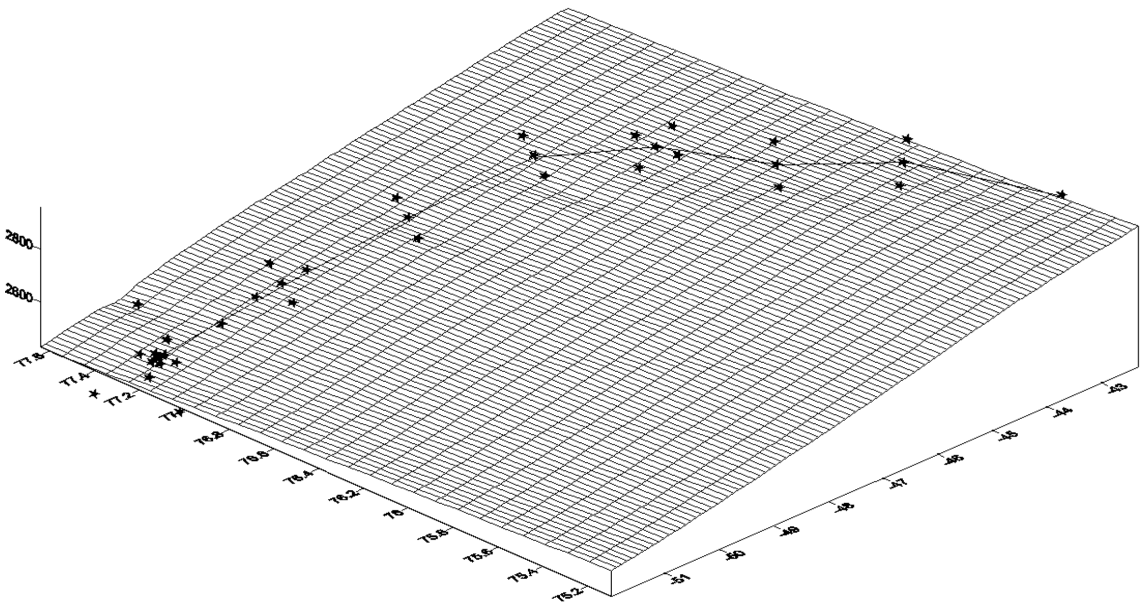
Details on strain net.

If time permits during the traverse to NGRIP, some of the strainnet markers will be remeasured.

The strainnet around NEEM was laid out in 2007 and consists of an inner and outer strainnet each consisting of four stakes in a square. The inner strainnet at a distance of one ice thickness, (2,5) km, to the NEEM reference pole. The outer strainnet at a distance of ten ice thicknesses away.

If possible we will install and freeze in a 110 m pole in the NEEM shallow hole. This will serve as the future NEEM reference.

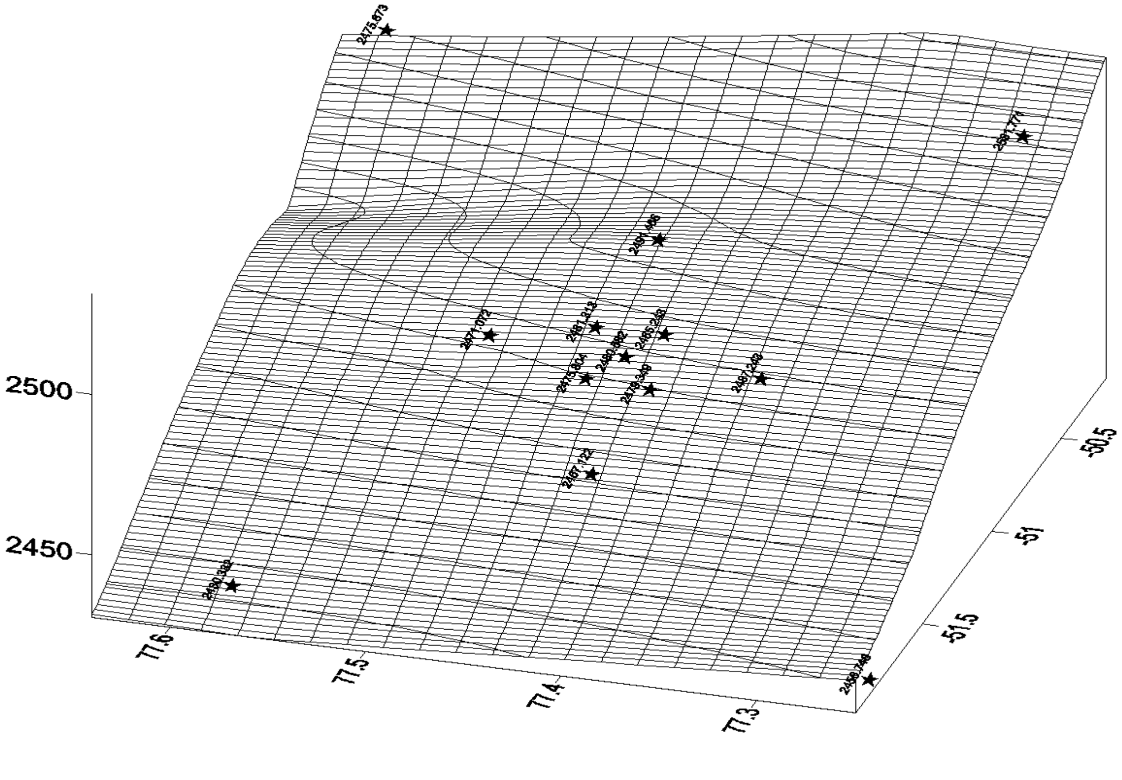
Traverse route NEEM > NGRIP with GPS strain net stages



Name	Latitude	Longitude	Latitude	Longitude		Elev. Height	Lat-dms	Long-dms
CLA ITRF	77 27 58.0930	-51 01 53.1172	77,4661	-51,0314214	2481,31300000	2.481.313,0000		
MAR ITRF	77 26 03.5648	-50 58 47.0485	77,4343	-50,9797357	2485,24300000	2.485.243,0000	0.054	0.095
NEEM Reference ITRF	77 26 41.9520	-51 04 08.6526	77,445	-51,0690702	2480,58200000	2.480.582,0000	0.002	0.003
NGRIP Reference	75 05 47.3954	-42 19 42.4079	75,0965	-42,3284466	2957,10600000	2.957.106,0000	0.005	0.006
NGRIP Reference WCS84 (SOPAC)	75,09649867	317,6715543900			2955,49500000	2.955.495,0000	0.0161	0.0212
PET ITRF	77 25 30.3409	-51 07 12.3672	77,4251	-51,120102	2479,34900000	2.479.349,0000	0.012	0.032
SUS ITRF	77 27 21.1545	-51 09 30.2845	77,4559	-51,1584124	2475,80400000	2.475.804,0000	0.047	0.046
WP-13 ITRF	75 39 25.2634	-43 06 54.1247	75,657	-43,1150346	2906,46800000	2.906.468,0000	0.023	0.049
WP-13-A ITRF	75 36 41.3337	-43 25 33.2703	75,6115	-43,4259084	2905,27300000	2.905.273,0000	0.038	0.046
WP-13-A NAD-83	75 36 41.2850	-43 25 33.3007	75,6115	-43,4259169	2905,26000000	2.905.260,0000	0.038	0.046
WP-13-B ITRF-83	75 42 06.4916	-42 47 58.1033	75,7018	-42,7994731	2903,03200000	2.903.032,0000	0.042	0.066
WP-13-B NAD-83	75 42 06.4429	-42 47 58.1359	75,7018	-42,7994822	2903,01400000	2.903.014,0000	0.042	0.066
WP-23 ITRF	76 02 16.9748	-44 05 05.7534	76,038	-44,0849315	2858,09000000	2.858.090,0000	0.024	0.041
WP-23-A ITRF	75 58 26.1533	-44 20 44.7912	75,9739	-44,3457753	2855,56000000	2.855.560,0000	0.026	0.033
WP-23-B ITRF	76 06 05.3187	-43 49 11.7223	76,1015	-43,8199229	2853,85900000	2.853.859,0000	0.049	0.043
WP-31 ITRF	76 21 32.3098	-44 42 21.7799	76,359	-44,70605	2815,13300000	2.815.133,0000	0.031	0.062
WP-33 ITRF	76 26 52.7992	-44 46 16.6464	76,448	-44,7712907	2807,25700000	2.807.257,0000	0.005	0.007
WP-33-A ITRF	76 26 50.5697	-45 09 09.1353	76,4474	-45,1525376	2798,98600000	2.798.986,0000	0.018	0.043
WP-33-B ITRF	76 26 48.7695	-44 23 14.6405	76,4469	-44,3874001	2812,00700000	2.812.007,0000	0.042	0.039
WP-35 ITRF	76 32 13.3585	-44 46 54.9945	76,537	-44,7819429	2798,20800000	2.798.208,0000	0.018	0.020
WP-43 ITRF	76 47 49.6543	-45 46 46.4402	76,7971	-45,7795667	2740,03700000	2.740.037,0000	0.053	0.102
WP-43-A ITRF	76 43 00.7018	-45 57 22.1422	76,7169	-45,9561506	2747,90800000	2.747.908,0000	0.048	0.041
WP-43-B ITRF	76 52 47.5722	-45 37 28.5509	76,8799	-45,6245975	2735,16200000	2.735.162,0000	0.020	0.033
WP-53 ITRF	77 01 44.3634	-47 28 45.8452	77,029	-47,4794014	2661,04900000	2.661.049,0000	0.014	0.030
WP-53-A ITRF	76 56 56.1690	-47 39 38.9273	76,9489	-47,6608131	2664,44800000	2.664.448,0000	0.041	0.057
WP-53-B ITRF	77 06 43.3435	-47 19 27.8550	77,112	-47,3244042	2658,21700000	2.658.217,0000	0.011	0.018
WP-61 ITRF	77 12 36.3099	-48 52 27.0389	77,2101	-48,8741775	2596,13900000	2.596.139,0000	0.040	0.033
WP-63 ITRF	77 15 14.0872	-49 13 40.9971	77,2539	-49,2280548	2580,74800000	2.580.748,0000	0.030	0.032
WP-63-A ITRF	77 10 12.8721	-49 22 52.2526	77,1702	-49,3811813	2577,50800000	2.577.508,0000	0.034	0.042
WP-63-B	77 20 14.8850	-49 04 34.1969	77,3375	-49,0761658	2581,93700000	2.581.937,0000	0.102	0.068
WP-65 ITRF	77 17 56.5816	-49 34 55.8100	77,2991	-49,5821694	2559,41000000	2.559.410,0000	0.049	0.093
WPN-001 ITRF	77 25 36.0321	-51 22 11.7835	77,4267	-51,3699399	2467,12200000	2.467.122,0000	0.078	0.060
WPN-002 ITRF	77 30 34.9697	-51 09 16.2549	77,5097	-51,1545152	2471,07200000	2.471.072,0000	0.041	0.043

Strain net around NEEM site

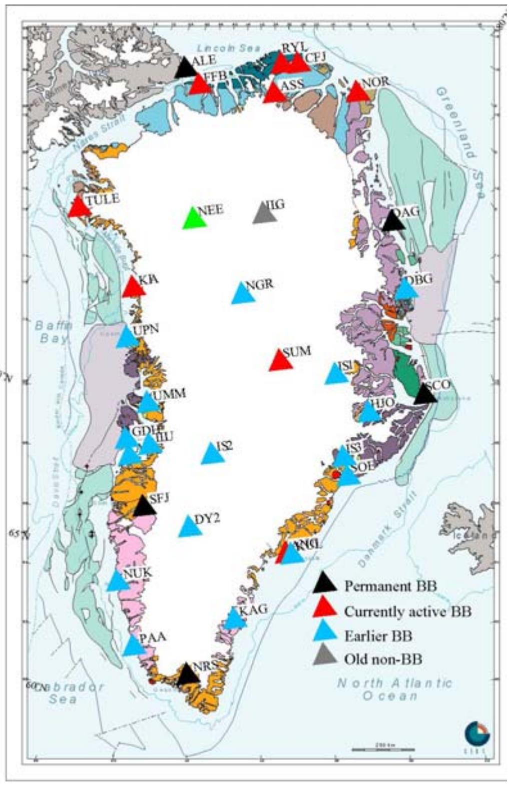
Name	Latitude	Longitude		Antenna height
WPN-299	77,5509236	-51,9796059	2430,33	2.45
WPN-209	77,2490623	-51,5625473	2456,75	2.54
WPN-001	77,4266756	-51,3699399	2467,12	2.61
WPN-002	77,5097138	-51,1545152	2471,07	2.60
SUS	77,4558763	-51,1584124	2475,80	2.55
WPN-029	77,63987	-50,5627345	2475,87	2.51
PET	77,4250947	-51,120102	2479,35	2.45
NEEM Reference	77,4449867	-51,0690702	2480,58	2.00
CLA	77,4661369	-51,0314214	2481,31	
MAR	77,4343236	-50,9797357	2485,24	2.08
WPN-021	77,3801657	-50,9850457	2487,24	2.56
WPN-022	77,4634856	-50,7702814	2491,47	2.51
WPN-119	77,3350287	-50,1733762	2531,77	2.40



Associated project: Earthquake station at NEEM

Trine Dahl-Jensen and Tine B. Larsen, GEUS.
Starting in 2000, the seismological groups at KMS and GEUS – now all at GEUS – have placed earthquake seismic stations at over 20 sites in Greenland, both on the coast and on the ice sheet. We record globally occurring earthquakes, and use the data to investigate the local structure beneath and between the stations. A station placed at NEEM will fit into the network very well; we always seek to place more stations on the ice sheet.

The station will consist of a Broad-Band (up to 120 sec period) STS-2 seismometer, a data logger with data storage on flashcards, GPS (for time) and batteries charged by a solar panel. The seismometer will initially be dug down approx. 2m under the surface, but when NEEM camp is established we will move the seismometer to a small side cave off one of the camps labs or the food freezer. Thus re-levelling the instrument will not require digging a several meters deep pit.



Data quality from stations on the ice sheet is very good; the station at NGRIP (NGR) provided sufficient data for an analysis of crustal thickness in just one summer season. The crust at NGR is 42 km thick. The traverse group has kindly taken on the job of not only transporting the station to NEEM but also installing it for us.
We plan to move the station from it's temporary position to a more practical site.
We will dig a cave in the wall of the far end of the Science trench for the seismometer.

Contact: Trine Dahl-Jensen tdj@geus.dk, work phone +45 3814 2519, mobile phone +45 2047 5962.

BAS radar description

Objectives

* Determine depths of radar layers (i.e. flow tracers) to high accuracy using the BAS phase sensitive radar at intervals of one year at two sites where ice cores have been (GRIP) or will be (NEEM) obtained, along sections 20km long. The measurements take about 15 mins, and will be carried out at separations of between 300m and 1km. The measurement campaign will take a fortnight. In addition, GPS measurements will be use dto measure the horizontal separation of poles and to conduct a topographic survey.

* Use the phase difference between layer reflections from the two time-different readings to measure the vertical strain in the ice, and thereby, for the first time, directly measure "instantaneous" strain-rates in the field in Greenland to depths of > 1000m. This will be done in locations where the boundary conditions are well specified, where the flow is essentially two-dimensional, and where the flow pattern near the surface is sensitive to the parameters defining the rheology.

* Use finite element methods to generate a suite of models of ice flow in the locality which explore the effect of ice rheology on the strain-rate pattern

* Fit strain-rate patterns deduced from models to the observed strain-rate to retrieve the rheological index at geophysically strain-rates of < 0.0001/year, several orders of magnitude below nearly all laboratory measurements.

* Present a set of field-derived rheological models for use in ice-sheet modelling.

Summary

The rate at which ice flows into the sea from the large ice-sheets directly affects sea-level. The forces which drive this flow are controlled by the increasingly well-known geometry of the the ice-sheets, but the resistance to flow depends upon the viscous properties of ice. Ice has the peculiar property that the the viscosity depends upon the rate at which the ice is deforming. This sensitivity is usually described with the Glen index. Recent theoretical studies have shown that our knowledge of the Glen index is not sufficiently well known to (i) accurately predict very basic outcomes of marine icesheet change during glacial cycles; and (ii) predict the spatial dimensions of surface response in ice-streams to a better accuracy than current satellite measurements.

The Glen index can be measured in the laboratory or the field. Laboratory measurements diverge from field measurements, and are very difficult to make at the low strain-rates observed in the field. In many field measurements it is difficult to characterise the stresses very well and to know how the provenance of the ice has affected measurements. We will go to divide locations where the stress field can be characterised well and the provenance is very well constrained. Radar layers provide markers within the ice, and their vertical displacement over relatively short time periods can be measured using interferometric phase-sensitive radar techniques. This will provide instantaneous vertical velocity fields and strain-rate fields in the upper third to a half of the ice field. GPS techniques will also be used to measure surface strain-rates, which can be compared with the vertical strain-rates derived from the radar. Measurements will be made at GRIP and NEEM (Greenland), sites for ice-core drilling at intervals of one year. We have carried out a proof-of-concept study making measurements with a time interval of a fortnight at NGRIP (a 3000m thickness of ice). Here we were able to measure vertical strain-rates of less than 10^-4/yr with 30% accuracy. Time intervals of a year will improve the accuracy considerably, likely below 5%. At divide locations the velocity field is especially sensitive to the Glen index, and this is particularly the case in the upper part of the ice. We will use full-system modelling to determine the Glen index which best fits the data, and thereby measure the Glen index in the field in a well-controlled location.

Richard Hindmarch, British Antarctic Survey

NEEM 2008 schedule

April, 24, Thursday	FOMs arrive in Kangerlussuaq
April, 28, Monday	C5 arrives in Kangerlussuaq with main dome.
May, 5 Monday	Field personnel arrives in Kangerlussuaq.
May, 6, Tuesday	First NEEM put-in, 5 PAX in
May 9, Friday	Second put-in at NEEM. Skiway, weatherport and garage construction.
May 13, Tuesday-	5 put-in flights: 4 PAX in, timber, pistenbully, fuel+tank, garage, food.
May 16, Friday	Pistenbully mounting. Garage construction. Red domes and weatherport construction. Construction of drill trench and science trench.
May, 27, Tuesday – June, 5, Thursday	5 flights: Main dome, timber, deep drill parts, cables. 4 PAX out, 6 PAX in. Main dome construction. Outfitting drill trench and science trenches. Liz Morris Team pick up.
June, 8, Sunday	Air show in Karup. Main generator and Viessman hut to Kanger.
June,24,Tuesday	1 flight: 7 PAX out, 14 PAX in. Main generator and hut. Generator hut construction, plumbing and electrical in main dome. Pilot hole drilling. Reaming. BAS radar in.
July, 1 , Tuesday	Ship cargo ready in Kangerlussuaq.
July, 8, Tuesday - July, 11, Friday	5 flights: 6 PAX out. 20 PAX in. Gas pumping equipment. Ship cargo. Finishing main dome infrastructure. Casing deep hole. Constructing Viesmann huts. Wet drilling equipment. BAS radar out.
July 13, Sunday	Begin traverse to NGRIP (3 PAX)
July 19, Saturday	Traverse arrival at NGRIP
July 21, Monday	Traverse departure from NGRIP
July, 22, Tuesday	NEEM resupply flight. 2 PAX out. 2 PAX in. Seismic station maintenance.
July, 24, Thursday	NEEM resupply flight. 1 PAX out.
July, 29, Tuesday	Traverse arrival to NEEM
July, 31, Thursday	NEEM resupply. Gas pumping equipment out. Kansas radar in. 15 DVs in.
August 1, Friday	Solar Eclipse. 4 PAX in. 17 PAX out. 15 DVs out.
August 18, Monday	Camp closing. 19 PAX out. Kansas radar out. Final pull-out.
August 26, Tuesday	Fom office in Kangerlussuaq closes.

