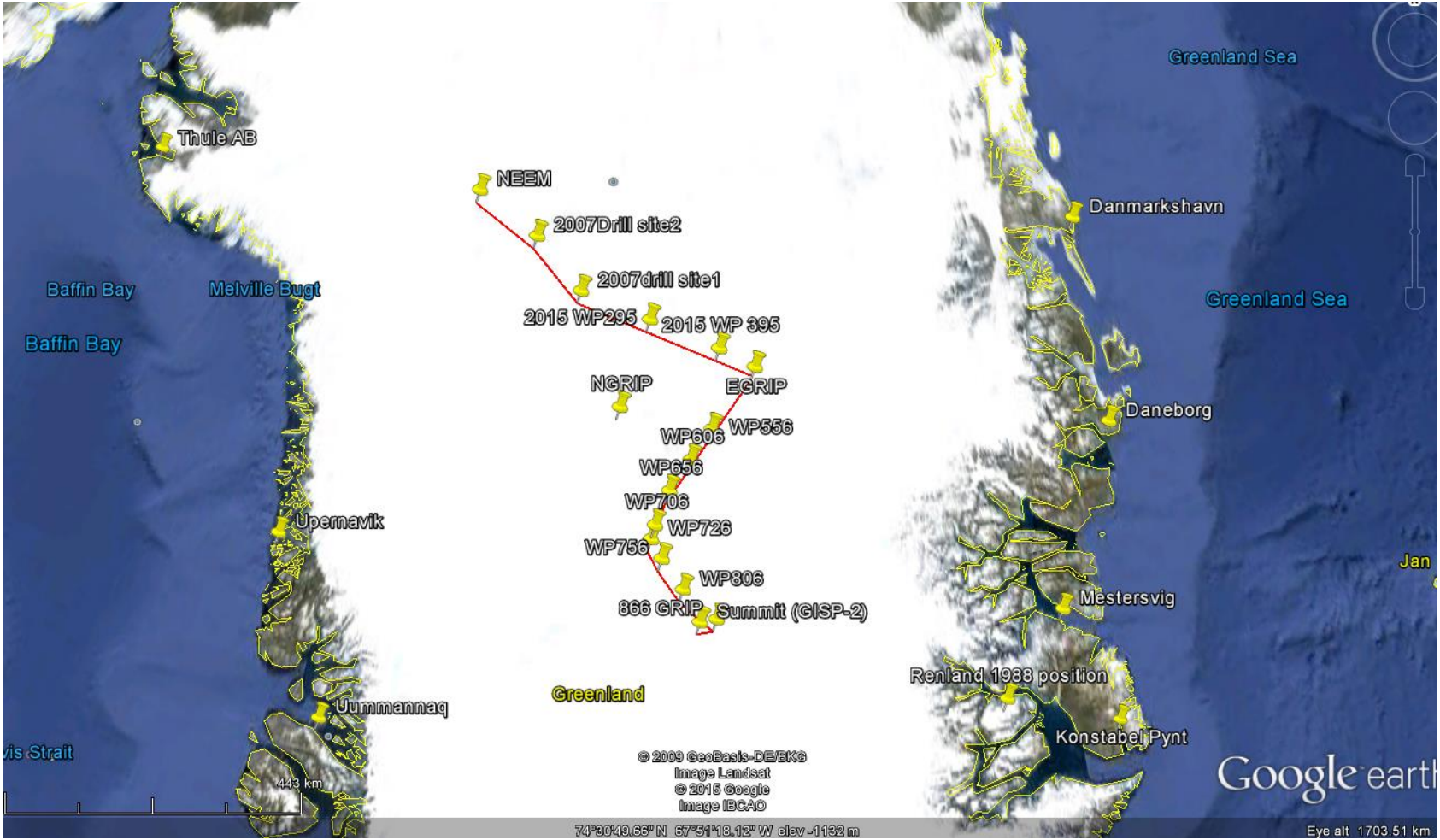
Thule AB
NEEM
2007Drill site2
2007drill site1
2015 WP295
2015 WP 395
NGRIP
EGRIP
WP606
WP556
WP656
WP706
WP726
WP756
WP806
866 GRIP
Summit (GISP-2)
Upernavik
Uummannaq
Greenland
Baffin Bay
Melville Bugt
Baffin Bay
Greenland Sea
Greenland Sea
Danmarkshavn
Daneborg
Mestersvig
Renland 1988 position
Konstabel Pynt
Jan
443 km
© 2009 GeoBasis-DE/BKG
Image Landsat
© 2015 Google
Image IBCAO
74°30'49.86" N 67°51'18.12" W elev -1132 m
Eye alt 1703.51 km
Google earth