Manning plan.

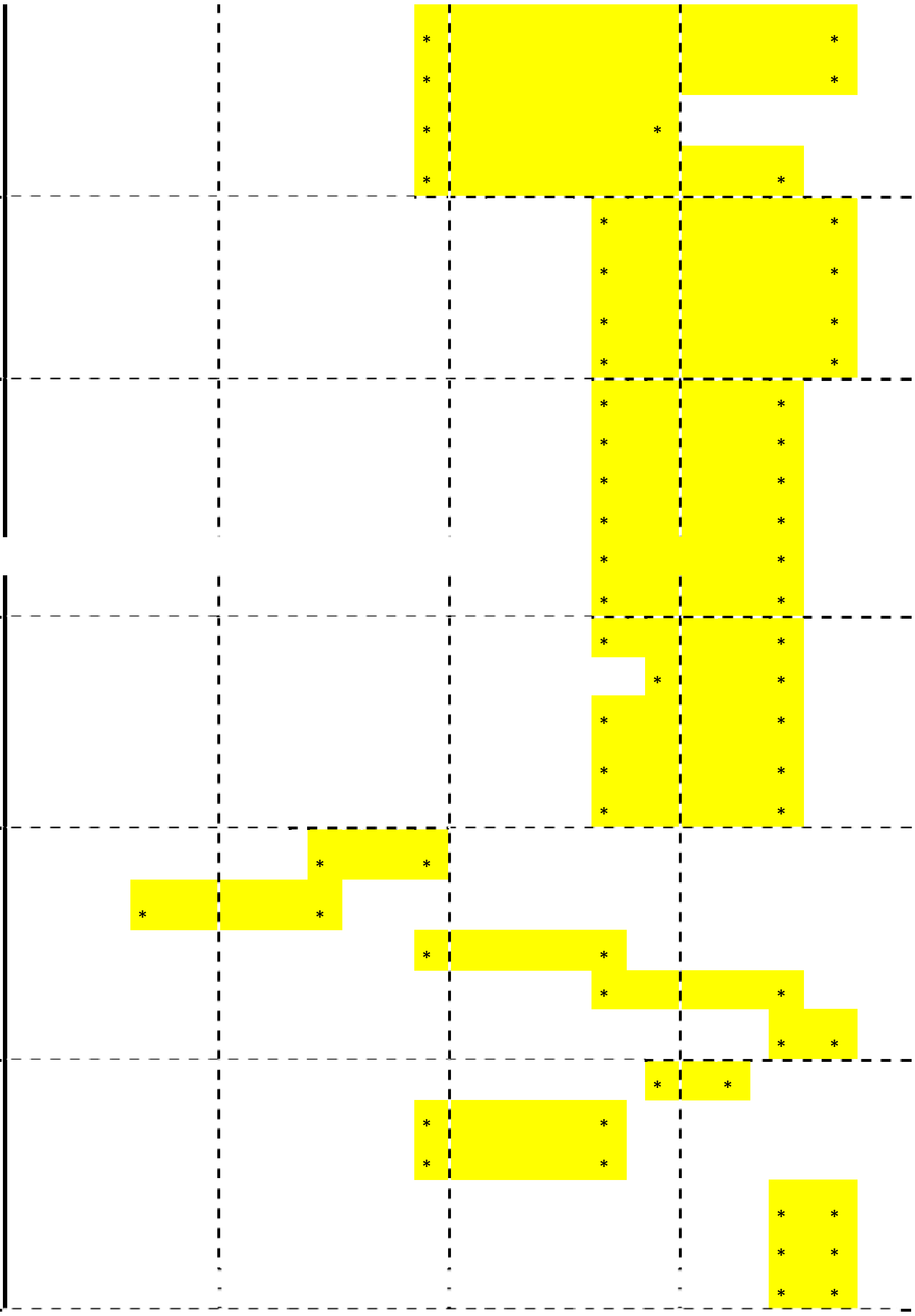
	Name	Nationality	To SFJ	To NEEM	From NEEM	From SFJ	Number of days in camp.	Number of days in KISS
FOM	Bjerregaard Simonsen, Sebastian	DK	24-Apr			14-May	0	20
FOM	Larsen, Lars Berg	DK	24-Apr			06-Jun	0	43
FOM	Rasmussen, Sune O.	DK	24-Apr			06-May	0	12
GFA	Durand, Gaël	F	05-May	06-May	24-Jun	27-Jun	49	4
GFA	Hedfors, Jim	S	05-May	06-May	29-May	02-Jun	23	5
MECH	Hilmarsson, Sverrir Æ.	IS	05-May	06-May	24-Jun	27-Jun	49	4
GFA	Overly, Thomas	US	05-May	06-May	29-May	02-Jun	23	5
FL	Steffensen, Jørgen Peder	DK	05-May	06-May	24-Jun		49	1
COOK	Harvey, Sarah	US	11-May	14-May	24-Jun	28-Jun	41	7
MECH	Druecker, Cord	D	12-May	13-May	29-May	02-Jun	16	5
DOC	Florian, Hans Christian	GRL	12-May	14-May	03-Jun	04-Jun	20	3
HVO	Bang, Claus	DK	12-May	14-May	08-Jul	12-Jul	55	6
FOM	Strand, Michael	DK	21-May	03-Jun			0	13
DOME	Wolfram, Blair F.	US	28-May	29-May	24-Jun	27-Jun	26	4
DOME	Davis, William J.	US	28-May	29-May	24-Jun	27-Jun	26	4
ELECTRIC	Vaughn, Bruce	US	28-May	29-May	06-Jul	12-Jul	38	7
DOC	Sørensen, Hasse Møller.	DK	02-Jun	03-Jun	24-Jun	27-Jun	21	4
FOM	Chalmas, Remi	DK	02-Jun			25-Jun	0	23
GFA	Langen, Peter	DK	02-Jun	03-Jun	10-Jul	11-Jul	37	2
BAS RADAR	Gillet, Fabian	GB	23-Jun	24-Jun	10-Jul	11-Jul	16	2
BAS RADAR	Burton, Timothy	GB	23-Jun	24-Jun	10-Jul	11-Jul	16	2
DOC	Benn, Marianne	DK	23-Jun	24-Jun	10-Jul	11-Jul	16	2
VVS	Bundgaard, Henrik VVS	DK	23-Jun	24-Jun	22-Jul	25-Jul	28	4
DRILLER	Curran, Mark	AUS	23-Jun	24-Jun	18-Aug	22-Aug	55	5
FL	Dahl-Jensen, Dorthe	DK	23-Jun	24-Jun	18-Aug	22-Aug	55	5
DR.MECH	Hansen, Steffen Bo	DK	23-Jun	24-Jun	18-Aug	22-Aug	55	5
DRILLER	JiWoong Chung	COR	23-Jun	24-Jun	18-Aug	22-Aug	55	5
DRILLER	Johnsen, Sigfus Johann	IS	23-Jun	24-Jun	18-Aug	22-Aug	55	5
PROCESSOR	Masson-Delmotte, Valerie	F	23-Jun	24-Jun	01-Aug	04-Aug	38	4
CARPENTER	Moret, HansPeter	CH	23-Jun	24-Jun	01-Aug	04-Aug	38	4
DRILLER	Popp, Trevor	US	23-Jun	24-Jun	18-Aug	22-Aug	55	5
COOK	Ravnebjerg, Louise Wolff	DK	23-Jun	24-Jun	18-Aug	22-Aug	55	5
DR.MECH	Vistisen, Dennis MECH	DK	23-Jun	24-Jun	22-Jul	25-Jul	28	4
FOM	Steffensen, Jørgen Peder	DK	25-Jun			26-Aug	0	62
FIRN GAS	Sowers, Todd	US	06-Jul	08-Jul	01-Aug	02-Aug	24	3
FIRN GAS	Petrenko, Vas	US	06-Jul	08-Jul	01-Aug	02-Aug	24	3
HVO	Pedersen, Thomas Ramsdal	DK	07-Jul	08-Jul	18-Aug	22-Aug	41	5
TRAVERSE	Larsen, Lars Berg	DK	07-Jul	08-Jul	01-Aug	04-Aug	24	4
TRAVERSE	Hilmarsson, Sverrir Æ.	IS	07-Jul	08-Jul	01-Aug	04-Aug	24	4
DRILLER	Alemany, Olivier	F	07-Jul	08-Jul	01-Aug	04-Aug	24	4
DOC	Beck, Thomas	DK	07-Jul	08-Jul	01-Aug	04-Aug	24	4
FIRN GAS	Blunier, Thomas	DK	07-Jul	08-Jul	01-Aug	04-Aug	24	4

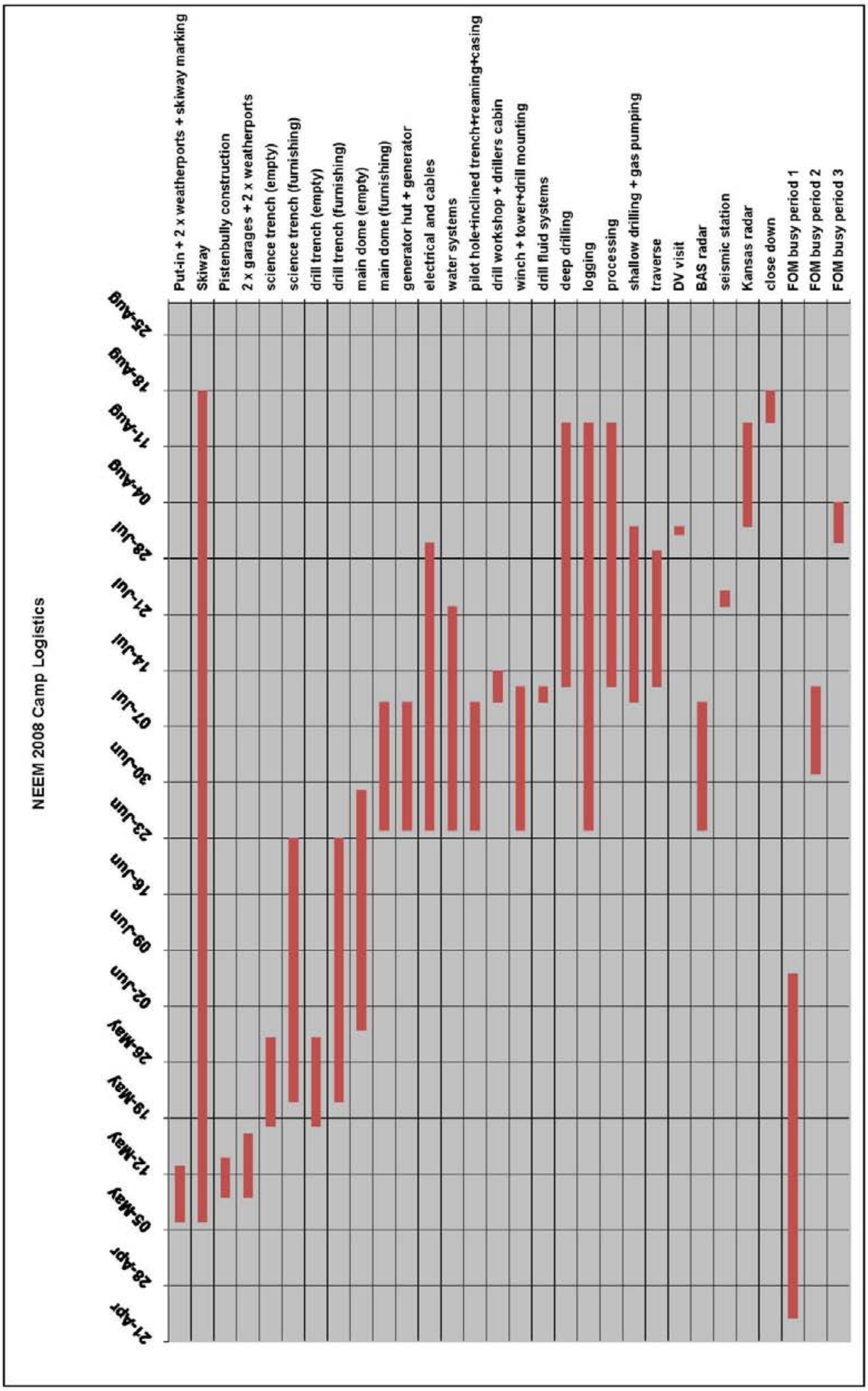
LOGGER	Buchardt, Susanne Lilja	DK	07-Jul	08-Jul	18-Aug	22-Aug	41	5
SH.DRILLER	Jenk, Theo	DK	07-Jul	08-Jul	01-Aug	04-Aug	24	4
IT	Panton, Christian	DK	07-Jul	08-Jul	01-Aug	04-Aug	24	4
MECH	Rufli, Henry	CH	07-Jul	08-Jul	01-Aug	04-Aug	24	4
FIRN GAS	Schwander, Jakob	CH	07-Jul	08-Jul	01-Aug	04-Aug	24	4
LOGGER	Seierstad, Inger	DK	07-Jul	08-Jul	18-Aug	22-Aug	41	5
ELECTRIC	Sheldon, Simon	DK	07-Jul	08-Jul	18-Aug	22-Aug	41	5
SH.DRILLER	Steen-Larsen, H.C.	DK	07-Jul	08-Jul	18-Aug	22-Aug	41	5
TRAVERSE	Svensson, Anders M.	DK	07-Jul	08-Jul	01-Aug	04-Aug	24	4
FIRN GAS	Uglietti, Ciara (Bern)	CH	07-Jul	08-Jul	01-Aug	04-Aug	24	4
PROCESSOR	v.d. Veen, Carina (lab)	NL	07-Jul	08-Jul	18-Aug	22-Aug	41	5
PROCESSOR	Vinther, Bo	DK	07-Jul	08-Jul	18-Aug	22-Aug	41	5
GFA	Stocker, Thomas	CH	21-Jul	22-Jul	01-Aug	04-Aug	10	4
SEISMIC	Dahl-Jensen, Trine	DK	21-Jul	22-Jul	24-Jul	28-Jul	2	5
RADAR	Leuschen, Carl	US	27-Jul	31-Jul	18-Aug	23-Aug	18	9
RADAR	Rodriguez-Morales, Fernando	US	27-Jul	31-Jul	18-Aug	23-Aug	18	9
RADAR	Sundermeier, Dennis	US	27-Jul	31-Jul	18-Aug	23-Aug	18	9
DOC	Elliott, Elizabeth	AUS	30-Jul	01-Aug	18-Aug	22-Aug	17	6
GFA	Bjerregaard Simonsen, Sebastian	DK		15-May	29-May	04-Jun	14	7
MECH	Strand, Michael	DK		04-Jun	18-Aug	22-Aug	75	4

Manning plan. Overview

			24 April 2008	06 May 2008	14 May 2008	21 May 2008	29 May 2008	03 June 2008	06 June 2008	24 June 2008	06 July 2008	08 July 2008	12 July 2008	22 July 2008	24 July 2008	01 August 2008	18 August 2008	26 August 2008
FOM	Larsen, Lars Berg	DK	*						*									
FOM	Rasmussen, Sune O.	DK	*	*														
FOM	Bjerregaard Simonsen, Sebastian	DK	*		*													
FOM	Strand, Michael	DK				*		*										
FOM	Steffensen, Jørgen Peder	DK								*								*
FOM	Chalmas, Remi	DK						*		*								
Mech	Hilmarsson, Sverrir Æ.	IS		*						*								
Mech	Strand, Michael	DK						*									*	
GFA	Durand, Gaël	F		*						*								
GFA	Hedfors, Jim	S		*			*											
GFA	Overly, Thomas	US		*			*											
GFA	Bjerregaard Simonsen, Sebastian	DK			*		*											
GFA	Langen, Peter	DK						*				*						
GFA	Steen-Larsen, H.C.	DK														*	*	
FL	Steffensen, Jørgen Peder	DK		*						*								
FL	Dahl-Jensen, Dorthe	DK								*							*	
DOME	Davis, William J.	US					*			*								
DOME	Wolfram, Blair F.	US					*			*								
Mech	Moret, HansPeter	CH								*						*		
Mech	Rufli, Henry	CH											*			*		
MECH	Druecker, Cord	D			*		*											
Elec.	Vaughn, Bruce	US					*						*					
Elec.	Sheldon, Simon	DK										*					*	
Plumber	Bundgaard, Henrik VVS	DK								*				*				
IT	Panton, Christian	DK											*			*		
Cook	Harvey, Sarah	US			*					*								
Cook	Ravnebjerg, Louise Wolff	DK								*							*	
HVO	Bang, Claus	DK			*							*						
HVO	Pedersen, Thomas Ramsdal	DK										*					*	
Driller	Alemany, Olivier	F										*				*		
Driller	Curran, Mark	AUS								*							*	
Driller	Hansen, Steffen Bo	DK								*							*	
Driller	JiWoong Chung	Cor								*							*	

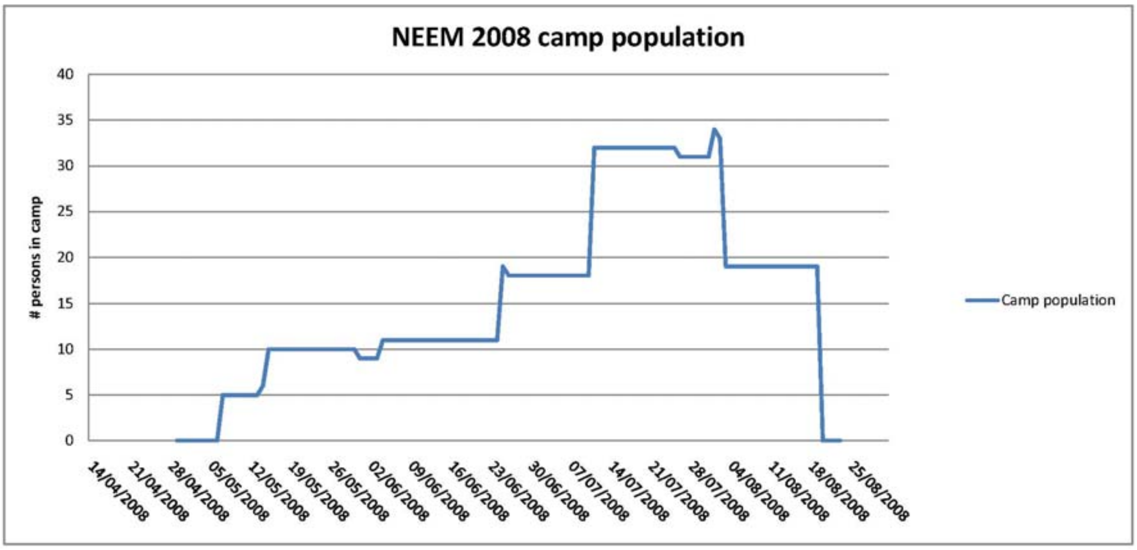
Driller	Johnsen, Sigfus Johann	IS
Driller	Popp, Trevor	US
Driller	Vistisen, Dennis MECH	DK
Processor	Masson-Delmotte, Valerie	F
Processor	Seierstad, Inger	DK
Processor	Buchardt, Susanne Lilja	DK
Processor	v.d. Veen, Carina (lab)	NL
Processor	Vinther, Bo	DK
Gas	Blunier, Thomas	CH
Gas	Uglietti, Ciara (Bern)	CH
Gas	Jenk, Theo	DK
Gas	Schwander, Jakob	CH
Gas	Petrenko, Vas	US
Gas	Sowers, Todd	US
GFA	Steen-Larsen, H.C.	DK
GFA	Stocker, Thomas	CH
Traverse	Larsen, Lars Berg	DK
Traverse	Hilmarsson, Sverrir Æ.	IS
Traverse	Svensson, Anders M.	DK
Doctor	Sørensen, Hasse Møller.	DK
Doctor	Florian, Hans Christian	DK
Doctor	Marianne Benn	DK
Doctor	Thomas Beck	CH
Doctor	Elliott, Elizabeth	AUS
Seismic	Dahl-Jensen, Trine	DK
UK radar	Burton, Timothy	UK
UK radar	Gillet, Fabian	UK
Kansas	Rodriguez-Morales, Fernando	US
Kansas	Sundermeier, Dennis	US
Kansas	Leuschen, Carl	US




NEEM 2008 Camp Logistics
21-Apr
28-Apr
05-May
12-May
19-May
26-May
02-Jun
09-Jun
16-Jun
23-Jun
30-Jun
07-Jul
14-Jul
21-Jul
28-Jul
04-Aug
11-Aug
18-Aug
25-Aug
Put-in + 2 x weatherports + skiway marking
Skiway
Pistenbully construction
2 x garages + 2 x weatherports
science trench (empty)
science trench (furnishing)
drill trench (empty)
drill trench (furnishing)
main dome (empty)
main dome (furnishing)
generator hut + generator
electrical and cables
water systems
pilot hole+inclined trench+reaming+casing
drill workshop + drillers cabin
winch + tower+drill mounting
drill fluid systems
deep drilling
logging
processing
shallow drilling + gas pumping
traverse
DV visit
BAS radar
seismic station
Kansas radar
close down
FOM busy period 1
FOM busy period 2
FOM busy period 3

Camp population.

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



The DV and press visit July 31st and August 1st .

NEEM considers outreach to both the press and to political decision makers as an issue of great importance. Already at the writing stage (April) there is an overwhelming interest from the press to cover NEEM activities this year. In order to meet as many demands as possible and at the same time create as little disturbance as possible, we have arranged for a Distinguished Visitor (DV) and Press trip on July 31st . On August 1st the visitors will return to Kangerlussuaq after observing a 96 % Solar Eclipse at 7:30 in the morning. We consider the Eclipse as a free promotion happening. Absolute maximum attendance for the DV trip is 20. Dorthe Dahl-Jensen will be coordinating the trip. This DV visit will boost camp population to 52 persons unless the 16 camp crew who are scheduled to leave camp will leave on the same plane as the DVs arrive on the.31st July. Due to potential camp over load, persons in camp scheduled to leave August 1st should leave July 31st We are aware that some of the out going people might want to stay with the DVs, but how many can be allowed to stay will be decided by the Field Leader. **Please respect the Field Leaders decision on this matter.**

Handling of Waste and environmentally hazardous chemicals.

NEEM is presently negotiating the environmental conditions imposed on NEEM by the Greenland government. As NEEM camp is located in a pristine area of the Greenland ice sheet, the camp is constructed to reduce the environmental impact as much as possible, e.g. by using wood and snow as primary construction materials and by using temporary tent structures to maximum extent.

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

LITTERING IS NOT ALLOWED. It is the duty of everybody to pick up any litter encountered.
Any traffic outside the general camp area has to be sanctioned by the Field Leader.
All waste will have to be sorted into the following categories:

- Natural combustible (e.g. kitchen waste, wood, card board)
- Glasware
- Metal (e.g. cans, nails and screws).
- Hazardous solids (e.g. batteries, PVC)
- Hazardous fluids (e.g. fuel, hydraulic fluid, drill fluid).

All glassware, metal and hazardous material will be retrograded to Kangerlussuaq for further processing. NEEM is presently negotiating how to treat natural combustible waste.
To limit possible spills of fuel, only authorized personnel is allowed to operate pumps for fuel transfer.
All spills of hazardous fluids to the snow have to be excavated and the polluted snow has to be deposited in a salvage drum.
Use only designated toilets. Urination is only allowed at designated spots (pee-poles).

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

Fire hazards.

Camp structures are spaced so that an accidental fire will not spread to other structures.
Carbondioxide extinguishers and fire blankets will be placed at all locations where fuel is handled, in the kitchen and on the first floor of the main dome.
Only one of the three main fuel tanks will be in camp at any time. The other two will be at the apron on in the cargo line.

Quartering and buildings.

Until 24th June:

	PAX normal	Max.PAX	
Kitchen/office			12' x 20' Weatherport
Big tomato	2	2	Fiberglass dome
Small tomato	1	1	Fiberglass dome
Quarter	2	2	10' x 10' Weatherport
Quarter	2	4	12' x 20' Weatherport
Quarter	2	4	10' x 15' Weatherport
Quarter	2	4	10' x 15' Weatherport
Total	11	17	

After 24th June:

Kitchen/office	5	12	40' wooden dome
Quarter	6	8	25' red dome
Quarter	6	8	20' red dome
Quarter	2	2	10' x 10' Weatherport
Quarter	2	4	12' x 20' Weatherport
Quarter	2	4	10' x 15' Weatherport
Quarter	2	4	10' x 15' Weatherport
Food Storage	1	2	12' x 20' Weatherport
Garage			26' x 40' Weatherport
Workshop			26' x 40' Weatherport
Big tomato	2	2	Fiberglass dome
Small tomato	1	1	Fiberglass dome
Total	29	47	

All buildings will be equipped with a 230V powerline capable of delivering 1 kW. If heaters are used, please limit the heating to just above freezing. In May and early June temperatures in the quarters will be below freezing. Beds will be either bunk beds with foam mattresses or foldable beds with a 5 or 10 cm foam mattress. Do not remove mattresses from empty beds!

Personal field equipment

All participants are expected to provide their own personal clothing, including normal winter garments, towels, toiletries, soap, facecloth, etc. In addition, a typical polar field bag will be provided in Kangerlussuaq:

Polar Survival Kit

2 Woollen underwear, terry cloth, trousers and jacket
1 Fleeced trousers and jacket
1 Overall trousers
1 Polar boots, including extra liners, preferably 2 pairs.
3 LLB grey polar socks
1 LLB parka
1 Leather gloves
1 Thin inner gloves
1 Insulated leather gloves, or ski type gloves
1 *Mittens. Optional*
1 Dark sunglasses
1 Sleeping bag, -10 degC or lower
1 Fleece liner for sleeping bag
1 Balaklava cap
1 Ear gear, fleece or rubber.
1 Face mask, *optional, only for those involved in snowmobile traverses.*
1 Ear protectors
1 First Aid kit

Please bring

1 Neck Tie or Dress
1 Solid hiking boots
1 A sturdy cup for coffee or tea
1 Your favourite cooking book
1 Your favourite music CD's
1 Your favourite game

This polar survival bag must be with an individual, it is not permitted to board aircraft or engage in traverses without a suitable survival kit.

SITREP

The Field Leader will Sunday night prepare a **SIT**uation **REP**ort "SITREP", i.e. a report on the preceding week's field activity. This report will be transmitted by E-mail to the Copenhagen office. From here, it will be retyped and put on the NEEM home page for download and sent by e-mail on Monday the NEEM project group and the relevant Greenlandic and Danish authorities.

The Sitrep follows the following format:

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

Daily report on the web (www.icecores.dk)

Daily a short “What we have done today” report and stories from the traverse & camps will be placed on the web. Information will be sent from the NEEM camp to the Field Operations Manager office in Kangerlussuaq that will take care of the home page. The Field Operations Manager (neem-fom@gfy.ku.dk) will coordinate this activity.

NEEM Official Address in Greenland.

NEEM 2008
Box 12
DK-3910 Kangerlussuaq
Greenland
Phone +299 84 11 51; fax +299 84 12 27; e-mail: neem-fom@gfy.ku.dk

Term of reference for the NEEM 2008 Field Season

During the field season J.P. Steffensen & Dorthe Dahl-Jensen will be the field leader, having formal command & responsibility of operations.

Accidents and Illness

There will be a doctor for the majority of the season in camp. In case of accidents or illness, the patients will first be given First Aid & if evacuation is needed an aeroplane will be called in from either Kangerlussuaq, East Greenland, Thule, Summit, Station Nord, etc. to transport the patient(s) to a suitable emergency site/hospital.

Good communication (Iridium, BGAN, Radio) and navigation equipment (GPS) should ensure fast evacuation if needed. Under most circumstances, we can move a patient to a hospital within 24 hours.

NEEM 2008 – Useful numbers

During the field season contact to the participants at the NEEM site, or NEEM to NGRIP traverse, can be made as described below:

Direct numbers to participants:

Inmarsat BGAN telephones

+870 772 210 501
+870 772 210 502
+870 772 210 503
Only one of these numbers will be available at any given time. Please ask the Field Operations Manager which number is current.

Cost examples to or from BGAN

Land line or Cell phone	$1.20 per minute + line operator, up to $10/minute
Iridium or Thuraya Voice	$4.40 per minute
Global Star	$6.26 per minute

Iridium Satellite telephones

+ 8816 414 39863
+ 8816 414 39864
+ 8816 214 64908
+ 8816 214 42402

Cost examples to or from Iridium

Iridium to Iridium	$0.65 per minute
Land line or Cell phone	$1.20 per minute + line operator, up to $10/minute
Thuraya Voice	$4.40 per minute
Global Star	$6.26 per minute

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

Good times to call are during

Lunch	15:00 – 16:00 GMT
Evening dinner	21:00 – 22:00 GMT

The Inmarsat BGAN & iridium systems should be operational 24 hours.

The participants will have limited access to making the phone calls to limit costs.

EMAIL:

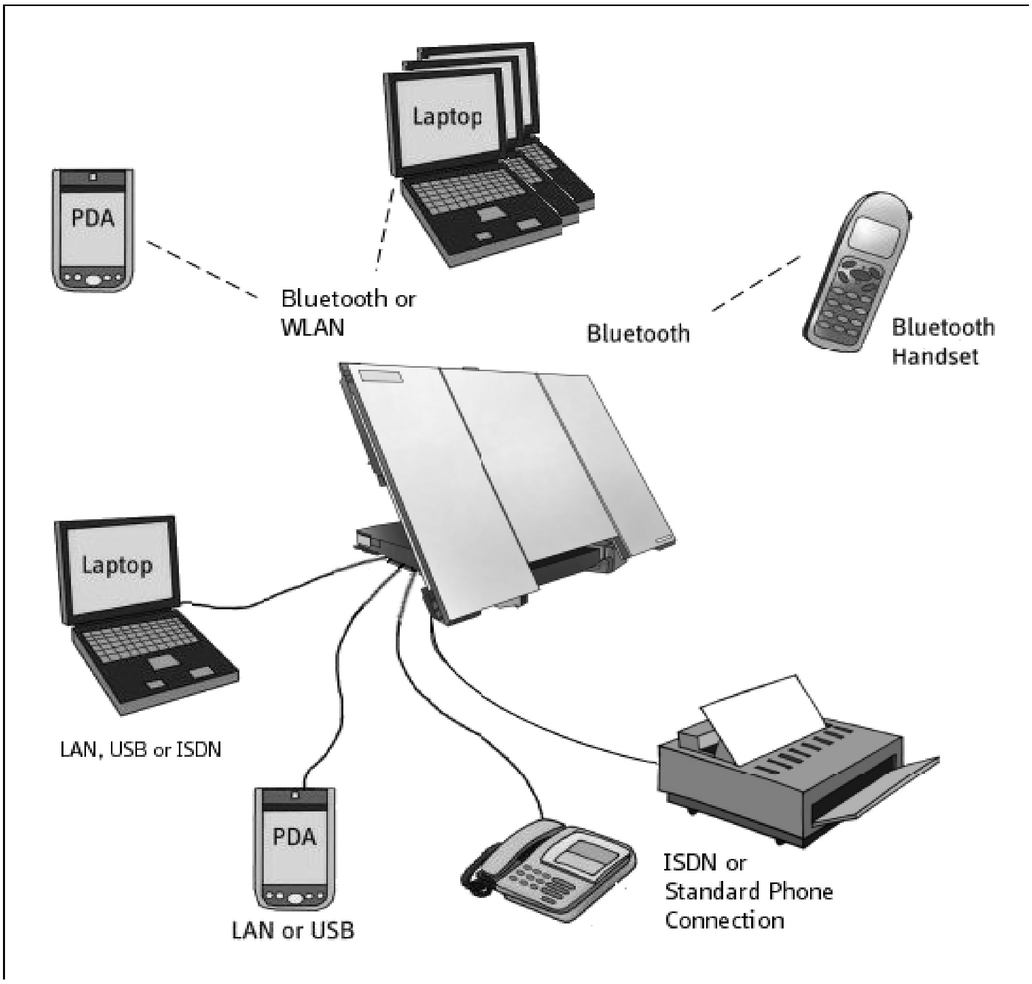
The Field Operations Manager will check arriving E-mail at least once a day on the following email: neem-fom@gfy.ku.dk. Don't forward large attached files.
On the ice we can use the new BGAN Inmarsat system to send & receive any E-mail via the address: neem-camp@gfy.ku.dk BUT at a high cost! PLEASE Remember to put the individuals name in the subject field of the e-mail.

Inmarsat BGAN system

Overview of the BGAN system

The Broadband Global Area Network (BGAN) is a mobile satellite service that offers high-speed data up to 492 kbps and voice telephony. BGAN enables users to access e-mail, Virtual networks and the Internet, transfer files and make telephone calls.

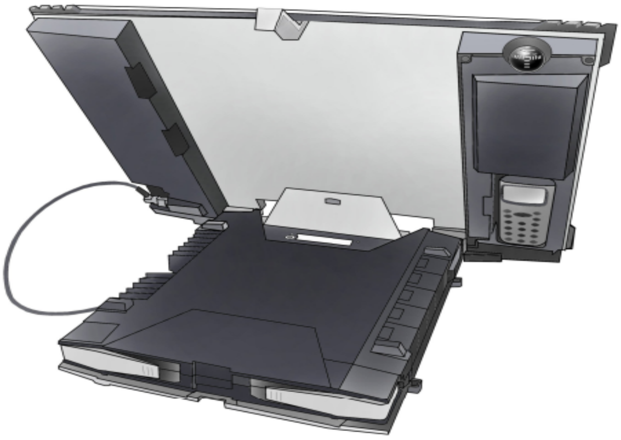
The complete BGAN system includes the EXPLORER™ 700 with connected peripherals, the BGAN satellite, and the Satellite Access Station (SAS). The satellites are the connection between your EXPLORER™ 700 and the SAS, which is the gateway to the worldwide networks (Internet, telephone network, cellular network, etc.).



EXPLORER™ 700 terminal

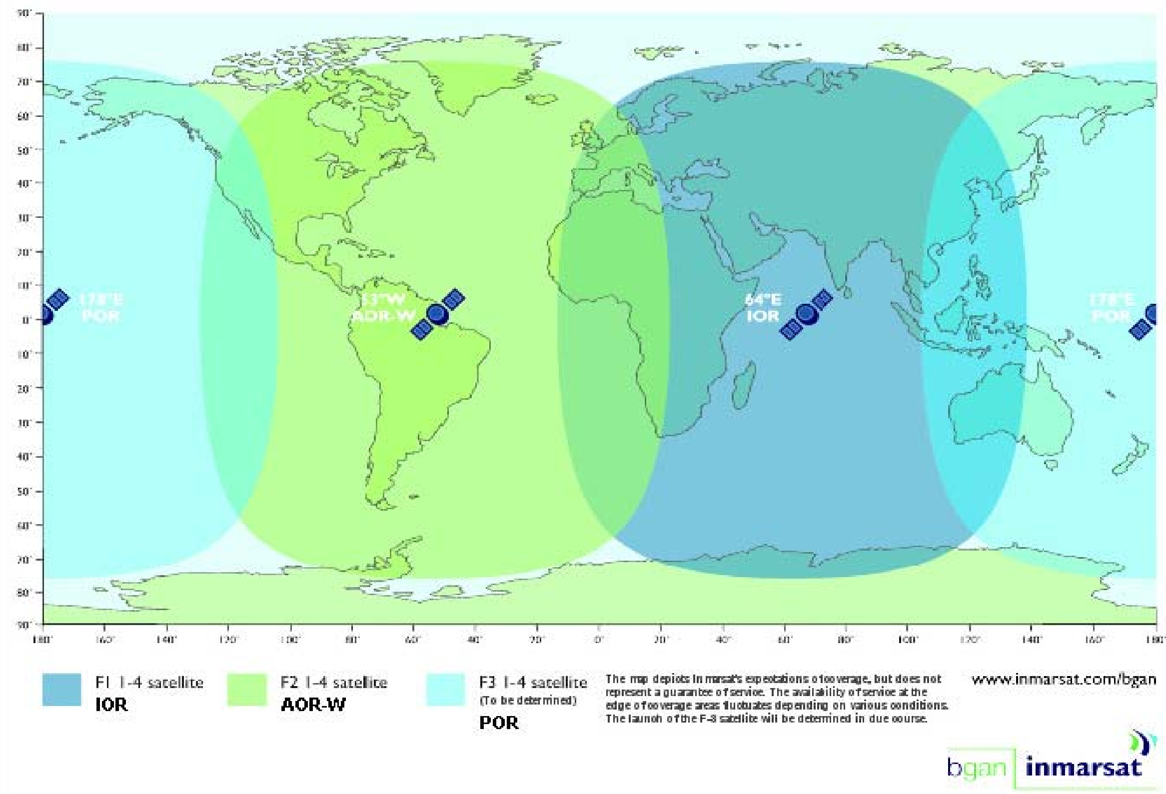
Overview

The EXPLORER™ 700 is a compact unit comprising a transceiver with a detachable antenna, compass, display and keypad, all in one unit.



Coverage

The Inmarsat BGAN services are based on geostationary satellites situated above the equator. Each satellite covers a certain area (footprint). The coverage map below shows the footprints of the BGAN system.



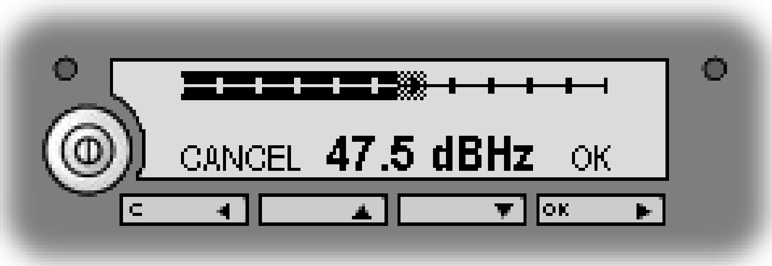
The map depicts Inmarsat's expectations of coverage, but does not represent a guarantee of service. The availability of service at the edge of coverage areas fluctuates depending on various conditions. In 2007 the NEEM signal reception was +54dB. Above +45dB is good enough to start communications with the outside world

BGAN Setup

For all Greenland operations we will be using the AOR-W satellite (green) situated at 53 degrees west. At NEEM & other Greenland ice sheet sites the antenna will need to be initially pointed directly south & inclined almost at the horizon.

This setup is easily made by using the built in compass. Declination is approximately 50 degrees, so point the antenna approximately SSW. The compass also indicates a very approximate inclination, but otherwise simple point slightly above the horizon.

Connect the antenna to the transceiver unit using the supplied 10m coax cable. Switch the transceiver ON and allow to boot-up. The first action will be to adjust the antenna for the most powerful signal. To help this setup the transceiver has a visual display showing power in a dB scale. Above 45dB the signal strength should allow communication, but the higher the strength the better for data speed & reliability. There is also an audio indicator to also help find the best direction.