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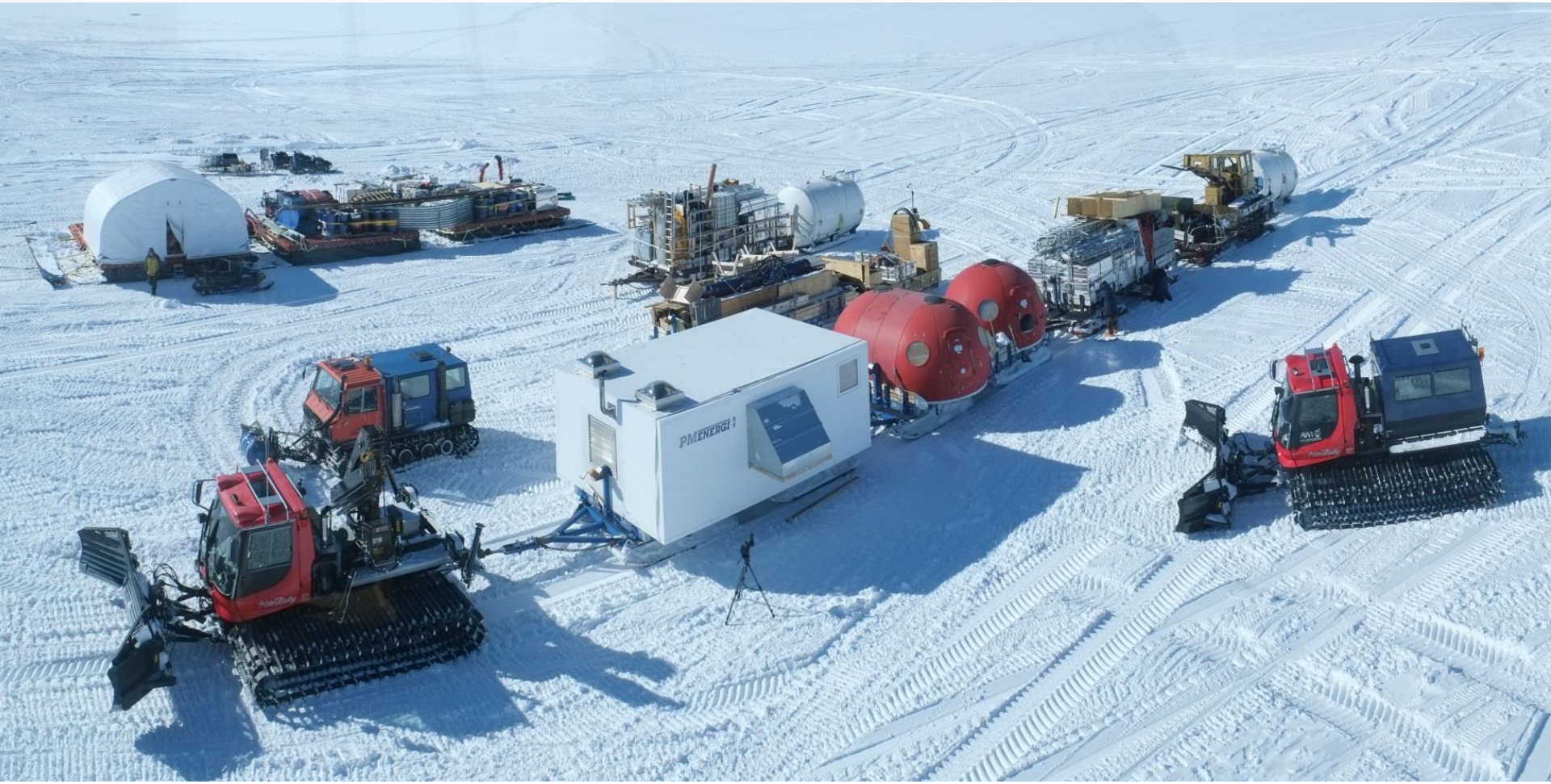
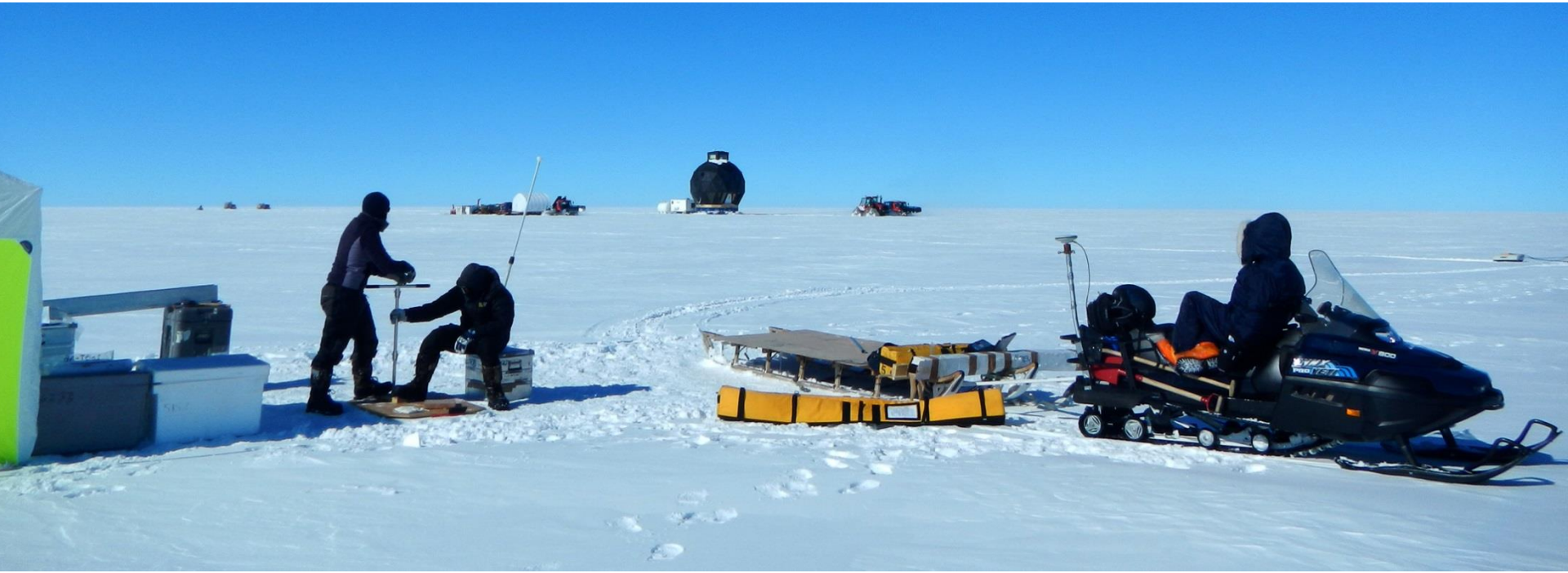