Carefully move the antenna West and then East until the signal is strongest. Then try tilting the antenna up & down until the signal is highest. One can repeat this process several times to home-in on the strongest signal.

Once you have a strong signal press the OK button and the transceiver will try to establish a connection to the BGAN network. The display shows the progress as follows:

• **SEARCHING:**
The EXPLORER™ 700 searches for the network operator. Note that the search procedure can be very short, so you may not see this text.

• **REGISTERING:**
The EXPLORER™ 700 is registering itself on the network. If the GPS position has not yet been acquired at this point, the display may show **NO GPS**.

• **READY or DATA ACTIVE:**
READY means the EXPLORER™ 700 is registered on the network and is ready to go online. If you have already connected a computer, the display shows DATA ACTIVE instead of READY.

You should now be ready to use the phone or connect your computer to the transceiver and connect to the WWW.

Telephone Dialling

With the BGAN equipment is a wireless phone which should be setup & ready to use. Just switch ON and dial the number remembering all calls require the international dialling code i.e. +45 ……. for Denmark, +1 ……. for USA

Internet Connection

In the 2008 field season the internet connection will be setup in 2 phases.

Initial phase
The Inmarsat BGAN Explorer 700 has 2 LAN sockets to connect to your laptop with a provided LAN cable. Your laptop & the transceiver will immediately start setting each other up. After 10 seconds or so you will be able to open your normal web browser and surf the web*.

Final phase
A mix of wired LAN within the main dome & wireless LAN will be setup during the later stages of the season. This will allow full access to all personnel of there email account, etc BUT with a daily limit.

*** Please Note**
Using the internet is paid for per MBit. If unlimited, unnecessary uploads & downloads of software updates, large email attachments, images, movies, etc. by NEEM participants will very quickly cost the NEEM budget a fortune! Please, turn off all automatic downloads before connecting.

Personnel Transport 2008

The NEEM participants will deploy to Greenland via either Scotia AB (from U.S.) or Kangerlussuaq (from Copenhagen. The put in to NEEM camp & pull out from NEEM camp will be direct from/to Kangerlussuaq with a U.S. air force LC130.

For people travelling through **Kangerlussuaq**, we have arranged quarter in KISS. At KISS, all participants will be provided with beddings but are responsible for cleaning their room

Unless arranged otherwise, each nation takes care of their tickets. If troubles arise at making ticket reservations we should be notified. The increasing number of tourists travelling to Greenland results in a long waiting list, so please make the reservations as early as possible.

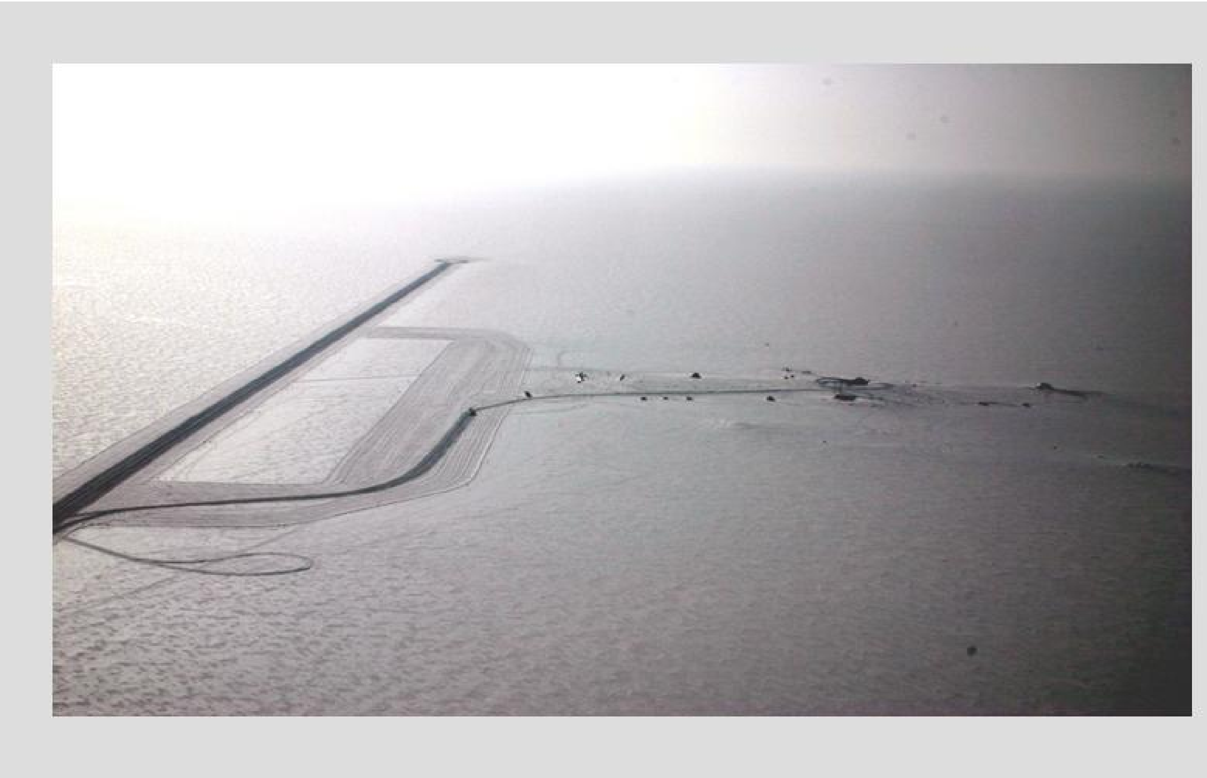
Note, unless arranged otherwise, each nation must take care of tickets and insuring their own people.

Each participant receives a per diem to cover the cost of living. In SFJ, the maximum per diem, which can be charged to the project, is 429 DK Kr per day. On the ice, the maximum per diem is 150 DK Kr per day. The actual per diem paid to the participants has to follow the rules in each country, and the physical payment will be taken care of by each nation unless arranged otherwise.

Booze and Drugs

You can bring the following tax free to Greenland: 1 l hard booze (22% or more) and limited amounts of beer and wine. 400 cigarettes are allowed. In case you have not purchased the duty free items in Copenhagen, you can do it in Kangerlussuaq on the day of arrival, showing the boarding pass, and before you leave the secure area. The price of one beer in Greenland is approximately 20 DK Kr, one litre hard liqueur cost approximately 500 DK Kr.

Welcome To The NEEM Camp



3The old NGRIP camp. NEEM camp will be looking much the same.

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

- The ski-way area is **off limits** unless approved by the Field Leader.
- When an aeroplane is expected, the Field Leader has assigned a person in charge of the apron activities. You are obliged to act as instructed by this person.
- Never leave the camp without informing somebody, the weather can change very quickly. If you go more than 2 km away from camp, the field leader should be informed.
- The eating hours are (please be in time, to make is easy for the cook.
    - Breakfast is individual (normally between 7:00 and 8:00),
    - Lunch is at noon (13:00 on sundays),
    - Dinner is at 19:00. While eating outside of lunch and dinner hours, make sure that all plates, etc. are cleaned after use.
- Heavy vehicles and snow blowers are only operated by few people assigned by the Field Leader.
- Skidoos –
    - Everybody can use the skidoos when not in specific use, but please make sure that:
        - Drive slowly around the camps.
        - Park the scooters with the gear in non-engaged position
        - Skidoos can only be removed from the camp area after an agreement with the Field Leader.
        - When attaching a sledge to a skidoo, always use the hook. Only connect the sledge with a rope if no other option exists, and keep the rope as short as possible.
        - Make sure the main drive belt is not frozen by wiggleing the skidoo from side to side before start.
        - Only drive skidoos when necessary.
- Never leave any cargo at the surface without marking it with a bamboo pole, otherwise it may be lost due to snow drift over night. Roll the cargo straps.
- If you remove cargo, then also remove the bamboo pole in order to avoid disorder and digging for nothing.
- Drinking water originates from a marked area. So never drive or walk through this area or contaminate it with any body fluid. Just keep out of the marked area.
- Water will be melted in a pot on the stove. Refill it with snow from the marked area when there is room in the pot to keep a steady water supply in the camp.
- In order to keep the camp clean there are only a few bamboo poles where you are allowed to take a leak.

Power Supplies

Within all operations during NEEM 2008 230 Volts, 50Hz will be the standard supply. Where possible the diesel generators will be used to conserve MoGas.

ONLY the Dome construction team & KU radar equipment will be using 115V, 60Hz.

Diesel

1 – Iveco	125KVA	3 x 230V (400V/50Hz)
1 – Mase	16KVA	3 x 230V (400V/50Hz)
1 – SDMO	15KVA	3 x 230V (400V/50Hz)
3 – Hatz	5 KVA	1 x 230V / 50Hz

The 2008 NEEM camp site has 3 drilling operations planned. We expect that the operations will run on one generator at a time.

If necessary, one Hatz Gen. Sets can be fitted with a 6.8KVA 3 phase (400V/50Hz) alternator.

MoGas

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

The KU radar team will be using a 3KVA (115V/60Hz) generator during their radar surveys. As an emergency spare the 4.5KVA (230V/50Hz) Honda generator will be used with a 3KVA 230V to 115V voltage transformer.

Please help to conserve power.

Assigned Duties

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

Cooking. Although there will be a cook in camp, Saturday night dinners are prepared by the camp crew. Sunday morning breakfast is self service. If you skip meals, please inform the cook in advance.

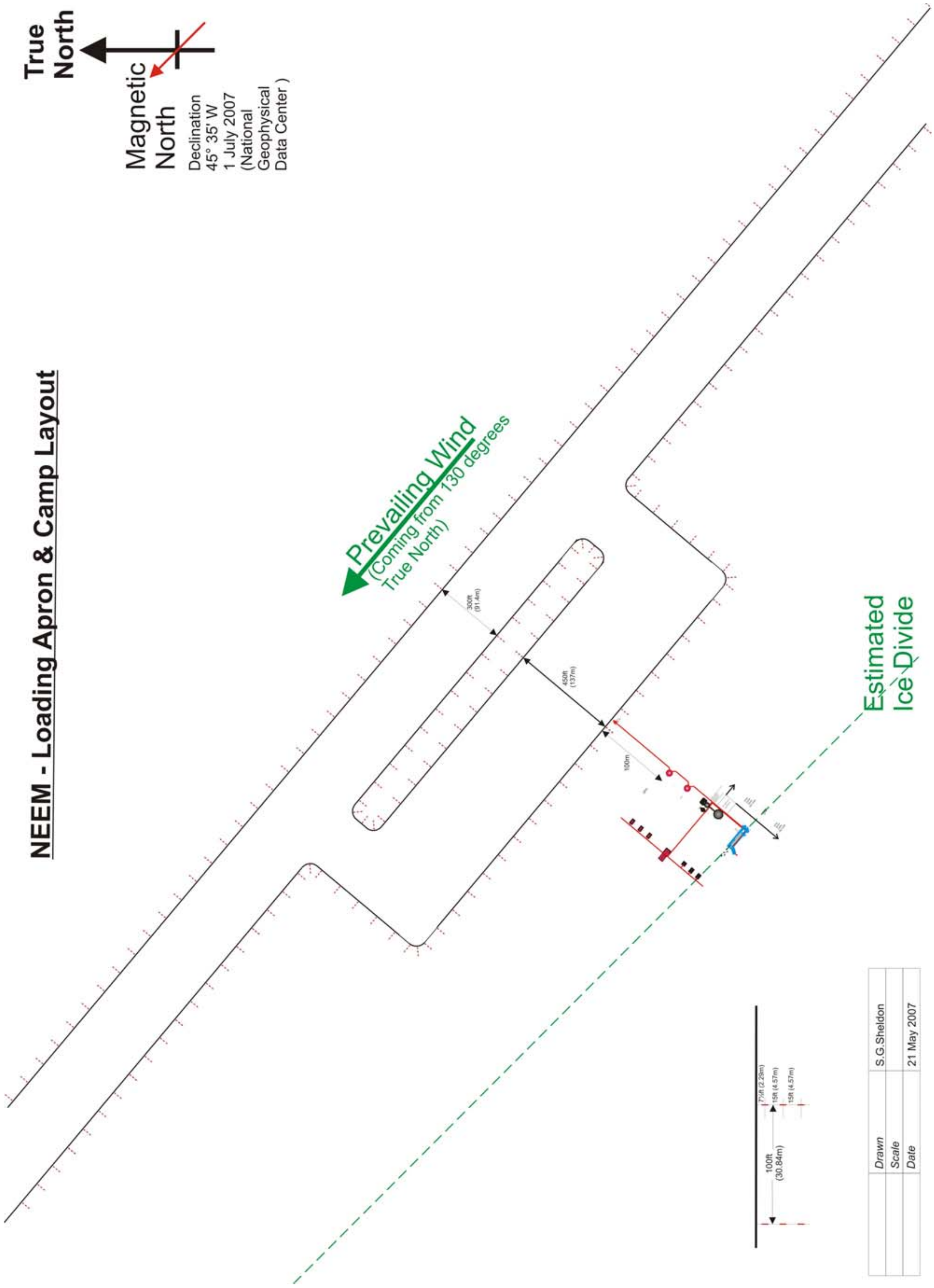
Dishwashing. We expect all to join the dishwashing.

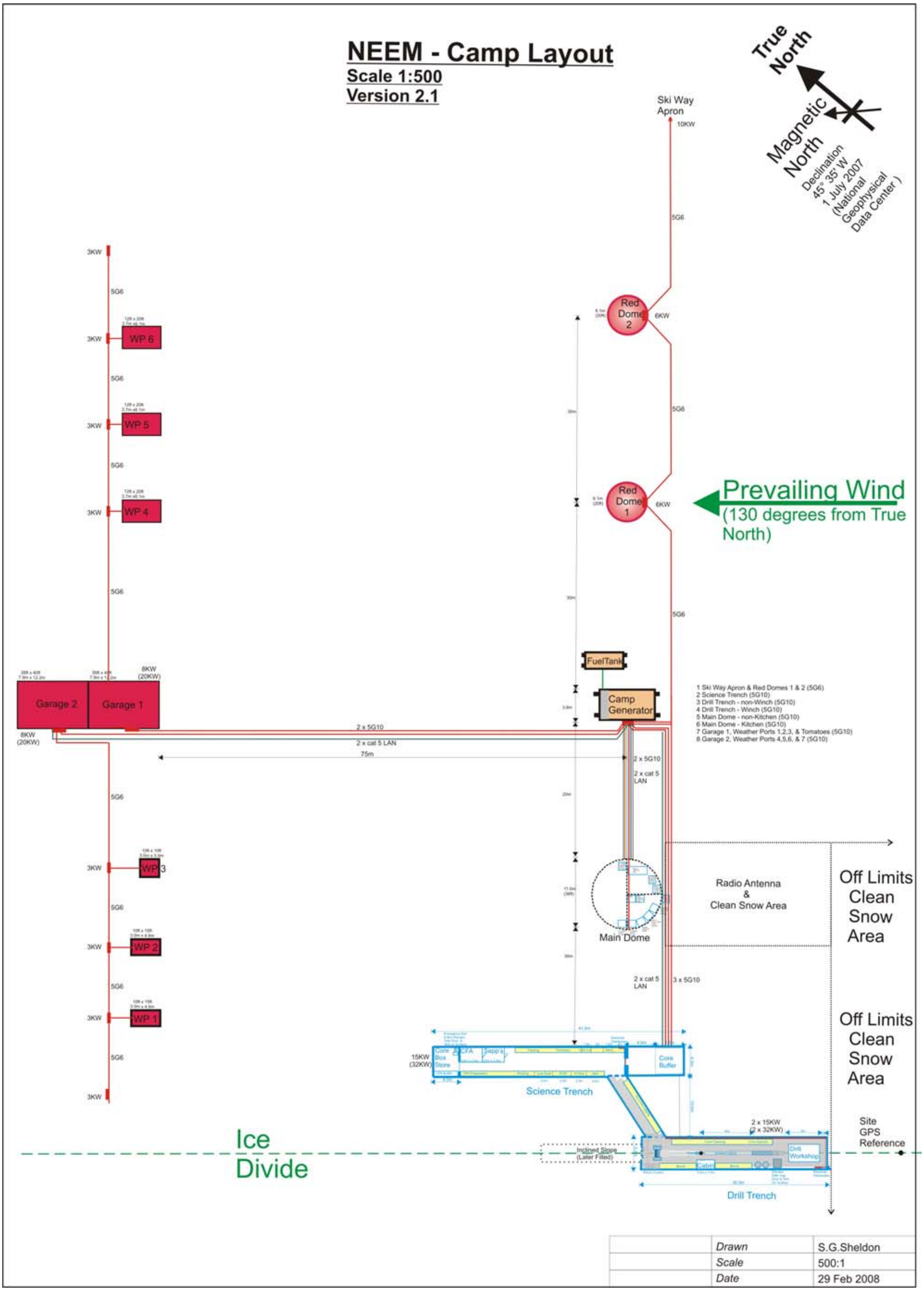
Snowmelter. Everybody has the duty to keep the snowmelter full. Check the water level before and after you have taken a shower.

Drinking water snow melter. Each day one person is assigned to be responsible for keeping the drinking water snowmelter full.

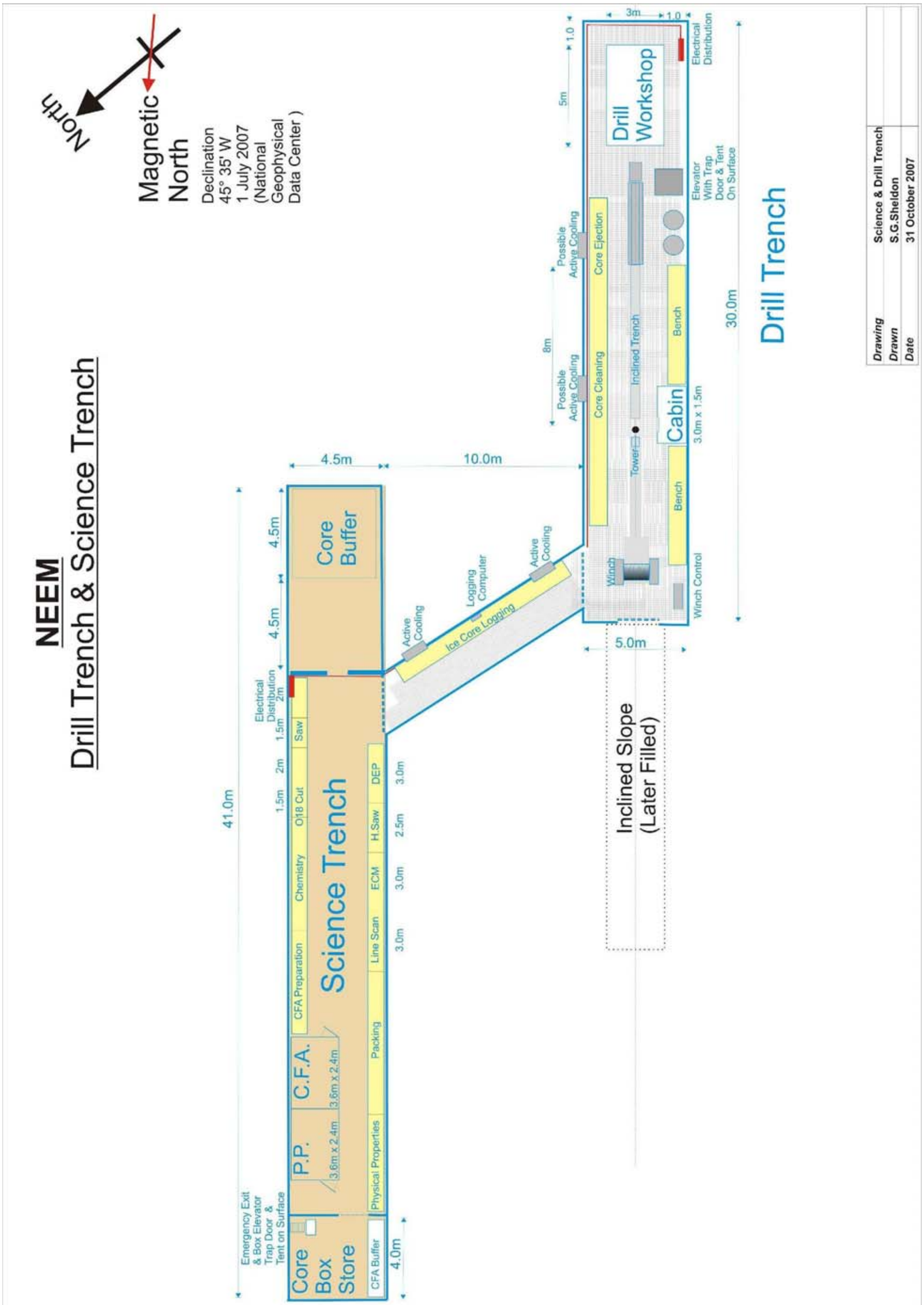
Maps of the NEEM camp area and layout.

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


NEEM - Loading Apron & Camp Layout
True North
Magnetic North
Declination
45° 35' W
1 July 2007
(National
Geophysical
Data Center)
Prevailing Wind
(Coming from 130 degrees
True North)
300ft
(91.4m)
450ft
(137m)
100m
Estimated
Ice Divide
100ft
(30.84m)
7.5ft (2.29m)
15ft (4.57m)
15ft (4.57m)
Drawn
S.G.Sheldon
Scale
Date
21 May 2007



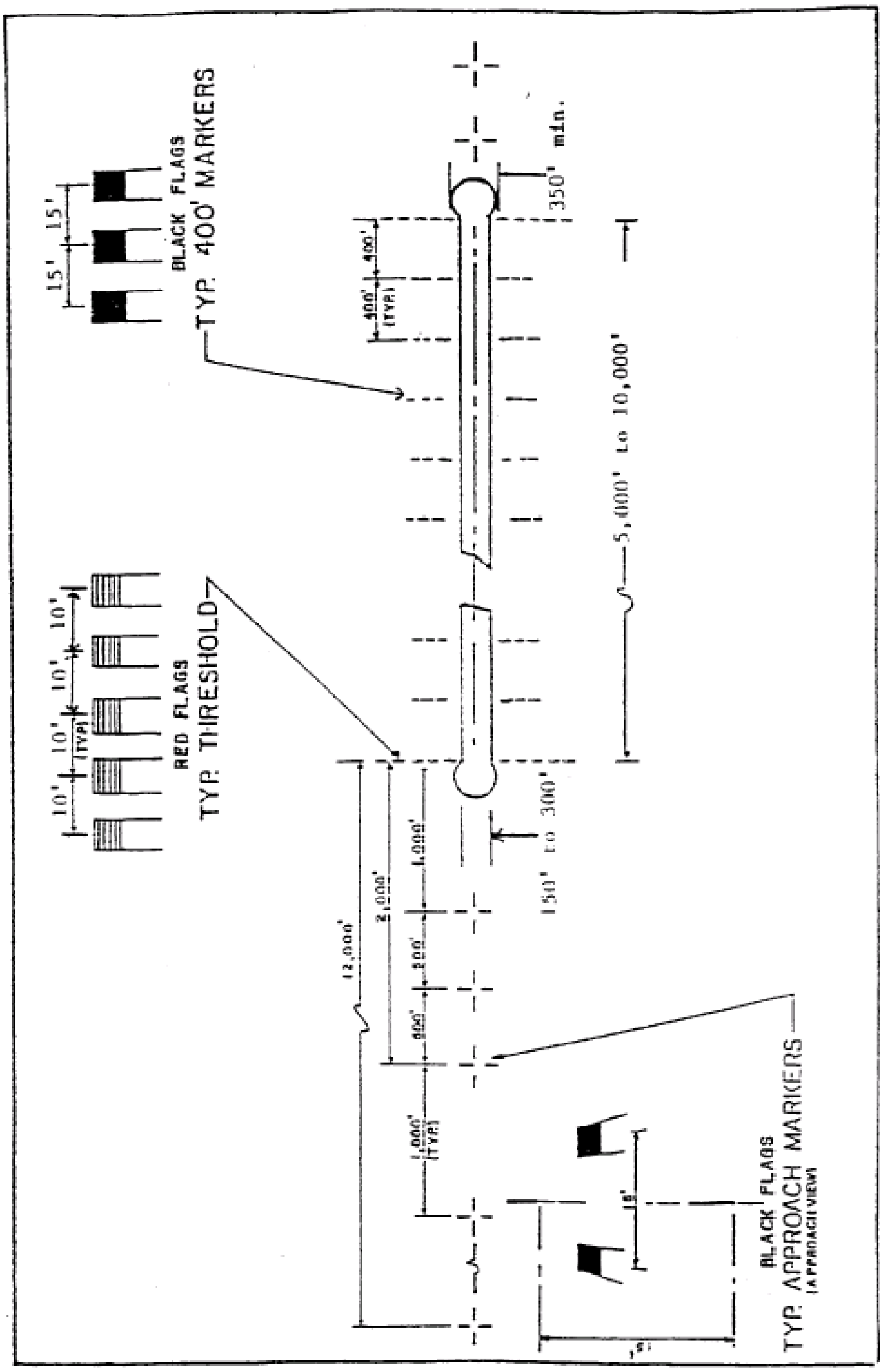
NEEM - Camp Layout
Scale 1:500
Version 2.1
True North
Magnetic North
Declination 45° 35' W 1 July 2007 (National Geophysical Data Center)
Ski Way Apron
10KW
5G6
Red Dome 2
6KW
Red Dome 1
6KW
Prevailing Wind
(130 degrees from True North)
FuelTank
Camp Generator
1 Ski Way Apron & Red Domes 1 & 2 (5G6)
2 Science Trench (5G10)
3 Drill Trench - non-Winch (5G10)
4 Drill Trench - Winch (5G10)
5 Main Dome - non-Kitchen (5G10)
6 Main Dome - Kitchen (5G10)
7 Garage 1, Weather Ports 1,2,3, & Tomatoes (5G10)
8 Garage 2, Weather Ports 4,5,6, & 7 (5G10)
3KW
WP 6
WP 5
WP 4
WP 3
WP 2
WP 1
Garage 2
Garage 1
8KW (20KW)
2 x 5G10
2 x cat 5 LAN
75m
2 x cat 5 LAN
3 x 5G10
Radio Antenna & Clean Snow Area
Main Dome
Off Limits Clean Snow Area
Off Limits Clean Snow Area
15KW (32KW)
Core Buffer
Science Trench
2 x 15KW (2 x 32KW)
Site GPS Reference
Ice Divide
Inclined Slope (Later Filled)
Drill Workshop
Drill Trench
Drawn S.G.Sheldon
Scale 500:1
Date 29 Feb 2008


NEEM
Drill Trench & Science Trench
North
Magnetic North
Declination
45° 35' W
1 July 2007
(National
Geophysical
Data Center)
Drill Trench
Drill Workshop
Electrical Distribution
Elevator With Trap Door & Tent On Surface
Core Ejection
Possible Active Cooling
Core Cleaning
Inclined Trench
Bench
Cabin
3.0m x 1.5m
Tower
Winch
Winch Control
30.0m
3m
1.0
5m
8m
10.0m
4.5m
5.0m
Inclined Slope
(Later Filled)
Active Cooling
Logging Computer
Ice Core Logging
Core Buffer
Science Trench
Electrical Distribution
Saw
O18 Cut
Chemistry
CFA Preparation
C.F.A.
3.6m x 2.4m
P.P.
3.6m x 2.4m
Physical Properties
Packing
Line Scan
ECM
H.Saw
DEP
Core Box Store
CFA Buffer
Emergency Exit & Box Elevator Trap Door & Tent on Surface
41.0m
4.0m
1.5m
2m
3.0m
2.5m
Drawing Science & Drill Trench
Drawn S.G.Sheldon
Date 31 October 2007

Skiway Marking

NEEM ski way is 200’ x 10.000’ (Feet)

109 AG Regulation 86-1 .ttachment 1, 1 May 1993

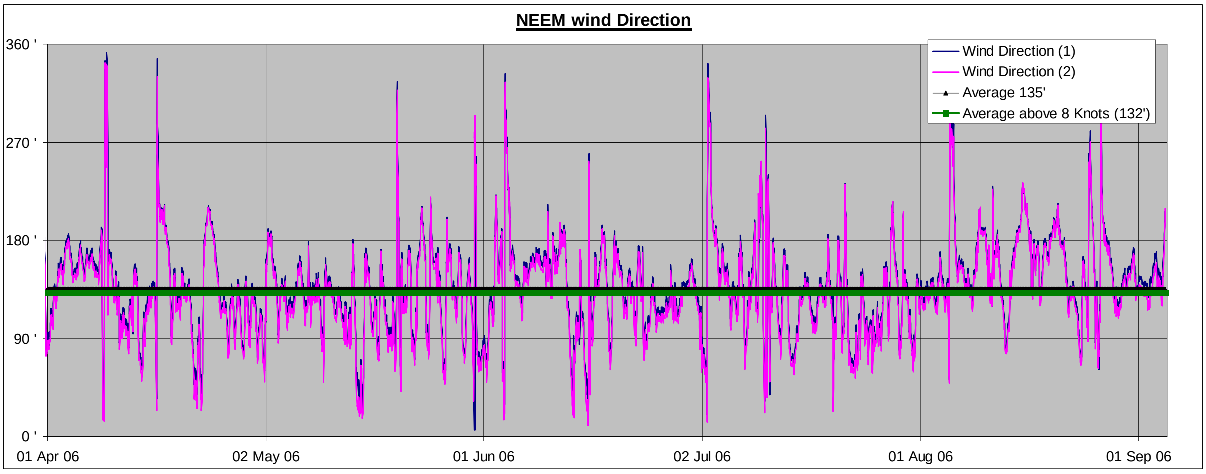


PERMANENT SKIWAY MARKING

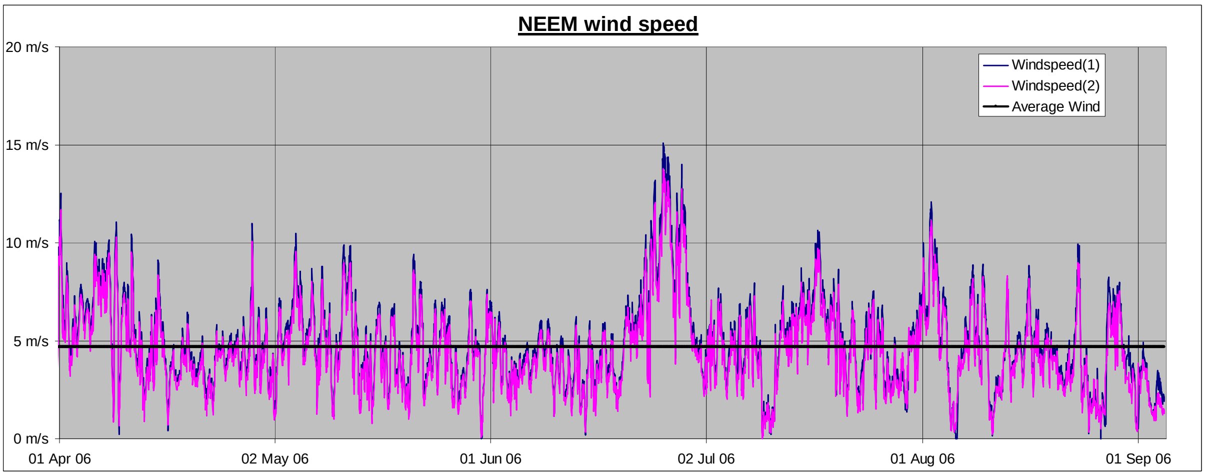
NEEM Site Weather Conditions

During the summer of 2006 Dr. Konrad Stefan (Uni. Boulder, US) set up a weather station at the proposed NEEM site from1 April 2006 to 6 September 2006

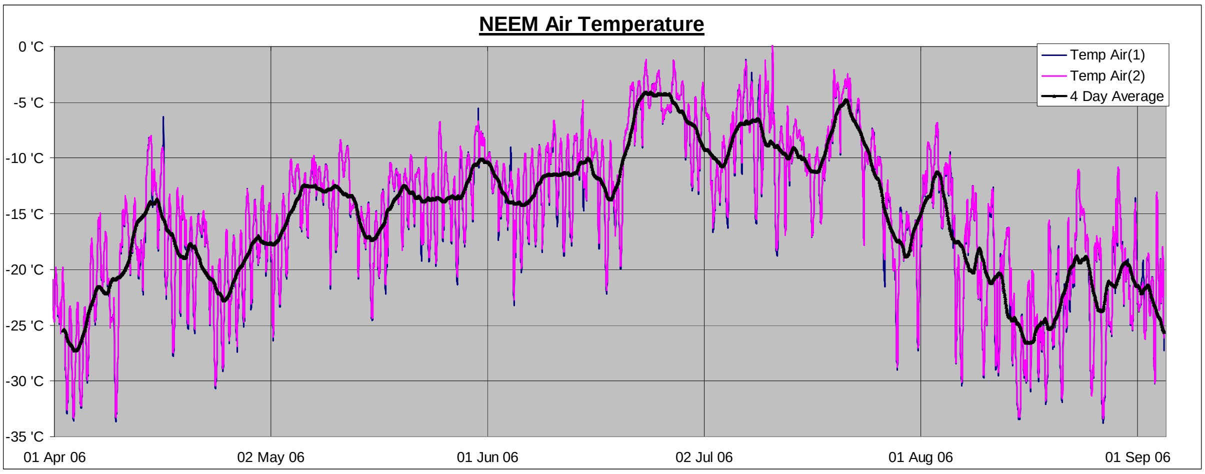
Average Wind direction	= 135 degrees (True North)	
Average Wind direction (Over 8 knots)	= 132 degrees (True North)	
Average Wind Speed	= 4.7 m/s	(9.1 knots)
Maximum Wind Speed (26 June 06)	= 15.1 m/s	(29.3 knots)
Maximum Temperature (11 July 06)	= +0.35'C	(32.63'F)
Minimum Temperature (27 August 06)	= -33.75'C	(-28.75'F)



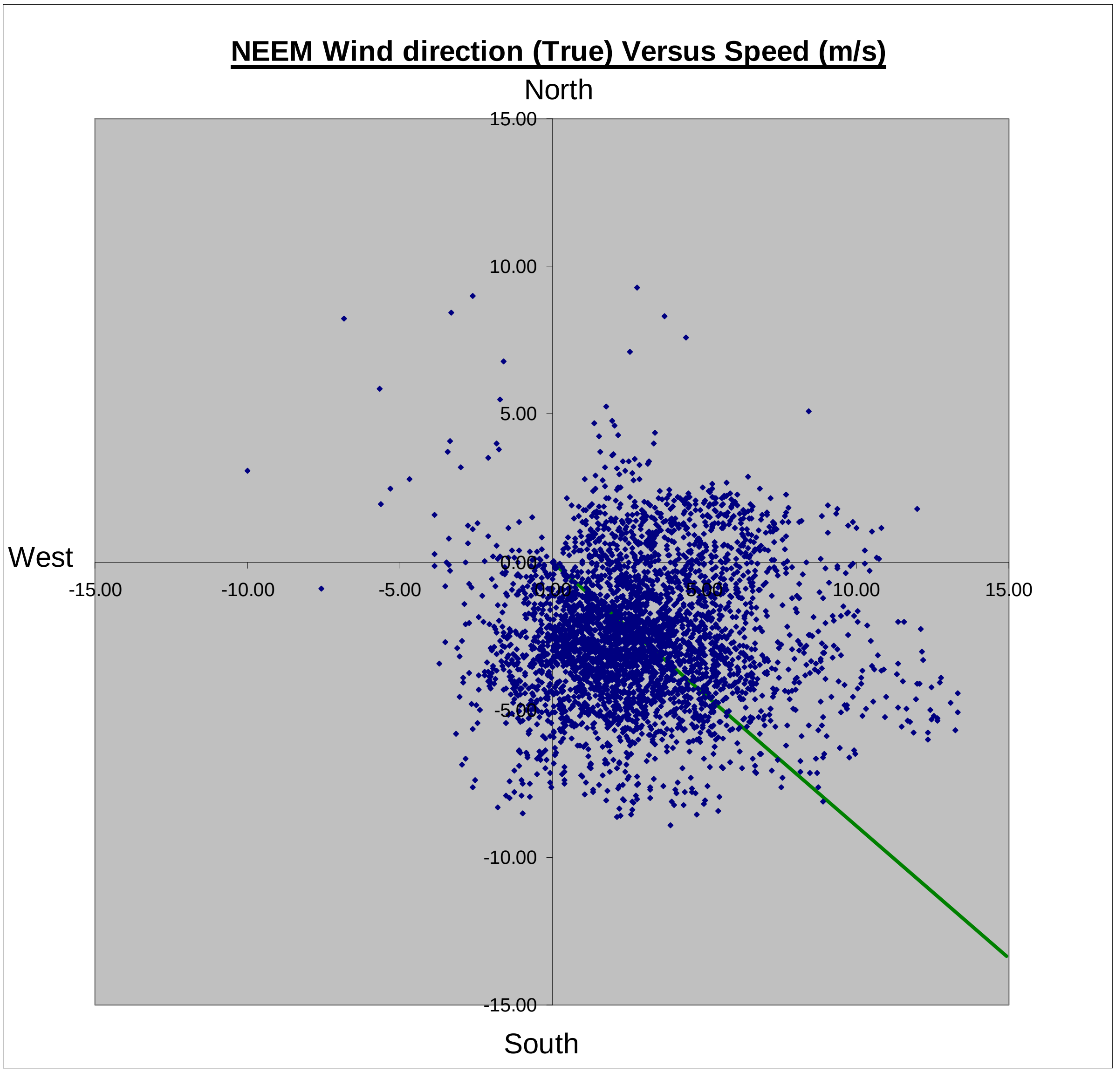
Wind direction to true North. Summer average (black) wind direction 135'. Average above 8 knots (green), 132'.



Wind speed in m/s (just double for approximate figure in knots). Average 4.7m/s (9.4 knots).

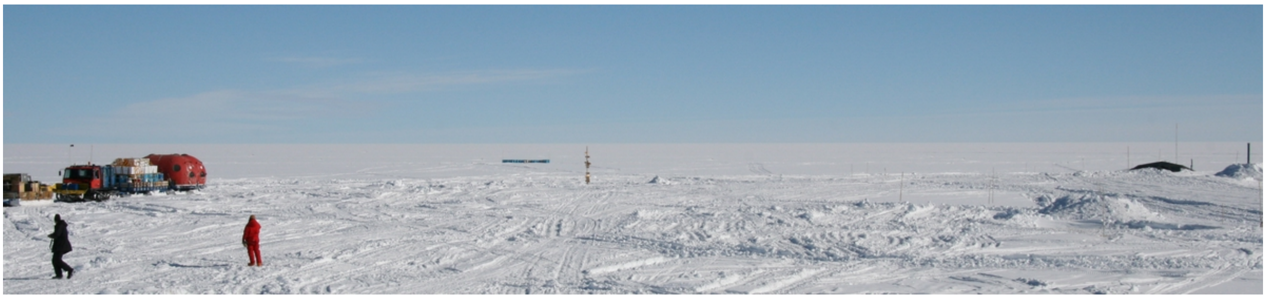


Air temperature in 'C. And 4 day average (black).