PMENERGI

While the traverse passes..




PMENERGI

Traverse at EGRIP


2
2
2


NEEM 440 KM
305°


Fire blanket
BEETS
HEAD CHEF
KIM
BakeSource


HEAVEN
HELL

NEEM-EGRIP traverse statistics:

Put-in April 27 (on schedule).
First landing on NEEM ski landing area April 30
Five LC-130 missions complete put-in May 4.
Traverse begins May 18. (6 days behind schedule, due to ice around buildings).
Arrival at EGRIP. May 26 after 465 km (2 days behing schedule).
Skiway ready June 1.
Pull-out from EGRIP June 9 (2 days behind schedule, due to tech. issues with LC-130).
GrIT traverse EGRIP-Summit: June 1 – June 4 (on schedule)

Net cargo hauled: 140 ton (Main dome 45 ton).
Fuel: 35 liter/km (planned 25 liter/km)
Traction: GrIT CASE tractor (460 HP), 2 x Pistenbully 300 (420 HP), 2 x Flexmobil (140 HP).
PAX traverse: 6 logistics and 5 science.
3 snowmobile teams for science.

Science support: NEEM: Strain net, logging NEEM borehole, surface snow samples,
GLISN seismic maintenance. On traverse: Surface radar, surface snow samples,
PARCA Twin Otter. At EGRIP: Surface radar, surface snow samples, Penn. State Twin Otter.
Traverse EGRIP-Summit: Surface radar, phase sensitive radar.