Status of the Closed NGRIP Camp

The camp was closed in 2004. The only buildings left are the Main Dome and theLucht Kastel. The camp was revisited in 2007, where access through the top window of the main dome was still possible.



NGRIP,July 2007, View from Lucht Castel. Main dome and hole casing to the right ,32 drum fuel depot on old apron in background

Main Dome (75.0977N, 42.3195W):
Only accessable through top window. Anything useful should be removed by the traverse team

The Lucht Kastel (75.0991N, 42.3208W): The Lucht Kastel now contains: The CAT 931 LGP, two yellow Alpine snowmobiles, fuel station, tools and spare parts and Shelves. Everything should be removed by the traverse

Tthe Lucht Kastel. Middle just before closing in 2007..

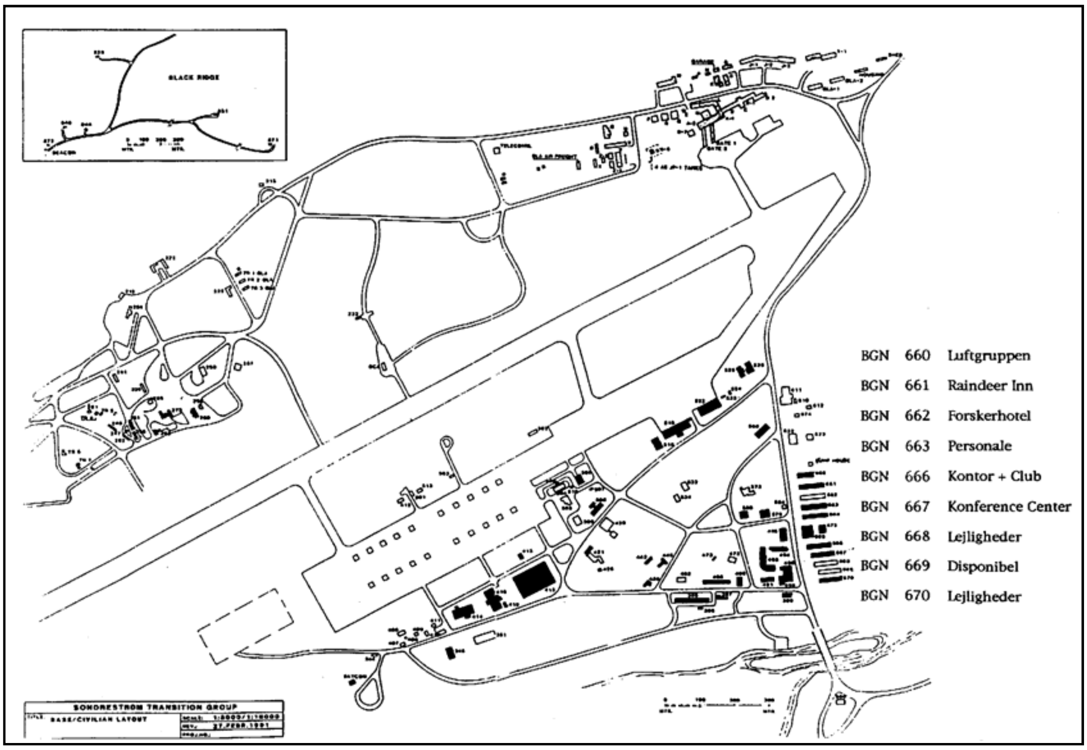
The NGRIP2 Deep Borehole (75.0970N, 42.3196W): The casing has been extended and runs roughly 5 m above the snow.

The NGRIP fuel depot (75.094923N; 42.312703W): The 32 drum depot is set up as two rows of drums on the old apron at NGRIP.

Kangerlussuaq and Surrounding Area

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

The population is approximately 550 including many kids. The terminal area is composed of several companies: Met office, Flight control, SAS, Local supermarket, Some souvenir shops, a road side grill, Air Greenland and Statoil. The terminal side includes private housing, a combination of SAS terminal and Hotel Kangerlussuaq, which also houses the GLAIR offices and pay phones. There are also buildings to the west of the SAS terminal which house the Administration and Spedition (where outgoing and incoming cargo between Denmark and points in Greenland can be sent and received). The Greenlandic Post Office is located next to the local supermarket.



Weather: The climate is continental and quite xeric with an annual precipitation averaging 120mm.; winter temperatures reaches down to -50°C and the summer temperature increases to above +20°C. In project planning for fieldwork in or around Kangerlussuaq, it is always best to prepare for the worst. The weather in Kangerlussuaq can be cold in May, and snow is always a possibility. June, July and August are normally fairly temperate with temperatures ranging from 5-21^{o}C. Rain is common in these months, and given the right conditions, it can still be quite cool.

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

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

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

In Kangerlussuaq you can buy regular, canned or freeze-dried foods, fuels (jet fuel/kerosene, gasoline, and field stove alcohol). There is also a post office, an airport hotel with restaurant and cafeteria, a gym centre with swimming pool, a tennis-, badminton-, racket ball- and soft ball court, a golf course, a rowing club, a non-scientific library, - and also a small museum with exhibitions about the history of Kangerlussuaq. Check **www.greenland-guide.gl** for information.

There are a number of alternative dining and drinking establishments in Kangerlussuaq. The Roklub at Lake Ferguson offers informal dinners at reasonable prices although the quality is varying. Dining is available at the SAS terminal. There is a cafeteria where the price of a typical meal is DK Kr 65. The restaurant can be used for formal dinners, and the prices are reasonable.

BASE FOR SCIENCE

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

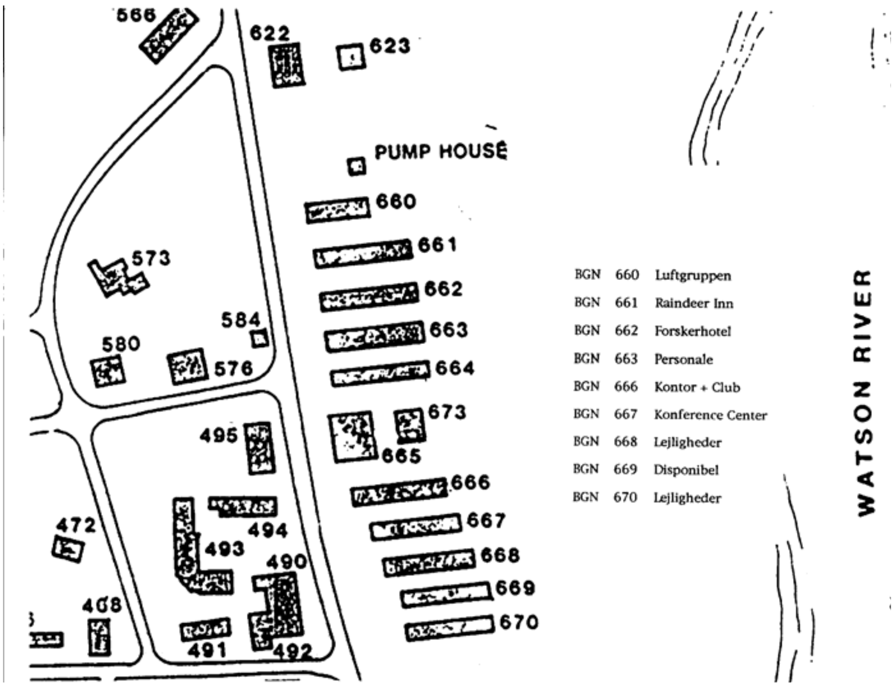
The Kangerlussuaq region is within the low Arctic eco zone with diverse habitats like salt lakes, dune systems, mountain tundra and steppes with caribou and musk ox populations etc. Caribou are indigenous but muskoxen were introduced from Northeast Greenland thirty years ago.

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

The Kangerlussuaq region is a well exposed high grade basement terrain forming the southern border zone of the Nagssugtoqidian orogen. The region has a glacial landscape dating back 8,000 years.

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

The KISS (Kangerlussuaq International Science Support) facility
Scientists and students who plan to work in Greenland now have new and improved facilities available in Kangerlussuaq. KISS offers an array of modern facilities and possibilities to rent equipment and goods for use in the field or at the labs of the KISS building.



KISS (bldg. 662 in the map) is owned by the Home Rule Government and operated by the Kangerlussuaq Airport Management. The use of KISS is reserved exclusively for researchers and research projects registered by the Danish Polar Centre after submission of project plans.

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

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

BE AWARE THAT.......

- Thule AB is UTC-4(DT-3). DT from 0600 UTC first Sunday in Apr to 0500 UTC last Sunday Oct.
- operating hours are as follows:

ATC: Mon thru Fri 0800 -1600
Base Ops: Mon thru Friday 0800- 1600.
Services: Mon thru Friday 0800- 1600

- The Airport is closed on Saturdays, Sundays and US holidays.
- Moving of aircraft, start- up of APU/GTC, or engine -runs will be coordinated through Base Ops

STORM ALERT CONDITION: Severe weather is forecasted.
Take all necessary preparatory action, tie down loose equipment, check emergency rations, pass the word to all personnel.

STORM ONE CONDITION:

Alerted for possible Storm Two or Three. Pedestrian traffic LAW the Buddy System only.

STORM TWO CONDITION:

Return to your living quarters. No pedestrian traffic allowed. Dining Hall and community facilities closed. Critical functions continue limited operation as approved by Crisis Action Center (CAC).

STORM THREE CONDITION:

Remain where you are. Required emergency or rescue traffic only, as approved by CAC.

Useful Telephone numbers at Thule AB, Duty/Home

Commander	2311/2311	Hangar #8	2695
Operations Officer	2750/275	Hangar #9	2304
Flightline Superintendent	2503/2149	Hangar #10	2712
Air Terminal Supervisor	3227/3227	Security Police Desk Sgt.	3234
Transient Alert Supervisor	2356/2167	Message Center	3344
Base Operations Dispatch	2717	TOW Club Paging/Taxi	2418
Passenger Service	2155	Club Reservations	3118
AMC Traffic Control	2455	Weather Forecast	2395
Fuels Management	2553	Service Call	2111
Crew Transport	3284	Hospital Ward	2877
Flightline Standby	3284	Crisis Action Center	2763
Taxi (Free)	2022	Telephone Information	113
Base Housing	3276	Inflight Lunches (3 hrs notice)	2101
Base Operator	0	Fire Reporting and Ambulance	117

Hours of operation

Dining Hall	**Ext. 2614**
Breakfast	0500-0800
Lunch	1100-1300
Dinner	1700-1900

TOW Club (Dining Room)	**Ext. 3118**
Monday	Closed
Tue-Friday	1800-2100
Saturday	1900-2200

Community Activity Center	**Ext. 3171**
Mon-Tue & Thursday	1500-2100
Friday	1500-2200
Sat & Sunday	1300-2200

Hobby Shop	**Ext.2228**
Mon, Thurs & Friday	1600-2100
Tue-Wednesday	Closed
Sat & Sunday	1200-2000

Bowling Center	**Ext. 2435**
Mon & Wednesday	Closed
Tue & Thursday	1700-2200
Friday	1300-2300
Saturday	1200-2300
Sunday	1200-2100

Base Exchange (BX)	
Mon thru Friday	1030-1330
	1600-2000
Saturday	1000-1600

Base Gym	**Ext. 2519**
Mon thru Friday	1000-2200
Sat & Sunday	1000-1900

TOW Club (Casual Lounge)	**Ext. 2418**
Monday	Closed
Tue thru Thursday	1100-2300
Friday & Saturday	1100-0200

Other useful information for Thule Passengers

There are only a few civilian phones in Thule. If you want to phone out of Thule, there is a pay phone at North Star Inn. Remember to bring Danish Currency! The normal currency in Thule is US$, but for letters going to Denmark/EU and phones you will need Danish currency.

We, NEEM Operations, have no representation in Thule. If a NEEM operated plane have to land at Thule, our contact person is the DPI, Insp. John H. Hansen.

Phone Contacts can be made to the following phone numbers:

DLO	+299 97 65 26
DLO, fax	+299 97 67 26
DLO, Email	fotab@greennet.gl
Danish Spedition, phone	+299 97 66 69 or Ext. 2704
Danish Spedition, Mobile	+299 594495
Danish Spedition, Fax	+299 97 65 74
Danish Spedition, Email	kin@tele.gl
Warehouse 628	+299 97 66 06 Ext. 3643
Housing	+299 97 66 06 Ext.
North Star Inn/Billeting	+299 97 65 06 ext. 2272 / 3276
Air Greenland	+299 97 65 77 or Ext 3340
DK Police	+299 97 65 22 or Ext. 2406
DK Police cell	+299 594122
DK Police, Fax	+299 97 65 00

Cargo shipments to Greenland

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

Cargo to Kangerlussuaq should be labelled:

NEEM Operations 2008
Box 12
DK-3910 Kangerlussuaq
Phone +299 841151. Fax +299 84 12 27
Greenland

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

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

Additional information and labeling
Non Freeze
Hold in Kangerlussuaq
Hazardous Material

Information on shipments and **Air Way Bill # (AWB)** should be emailed to:
neem-fom@gfy.ku.dk

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

SHIPPING DEADLINES
Cargo for NEEM May 5 - May 12, Must **arrive** Kangerlussuaq(SFJ) latest **APRIL 25.**
Cargo for NEEM May 29 - June 3, Must **arrive** Kangerlussuaq(SFJ) latest **MAY 23.**
Cargo for NEEM June 23, Must **arrive** Kangerlussuaq(SFJ) latest **JUNE 13.**
Cargo for NEEM July 8, Must **arrive** Kangerlussuaq(SFJ) latest **JUNE 27.**
Cargo for NEEM July 22 - July 31, Must **arrive** Kangerlussuaq(SFJ) latest **JULY 11.**
Cargo for NEEM August 18, Must **arrive** Kangerlussuaq(SFJ) latest **AUGUST 8.**

Shipping to NEEM from the United States/Canada:

CPS POLAR FIELD SERVICES Polar Resources and the NEEM FOM must be notified of all cargo shipments, including commercial air in order to arrange for the receipt and transportation of cargo to the appropriate location in Greenland.

PLEASE NOTE: Be sure to mark your cargo with "NEEM 2008" to avoid your cargo ending up at Summit!

CPS POLAR FIELD SERVICES contacts: Robin Abbott (robin@polarfield.com) and Earl Vaughn (Earl.Vaughn@gmail.com)

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

Below are the instructions provided to us by CPS Polar Field Services.

CUSTOMS INFORMATION - 2008

A Certificate of Registration (form CBP-4455) is required when shipping your cargo to Greenland via the 109th Air Guard. You can access these forms on-line so please follow the directions below.

STEP 1:

Go to US Customs & Border Protection website: <
http://www.cbp.gov/xp/cgov/toolbox/forms/ >
Scroll down to "CBP form 4455" and open it up.

You can then fill out the form on line and print. You will need 4 copies.

Information to include in the following blocks:

Carrier:	**-** 109 Air National Guard
Date:	**-** current date
Name, address and zip code:	- 'you' the shipper
Articles exported for:	**-** science use in Greenland
Number packages:	- whatever the number (must be identifiable on each item) *You do not need to certify personal clothing or food*
Kind of packages:	**-** hardigs, steel boxes, aluminum poles, wooden crate, whatever?
Description:	**-** type in: "**see following (#) pages"** and attach your packing list to each 4455 Form. The numbered boxes should correspond to the shipping information. - The customs agent will inspect the contents of all or some of your boxes and check your corresponding packing list for accuracy
Sign and date	

STEP 2 **:**

Call your local Customs and Border Protection Office (airports, harbors) and ask them to inspect and certify your cargo for shipment to Greenland. They will then schedule a time to look at your freight. After they do so, they will sign the Certificate of Registration form that you filled out and stamp all the copies of your registration and packing list. They will then keep a copy, and you should then include one copy along with your cargo, send one copy to Earl Vaughn, and keep one for yourself. Your cargo is then ready to ship to Scotia. **If you cannot get the cargo inspected and Registration signed at your location, then send the four completed and signed documents to the address below and the inspection will then take place in Scotia. Your cargo MUST arrive 2-3 week prior to your scheduled flight.**

The Certificate of Registration and packing lists will be all you will need to bring the cargo back into the country through any airport or terminal.

You also might consider filling out the CBP 4457 for your personal gear. It will also need to be inspected and paperwork stamped. It will eliminate any questions or problems with your gear or expensive equipment such as computers, electronic gadgets, etc. These two forms act like a visa for your equipment. It also eliminates the need for filing electronic Shipper's Declaration for equipment. If you have any questions please call or write Earl Vaughn (info below).

Earl Vaughn
VPR Scotia Bldg. 20
1 Air National Guard Rd.
Scotia New York 12302
518-331-3103

Earl.Vaughn@gmail.com

Address of the 109th:

109th Airlift Group
New York Air National Guard
Stratton Air National Guard Base
Scotia, New York 12302-9752

Ship connections to Kangerlussuaq (2008):

Ship 1: Cargo in Aalborg May 31 to June 7
depart AAL June 10,
arrive SFJ June 19.

Ship 2: Cargo in Aalborg July 21 to July 28
depart AAL Sept 2.
arrive SFJ Sept. 15.

NEEM Drilling Liquid Properties

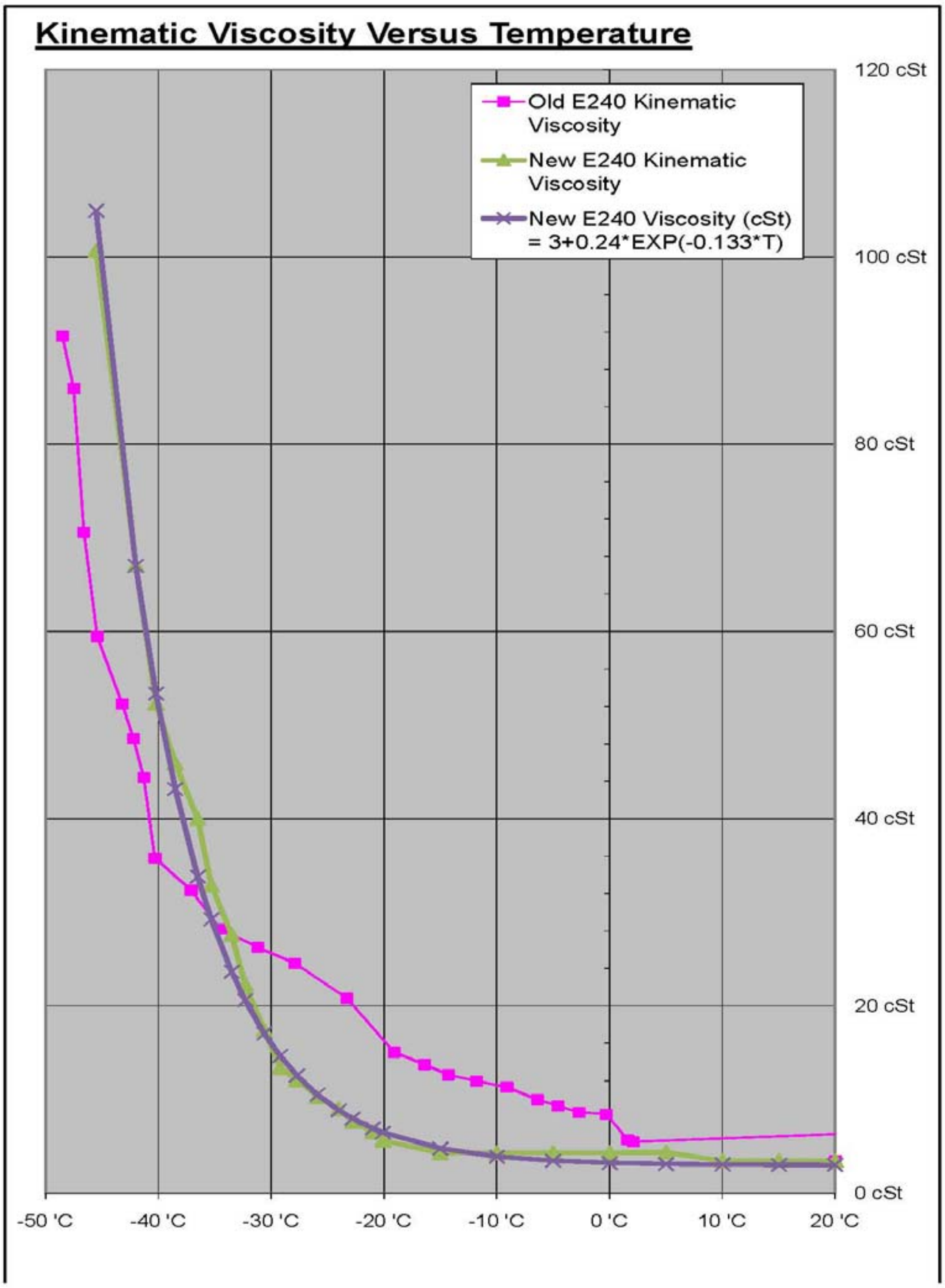
A new drilling liquid has been developed for NEEM based on ESTISOL 240 (coconut oil extract) mixed with COASOL. This liquid is non-polar, non-hazardous, no explosive risk, 'healthy', has a low environmental impact, and is available. BUT is twice the price of D-40/HCFC-141b and has 5 times the viscosity at -30'C.

TABLE .	**COASOL**	**ESTISOL 240**
Manufacturer	DOW	DOW
Melting point	< - 60 ^oC	< -50 ^oC
Boiling point	274 - 289 ^oC	255 - 290 ^oC
Flash point	131 ^oC	136 ^oC
Explosive limit	0.6 – 4.7 % (vol)	None
Vapour pressure (20^{o}C)	0.004 kPa	
Density (20^{o}C)	960 kg/m^3	863 kg/m^3
Density (-30^{o}C)	995 kg/m^3	898 kg/m^3
Viscosity (20^{o}C)	5.3 cSt	3 cSt
Viscosity (-30^{o}C)	25 cSt	13 cSt
Auto ignition temperature	400 ^oC	None
Bio-degradable	Yes	Yes
Fire fighting equipment	Water spray, foam, CO^2	Water spray, CO^2, foam, dry chemical
Special protection	No	No
Hazardous material	No	No
Explosive risk	None	None
Max. Workplace air levels	None	None
Price US$ equiv. in Kg	5.50 $/Kg	4.60 $/Kg

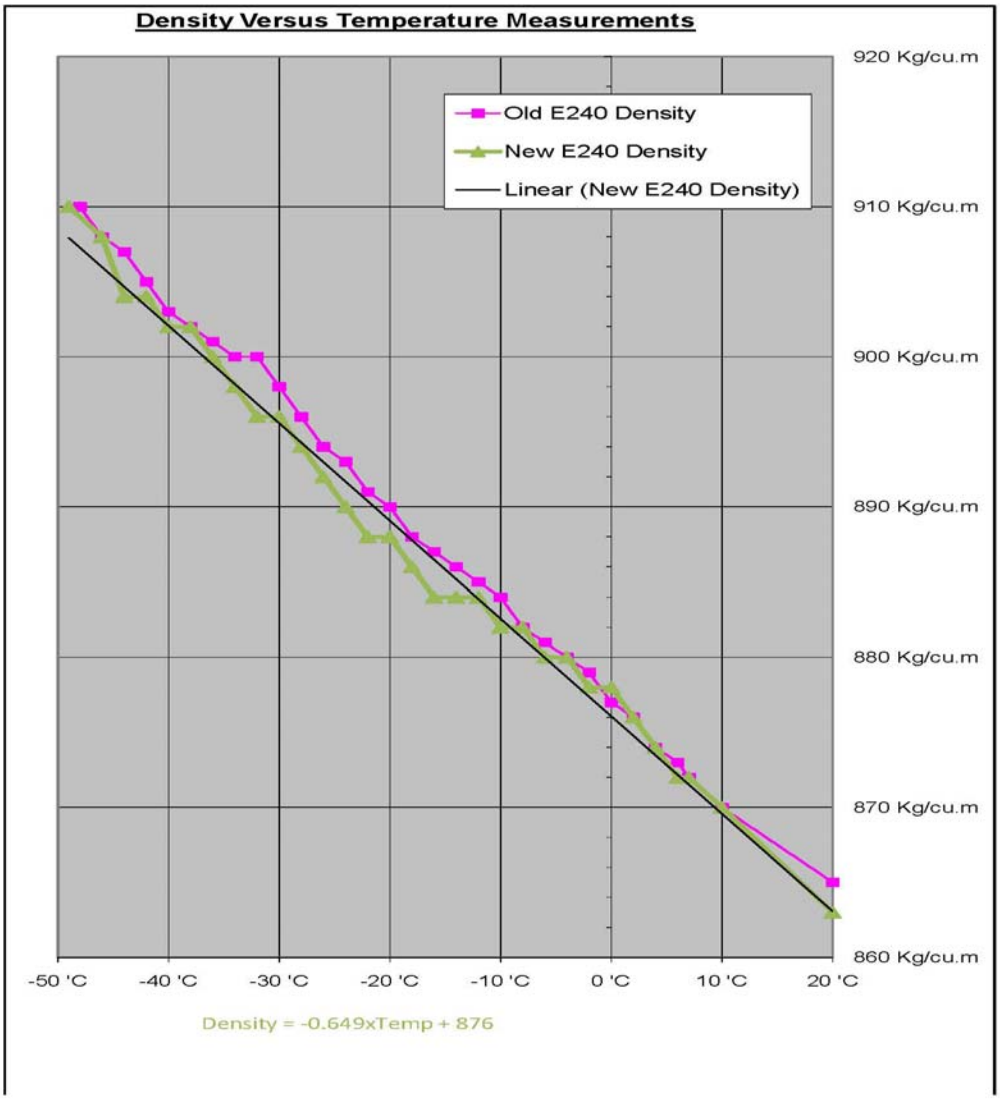
Data on ESTISOL 240, 256, EGDA, & COASOL are from safety tests according to EU Safety 91/155/EU, article 204020, 203989, 205698 & 204872 respectively

ESTISOL 240 was field tested as a drilling liquid at Flade Isblink, Greenland 2006 with a 4" diameter ice core drilled using the Hans Tausen electro-mechanical drill to a depth of 423.30m (260m of this core using the new liquid). The ice core quality was 'good', no problems encountered cleaning and processing the ice core, the mixture has a slippery feel with no discernable odour, and the liquid is very slippery when spilt on the smooth wooden flooring. The Hans Tausen drill descents at speeds of 0.95m/s at drill liquid temperatures of -16 deg. C. By increasing the borehole diameter by 4mm (to 134mm) a 36% descent speed increase was achieved (1.28m/s). Further improvements can be achieved by adding a dead weight, reducing the pressure chamber diameter, or reducing the pressure chamber length.

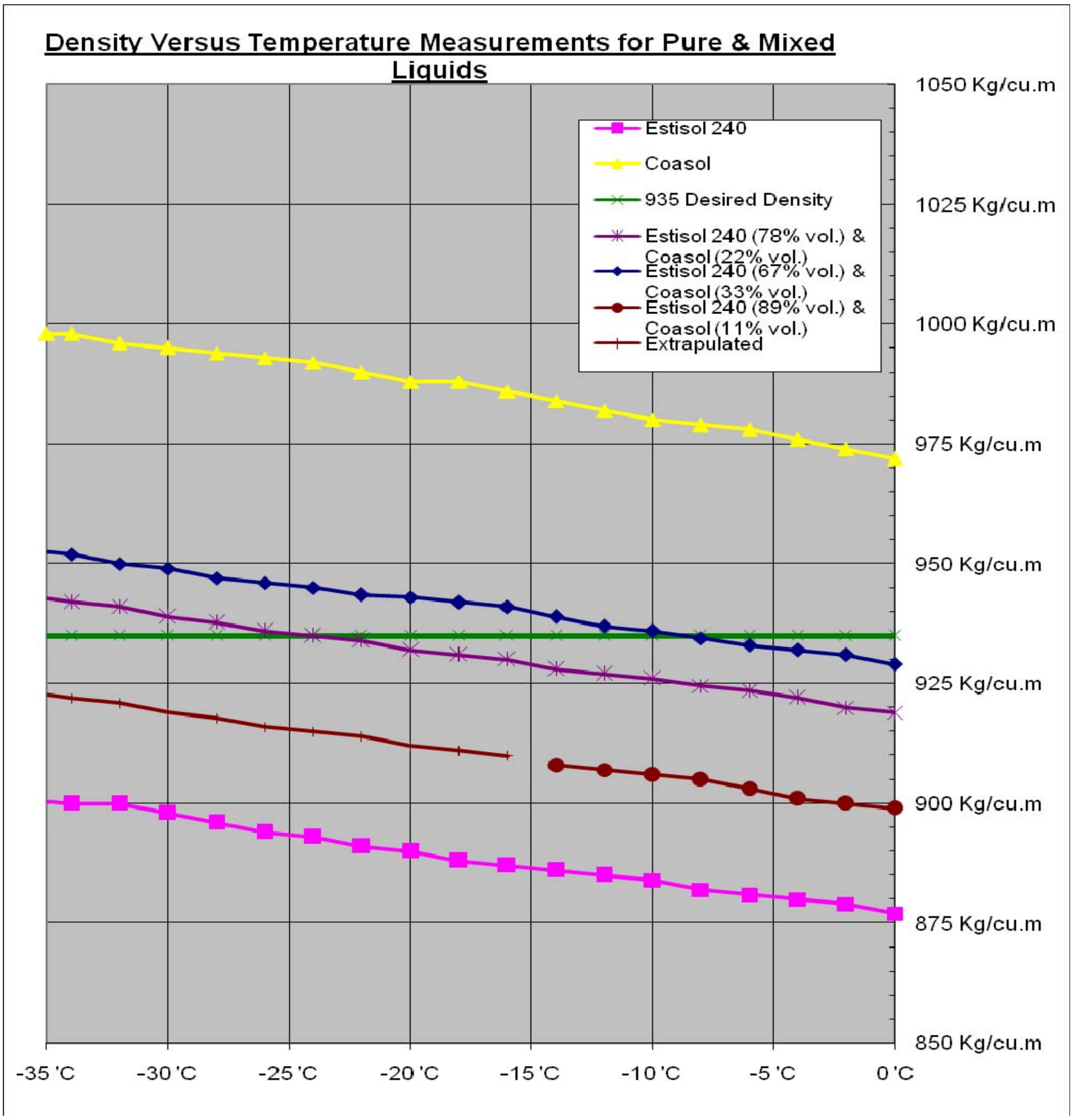
The mix proportions for the first 1000m are expected to be approximately,
4 litre ESTISOL 1 litre COASOL



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

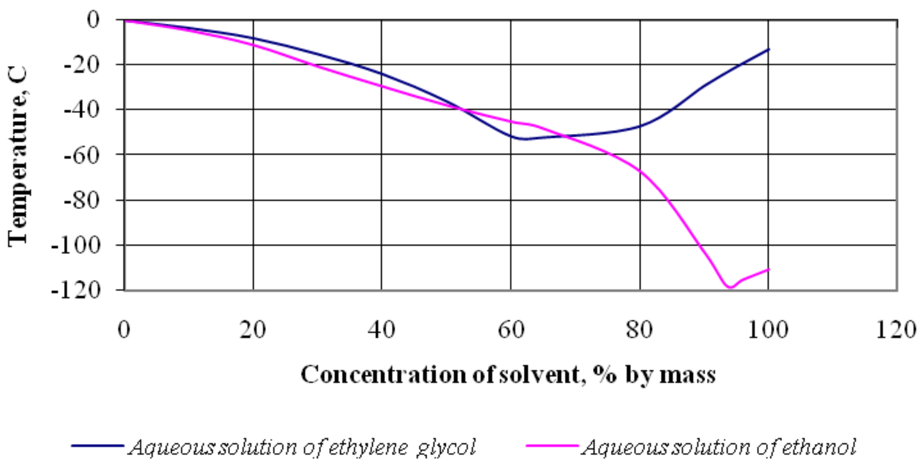


As seen above, the densities of new and old Estisol 240 are comparable.



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

Fig. 1. Freezing points of alcohol aqueous solutions



Shipping boxes

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

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

order nr	Internal dimens (L*W*H)	Outside dimens	Weight
40678	550*350*310	600*400*340	5,0
40564	550*350*380	600*400*410	5,3
40565	750*550*380	800*600*410	10,0
40566	750*550*580	800*600*610	12,0
40580	1150*750*480	1200*800*510	20,0

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

For NEEM operations proposes, whenever possible, all participants use these or compatible boxes for their cargo. In order to be compatible, a box should have the same outside dimensions, and the same type of inter-box locking mechanism. The boxes should be equipped with handles.

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

Flight and cargo considerations 2008.

We have planned for 23 LC-130 missions this year. In our cargo schedule we have planned for an average load per flight of 19,000 lbs. It is our hope that with a good skiway and good refuelling possibilities we may negotiate a slightly higher payload with the pilots. However, as the schedule now looks, we have to ask all participants to be aware of the importance of keeping weights low.

Typical specifications for LC-130 and Twin Otter:

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

De Havilland DHC-6, Twin Otter:

Weight empty [kg]	3456
Max take off weight [kg]	5682
Weight of ski	250
Empty weight with ski	3706
Max load [kg]	1976
Fuel consumption(330l/hr) [kg/hr]	270
Speed without ski(135 kn) [km/hr]	250
Speed with ski (125 kn) [km/hr]	230
Max range [km]	556
Max altitude [ft]	30,000
With pax	10,000
Fuel load [kg]	1100

Loading data:	
Cargo hatch [m]	2.0*1.9
Cargo compartment	
Length, incl rear cabin etc [m]	8.1
Width 1,1m, max	1.2
Hight 1,3m, max	1.4
Pay load	
Normal with full fuel load [kg]	990
Maximum	1260

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

5.5m long, it must not be more than 0.2m thick
4.0m long, it must not be more than 0.35m thick
2.5m long, it must not be more than 0.65m thick
1.3m long, it must not be more than 0.12m thick

Typical LC-130 specifications: (all specs for info only, depends on aircraft etc)

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

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

Useful data

Standard containers

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

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

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

1 feet =	0.3048 m
1 lbs =	0.4536 kg
1 US gallon =	3.7854 l

Max dimension of cabin luggage:	55*40*23 cm, 8 kg
Density of Jet A1	805 kg/m^3
Density of mogas	720 kg/m^3
200 l drum of JET A1 or D60	178 kg
Empty standard drum	15 kg

Firn density for stop of water flow: 720 kg/m^3

CINA equation for the relation between pressure and altitude:

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

where p_o=1013,25mb, 288K standard air temperature at sea level (15 ^oC) and 6.5*10^{-3} the standard lapse rate in the troposphere [^oC/m]. Use this equation to obtain the sea level pressure when the altitude is known, i.e. for aviation weather reports.

Chill temperature:

This is the formula used for calculating wind-chill-temperatures:

$$t_{Chill}[^0C] = \left(\frac{10.45 + 10\sqrt{v} - v}{22.034} \right) \cdot (t - 33) + 33[^0C; m/s]$$

Current capability of electrical cables:

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

Connections to 5-conductor cable:

Yellow/green:	Protective ground
Black	L1
Blue	N
Brown	L2
Black	L3

Attenuation of coaxial cables:

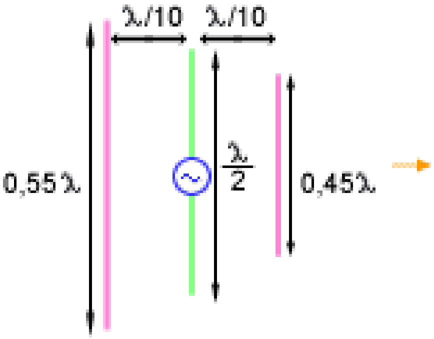
RG58/U attenuation per 30m:

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

RG213/U attenuation per 30m:

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

HF Radio Yagi-Uda Antenna:



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

Reflector element
Driver element
Director element

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

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

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

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

Coordination of LC-130 in Kangerlussuaq

Proposal regarding the coordination of GISP/NEEM and 109'th TAG activities in Sonde.

This proposal is written to make the field coordination between GISP, NEEM and 109'th TAG as smooth and easy as possible by ensuring efficient ways of exchanging first hand information between the responsible Field Operations Managers (FOM's) for GISP and NEEM and 109'th TAG personnel during periods with flights for the GISP and NEEMS programmes.

Copies of this paper should be given to each Mission Commander and the mission crew should be briefed on the contents before departure to Greenland. This will ensure that the FOM's and the 109'th personnel will operate along the same outlines throughout the field season.

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

Flight period:

After arrival of 109'th to Sonde a meeting should be held between 109'th MC, 109'th cargo responsible and the FOM's of GISP and NEEM. Both FOM's need to be there since the U.S. GISP programme and the European NGRIP programme are financially independent and each FOM carry the financial responsibility regarding 109'th operations. At this meeting the FOM's will provide information on:

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

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

Day to day operations:

The FOM's will make sure that all cargo is palletized and strapped down. In cases of doubt the FOM's will consult the ground crew regarding palletization. The FOM's will always consult the ground crew when married pallets are being built and when a load vehicle is needed. In case scales are available the FOM's will also determine the weight of the pallets. The FOM's will indicate to the ground crew which pallets are going on each flight and will inform if any hazardous cargo is palletized. Normally, transportation of pallets from the staging area to the planes and vice versa will be handled by the ground crew using the GRIP forklift or other load vehicles. However, the FOM's will assist in the on- and off-loading of aircraft whenever needed using the GRIP forklift.

Cargo manifests will be prepared by each FOM office and delivered to Ravens operations latest 1700 on the day before departure. In case of last minute changes (e.g. changes in passengers) the changes to the manifests will be passed on to Ravens operations the latest 0730 on the day of departure. This will of course not be applicable to early morning and night missions. The FOM's will get aviation weather observations from the field camps on an half hourly basis, starting at least 2 hours prior to scheduled departure.

Since each FOM is economical responsible to his/her programme, the flight crew will request a clearance to go from the FOM just before brake release prior to take-off. In case the FOM has not been present at plane departure, the flight crew will call the appropriate FOM office (either CPS SONDE or GOC SONDE) by radio HF 8.093 MHz of VHF 122.8 MHz to obtain clearance to go.

During missions 8.093 MHz, Iridium phone and BGAN phone will be monitored for updates on weather and mission progress from plane crews and field camps. NOTE: Both camps and FOM offices will have phone lines open 24 hours a day. The FOM offices will relay information on mission progress to Ravens OPS.

End of flight period:

Before departure of the 109'th to the U.S. or, when there is a change of MC, a meeting should be held between the 109'th and the GISP and NEEM FOM's in order to obtain an update of the flight records for both GISP and NEEM.

AVIATION WEATHER REPORTS

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

1. Time [local, here Sonde hours], use 24 hour format.
2. Ceiling [100 feet], estimated or observed %, [scattered, broken, overcast]
3. Visibility [nautical miles or fractions their off]
4. Temperature (Celsius). State centigrade.
5. Wind, Direction and Speed. Magnetic direction 10 deg, velocity knots
6. Pressure [milli-bars], reduced to zero elevation using 10700' for GRIP, 10600' for GISP, 9700' for NGRIP, 8140' for NEEM
7. Horizontal definition [good, fair, poor, nil]
8. Surface definition [good, fair, poor, nil]
9. Comments.

Example 1:
0630 local, 2500 feet estimated scattered 60%, 2 miles, -15 degC, Wind 290 mag 12 knots, 1013 milli-bars, good, fair, ski-way clear, fogbank SE of ski-way..

Visibility: Nautical miles or fractions of miles. Any visibility problems less than 6 miles state obscuring phenomenon.

Choices: Haze, snow, ice fog, ground fog, blowing snow, white out. Max visibility stated 25 miles.

Pressure: Local pressure converted to sea level according to international aviation CINA standard atmosphere. State millibars. Note, that the elevation used is the nominal elevation in feet, not the actual elevation.

Horizon definition: **Good:** Sharp horizon **Fair:** Identifiable
Poor: Barely discernable **Nil:** No horizon

<u>Surface definition</u>

GOOD: Snow surface features are easily identified by shadow. (Sun in obscured)
FAIR: Snow surface can be identified by contrast. No definite shadow exist. (Sun obscured).
POOR: Snow surface cannot be identified except close up. (Sun totally obscured).
NIL: Snow surface features cannot be identified. No shadow or contrast. Dark coloured objects seem to "float" in the air. Glare is equally bright from all directions.

Whiteout NIL surface, NIL horizon

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

Conversion:

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

Communication plan

Typical radio communication plan.

The major part of the communication is performed using BGAN and Iridium satellite communication. However, most flight related communication is performed on the radio.

Site Names: CPS Sonde, Summit radio, North GRIP, NEEM Traverse, NEEM site.

Frequencies:

Primary	**8093 kHz**	Ice freq. For camp to FOM communication
Secondary	**4753 kHz**	Ice freq, Best for distances up to 400 km.
	3815 kHz	Optional frequency for local traverse, 3350 may also be used depending on distance and antenna
	4050 khz	Main east Greenland party line frequency.
	5942 khz	Ice freq, backup, intermediate distances
	7995 khz	Ice freq, digital comms.
	9939 kHz	Used for digital communication.
	11217 kHz	Ground Air back up frequency

All frequencies use SSB, USB

VHF radio.	152.0125	CH1	GISP Primary	
	148.0125	CH2	GISP Sec	
	156.40		CH8	Mar. CH 8, main camp frequency
	156.45		CH9	Mar Ch 9
	156.50		CH10	Mar Ch 10
	155.775	CH14	AWI	
	156.800	CH16	Call	

Camp communication traffic is performed on Aviation 122.8MHz.

Schedule:
Sonde will monitor 8093 on a routine basis. Main Sonde-Camp contact time is at 18:45 SFJ hours, but depends on CPS Polarfield Services use of the frequency and the camp activities.

If aircrafts are expected, weather reporting starts 2 hours prior to estimated take off time on a 30 min basis unless otherwise arranged. Reporting primarily on radio with Iridium or BGAN as backup unless agreed otherwise.

Summary of frequencies used in Greenland

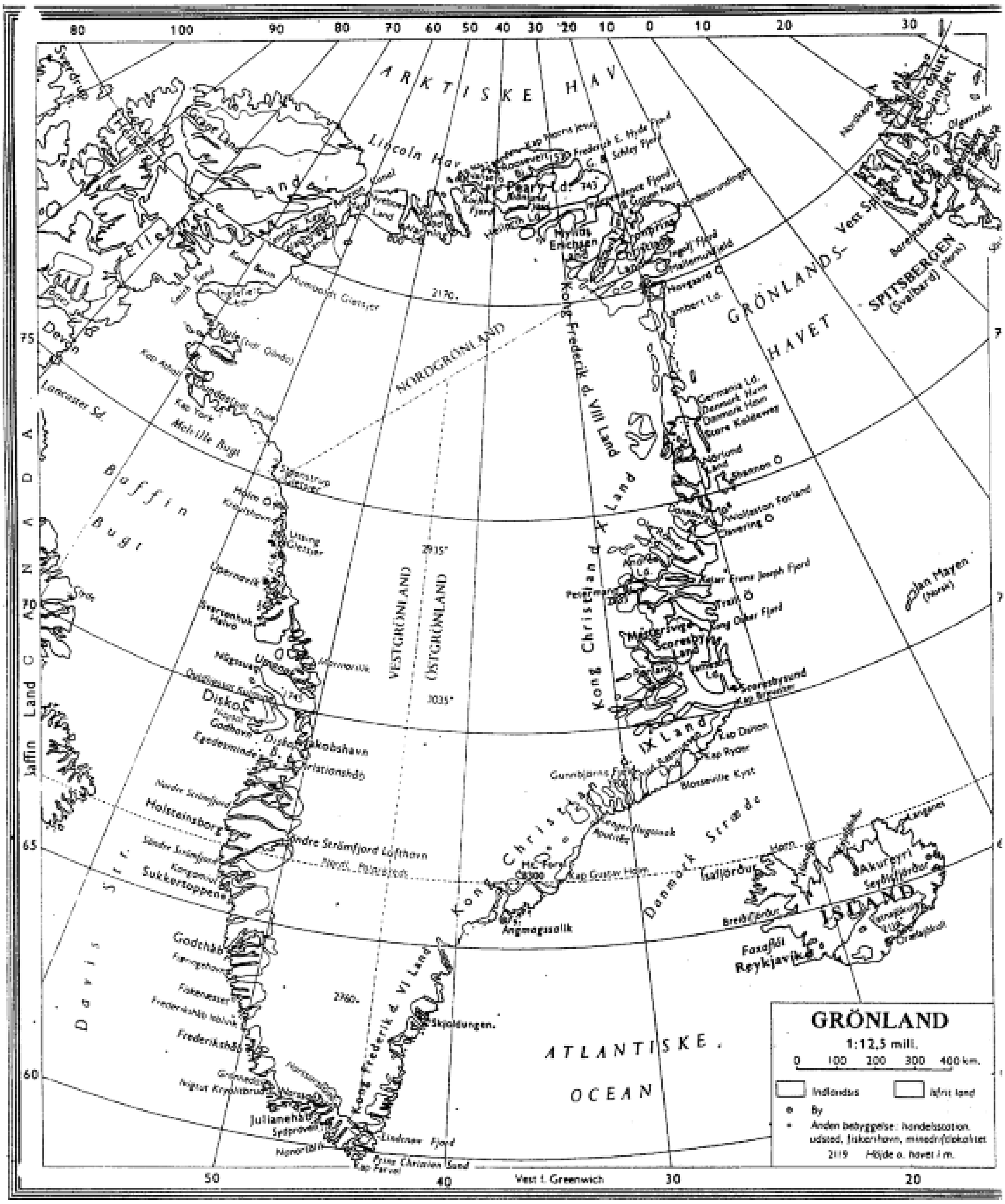
Maritime:	1638	Most likely outdated
	2090	
	2182	Call
GGU:	2784	
	3350	Main
	3815	
	4050	Main East Greenland frequency
Aircrafts:	2950	SFJ FIC
	4724	Thule Airways
	5526	SFJ FIC
	6739	Main Aircraft frequency
	8945	SFJ FIC
	8968	Thule Airways
	10042	SFJ FIC
Thule DLO	6756	Danish Liason Officer
Misc.	8891	Iceland Radio
	8924	Iceland Radio, Phone patch
	10030	Iceland Radio, Phone patch
	11270	Iceland Radio
VHF radio.	118.1	CNP AFIS
	118.3	SFJ Approach
	121.3	SFJ FIC
	121.5	**Call, Emergency**
	122.8	Air to ground
	126.2	SFJ Tower
BBC:	21710, 15070, 12095, 9410, 7325, 6180, 5975	
VOA:	16430, 11805, 9760, 6095	
DK:	13800,11840,9590,9485,7520,7465	

Phonetic alphabet

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

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

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


A R K T I S K E H A V
Lincoln Hav
Peary Ld.
Ellesmere Land
Smith Sund
Humboldt Gletsjer
Thule
Kap York
Melville Bugt
Lancaster Sd.
Devon
Baffin Bugt
C A N A D A
Baffin Land
Davis Str.
NORDGRÖNLAND
VESTGRÖNLAND
ÖSTGRÖNLAND
Kong Frederik d. VIII Land
Kong Christian d. X Land
Kong Christian d. IX Land
Kong Frederik d. VI Land
Upernavik
Umanak
Disko
Godhavn
Jakobshavn
Egedesminde
Christianshåb
Holsteinsborg
Söndre Strömfjord Lufthavn
Sukkertoppen
Godthåb
Fiskenæsset
Frederikshåb
Julianehåb
Kap Farvel
Prins Christian Sund
Skjoldungen
Angmagssalik
Kap Gustav Holm
Scoresbysund
Kap Brewster
Kap Dalton
Blosseville Kyst
Germania Ld.
Danmark Havn
Store Koldewey
Shannon Ö
Wollaston Forland
Clavering Ö
Kejser Franz Joseph Fjord
Kong Oscar Fjord
Traill Ö
Danmark Stræde
A T L A N T I S K E O C E A N
GRÖNLANDS HAVET
Jan Mayen (Norsk)
SPITSBERGEN (Svalbard) (Norsk)
Vest Spitsbergen
ISLAND
Reykjavik
Akureyri
Isafjörður
Faxaflói
Vest f. Greenwich
GRÖNLAND
1:12,5 mill.
0 100 200 300 400 km.
Indlandsis
Isfrit land
By
Anden bebyggelse: handelsstation, udsted, fiskerihavn, minedriftslokalitet
2119 Höjde o. havet i m.

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

Relevant distances and directions				
From	To	km	dir	dir
AEY	NOR	1780		
AEY	CNP	600		
CNP	THU	1532	315	90
CNP	DMH	686		
CNP	GRIP	561	298	104
DMH	NGT33	627	294	89
DMH	NOR	539		
GRIP	DMH	670	35	231
GRIP	NOR	1120	17	218
GRIP	JJ	198	131	315
HT	NGT23	410	177	358
JAV	THU	994	333	136
JAV	GRIP	618	46	239
NEEM	SFJ	1180		
NEEM	THU	480		
NEEM	UPERNAVIK	600		
NEEM	NGRIP	365		
NGRIP	CNP	799	117	316
NGRIP	GRIP	315	150	335
NOR	Longyearb	717		
NOR	HT	335		
SFJ	THU	1224	338	141
SFJ	JAV	245	356	176
SFJ	NOR	1861	17	23
SFJ	GRIP	796	33	225
THU	CC	205		
THU	HT	887	29	239
THU	NGT33	625		
THU	GRIP	1005	101	310
THU	NOR	1182		

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Iridium Satellite telephones

+ 8816 414 39863
+ 8816 414 39864
+ 8816 214 64908
+ 8816 214 42402

Iridium to Iridium $0.65 per minute

To Denmark $1.20 per minute

Land line or Cell phone $1.20 per minute + operator charge, e.g. up to $10 per minute

Kangerlussuaq
While participants are in Kangerlussuaq they can be reached by:
NEEM FOM Cell : +299 524125

CPS POLAR FIELD SERVICES, Kangerlussuaq

Office:	+299 84 15 98
Fax	+299 84 15 99
Mobile:	+299 52 42 18 (primary)
	299 52 42 81 (secondary)
Iridium sat. tel:	+8816 314 59737
Inmarsat Std. C:	584 49 3139141
E-mail:	robin@polarfield.com (Robin Abbott)
	mark@polarfield.com (Mark Begnaud "Sparky")
Air Greenland Cargo	+299 84 12 87
Tickets	+299 84 13 63
Statoil	+299 52 42 22

NYANG	+299 84 13 89
Met Office tel.:	+299 84 10 22
e-mail:	
FIC: telephone:	+299 84 10 34
Notam	+299 84 10 35
com	+299 84 10 24
KISS:	+299 84 13 00
	+299 84 14 87
	+299 84 11 07
fax:	+299 84 14 72
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Summit camp

Iridium sat. Tel.:		+8816 314 59738
Inmarsat Std. C		584 49 3139145
HF radio on	8093 MHz	(Summit Camp, daily at 08:45)

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Base Operations Dispatch	2717
Weather Forecaster	2395
Fuels Management	2553
Taxi (free)	2022
Telephone Information	113
Base Operator	0
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Danish Spedition, Emai l	pifuffik@greennet.gl
North Star Inn	+299 97 68 71?
	+299 97 66 36, ext 50606 or 3276
DK Police	+299 97 65 22
DK Police, fax	+299 97 65 00

Ilulissat Airport
Tel. +299 94 41 40
Fax +299 94 40 08

Station Nord
Iridium sat. tel.: +8816 314 10427

Inmarsat Std. C 581 49 2900091
E-mail: stnord@glk.gl
(via liason officer at Thule Air base, e-mails will be forwarded to Inmarsat Standard –C satellite telex unit at Station Nord).

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	Private	+45 3927 0045	
Gentofte Hospital:	**(**Phone	+45 3977 3977)	

Sun glasses

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

Standards for sunglasses – see labelling on inside of the frame

Europe CE (EN 1836:2005)

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

US (ANSI Z80.3-1972)
A compliable lens should have a UVB (280 to 315nm) transmittance of no more than one per cent and a UVA (315 to 380nm) transmittance of no more than 0.5 times of the visual light transmittance.

Australia (AS 1067)

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

Acute mountain sickness - AMS

Symptoms/signs of acute mountain sickness:

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

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

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

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

How to operate the Gamow bag

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

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

Ambient conditions			**Inside Gamow bag when pressurized to 2 psi (103 mmHg)**		
Meters	Feet	mmHg	Meters	Feet	mmHg
2400	7874	562	1054	3458	665
2700	8859	541	1310	4298	645
3000	9843	522	1555	5102	626
3300	10827	503	1805	5922	607
3600	11812	484	2053	6736	588

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

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

How to monitor blood pressure using the Omron electronic monitor

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

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

SBP= Systolic blood pressure

DBP= Diastolic blood pressure

How to monitor blood glucose

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

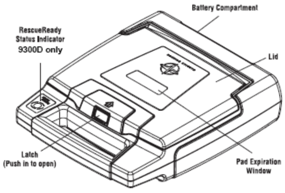
Result of blood glucose monitoring

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

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

Calibration of new test strip lot:
Insert calibration strip into strip port. Wait until the monitor displays the lot number. Check number against packet.

Automated External Defibrillator (AED)



CARDIAC SCIENCE AEDs
G3 *third generation*

STEP 1: ASSESSMENT AND PAD PLACEMENT

PREPARATION

Determine that the patient is over 8 years of age or weighs more than 55 pounds (25 kg) and exhibits the following:

The patient is unresponsive, and
the patient is not breathing.

Remove clothing from the patient's chest. Ensure the skin site is clean and dry. Dry the patient's chest and shave excessive hair if necessary.

Open the AED lid and wait until the LEDs are lit.

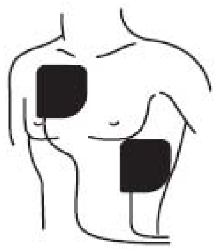
Note: When the patient is a child under 8 years of age or weighs less than 55 lbs (25kg), the AED should be used with the Model 9730 Pediatric Attenuated Defibrillation Pads. Therapy should not be delayed to determine the patient's exact age or weight. See the directions for use accompanying pediatric pads for procedure on changing adult pads to pediatric.

PLACE PADS

The AED will issue the prompt *"Tear Open Package and Remove Pads"* Keep the pads connected to the AED, tear the pad package along the dotted line and remove the pads from the package. Leave the package attached to the pad wires.

After the prompt *"Peel One Pad From Plastic Liner,"* with a firm, steady pull, carefully peel one pad away from the plastic liner.

Then, after the prompt *"Place One Pad on Bare Upper Chest,"* place the pad with the sticky side of on the patient's skin on the upper right chest, placing the top of the pad on the collarbone. Avoid placing the pad directly over the sternum.



Finally, after the prompt *"Peel Second Pad and Place on Bare Lower Chest As Shown,"* pull the second pad from the plastic liner and place it on the lower left chest, below and left of the breast.

Note: Cardiac Science's standard defibrillation pads are non-polarized and can be placed in either position as shown on the pad package.

When the pads are placed, the voice prompt will say *"Do not touch patient. Analyzing Rhythm."* If the pads are not properly placed or become disconnected at any time during the rescue, the voice prompt *"Check Pads"* will be heard. When this occurs, ensure that:

Pads are firmly placed on clean, dry skin
Pad cable is securely plugged into the AED

STEP 2: ECG ANALYSIS

As soon as the AED detects proper pad placement, the voice prompt *"Do Not Touch Patient. Analyzing Rhythm"* will be heard. The AED will begin to analyze the cardiac rhythm of the patient.

If a shock is advised, the voice prompt will say, *"Shock Advised. Charging."*

When the AED is charged, it continues to analyze the patient's heart rhythm. If the rhythm changes and a shock is no longer needed, the AED will issue the prompt *"Rhythm Changed. Shock Cancelled,"* disarm and initiate CPR.

If no shock is advised, the AED will prompt to start CPR.

If noise is detected during analysis, the AED will warn you with the prompt *"Analysis Interrupted. Stop Patient Motion"* and restart the analysis. This usually occurs if the patient is excessively jostled or there is a strong electromagnetic emitting electronic device nearby (within 5 meters). Remove the electronic device or stop the excessive motion when you hear this prompt.

STEP 3: SHOCK DELIVERY AND CPR MODE

When the AED is ready to deliver a defibrillation shock, the **SHOCK** button will flash and the prompt *"Stand Clear. Push Flashing Button to Deliver Shock"* will be heard.

Make sure no one is touching the patient and push the **SHOCK** button to deliver a defibrillation shock. (If you do not push the **SHOCK** button within 30 seconds of hearing the prompt, the AED will advise, *"It is now safe to touch the patient. Start CPR."*

After the AED delivers the defibrillation shock, the voice prompt will say, "*Shock Delivered.*" The AED will then prompt you to start CPR.

Note: During a rescue, the text screen displays voice prompts, elapsed time of rescue and number of shocks delivered, (for 9300D only).

CPR MODE

After shock delivery or detection of a non-shockable rhythm, the AED automatically enters CPR mode. The voice prompt *"Start CPR"* will be heard.

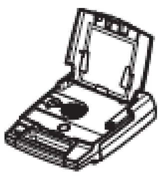
During the CPR time-out, the AED will not interrupt the CPR mode if the patient's condition changes and the AED detects a shockable rhythm. After the CPR time-out period has expired, the voice prompt *"Do Not Touch Patient. Analyzing Rhythm."* will be heard.

Note: During CPR mode, the text screen displays a countdown timer, (for 9300D only).

If the patient is conscious and breathing normally, leave the pads on the patient's chest connected to the AED. Make the patient as comfortable as possible and wait for Advanced Life Support [ALS] personnel to arrive. Continue to follow the voice prompts until the ALS personnel arrive, or proceed as recommended by the Medical Director.

STEP 4: POST RESCUE

After transferring the patient to ALS personnel, prepare the AED for the next rescue:



1. Retrieve the rescue data stored in the internal memory of the AED by using RescueLink software installed on a PC (see detailed procedure in the Data Management section).
2. Connect a new pair of pads to the AED.
3 Close the lid.
4. Verify that the **STATUS INDICATOR** on the handle is **GREEN**. (For 9300D only)