2015 Loads carried:								
Mission	Date	Hours	loads up	loads down	Route	Fuel		
			lbs	lbs		liter		
No.1	27-Apr	5.2	9000		SFJ-NEEM-SFJ			
No.2a	29-Apr	2.2	6160		SFJ-Thu			
No.2b	30-Apr	2.2	15000		Thu-NEEM-Thu	3000	Fuel for Koni Steffen	
No.2c	30-Apr	3.7	12300		Thu-NEEM-SFJ	3200	Fuel for Koni Steffen	
No.3	01-May	5.2	12500	2200	SFJ-NEEM-SFJ	2500	EGRIP fuel	
No.4	04-May	5.2	16500	2640	SFJ-NEEM-SFJ			
No.5	01-Jun	5	9000	2650	SFJ-EGRIP-SFJ	3424	GrIT and EGRIP fuel	
No.6	02-Jun	5	13000		SFJ-EGRIP-SFJ	5925	Extra fuel mission	
No.7	09-Jun	5	10500	2900	SFJ-EGRIP-SFJ			
Estimated Total:		38.7	103960	10390				

EGRIP 2015-2020

2015: Moving NEEM camp to EGRIP. Completed (picture).
2016: Construction and outfitting of science and drill trenches. 100 m pilot hole and casing.
Expanding camp capacity.
2017: Drilling to 1500 m. Processing; but not brittle zone.
2018: Drilling to 2560 m. Processing incl. Brittle zone.
2019: Finishing deep drilling. Experiments in hole. Drilling into base? Shallow coring.
Camp is being down scaled.
2020: Last experiments in hole. Shallow coring. Camp is packed down for next time.

EGRIP project outline:

2015:
Borehole logging at NEEM, traverse from NEEM to EGRIP with traverse train mostly along ice divide. Radar sounding, shallow ice coring and GPS strain net survey during the traverse. At EGRIP, setting up overwintering structures (dome, garages and skiway) and radar grid mapping. Transporting heavy equipment from NEEM to EGRIP. Staging for 2016 season, including build-up of fuel depot.
2016:
Continue construction of ice drilling camp which includes weatherports, workshops, drilling trench and science trench. Drilling pilot hole to 100 m, hole casing, setting up deep drill infrastructure. Ice core logging and limited processing.
2017:
Full time deep drilling and processing non brittle ice to 1600 m depth.
2018:
Full time deep drilling and full processing to basal/warm? ice (2450m) or bedrock (2560m).
2019:
Finish deep drilling. Borehole logging. Sampling of basal material. Additional shallow ice coring and finish processing of deep core. Last associated programs. Begin de-construction of camp.
2020:
Last basal experiments. Additional shallow cores. Limited processing. Packing down camp . Pull-out.

Planned man days in Greenland (associated programs not included):

Year	In camp	In SFJ	FOM	DV's	Average camp load
2015	700	100	70	0	10
2016	2000	200	200	20	20
2017	2500	250	230	40	25
2018	2500	250	230	20	25
2019	2000	200	230	32	20
2020	1500	150	230	20	15
total	11200	1150	1190	132	

Days of field work:

2015:	Apr-27(May-1)	Jun-9 (Jul-20)	43 days (80 days)
2016:	May-1	Aug-15	107 days
2017:	May-1	Aug-15	107 days
2018:	May-1	Aug-15	107 days
2019:	May-1	Aug-15	107 days
2020:	May-1	Aug-1	92 days

109th Status and update of estimates at end of 2015 season:

In 2015 we had one full SAAM from Schenectady to Sondrestrom, as we transported the Pistenbully through the U.S. this gave the "extra" ferry flight.

	weight (incl. fuel)	fuel	#missions	hours
2015 season	**90,000 lbs**	**23,800 lbs**	**6**	**34.6**
2015 Ferry flight	**25,000 lbs**	**0 lbs**	**1**	**12.0**
EGRIP outlook				
2016 season	150,000 lbs	72,600 lbs	8	37.6
2017 season	260,000 lbs	72,600 lbs	13	61.1
2018 season	260,000 lbs	72,600 lbs	13	61.1
2019 season	190,000 lbs	72,600 lbs	10	47.0
2020 season	150,000 lbs	72,600 lbs	7	32.9
2016-20 Ferry flights	**125,000 lbs**	**0 lbs**	**5**	**60.0**
Total flights need for EGRIP:			63 missions	346.3 hours

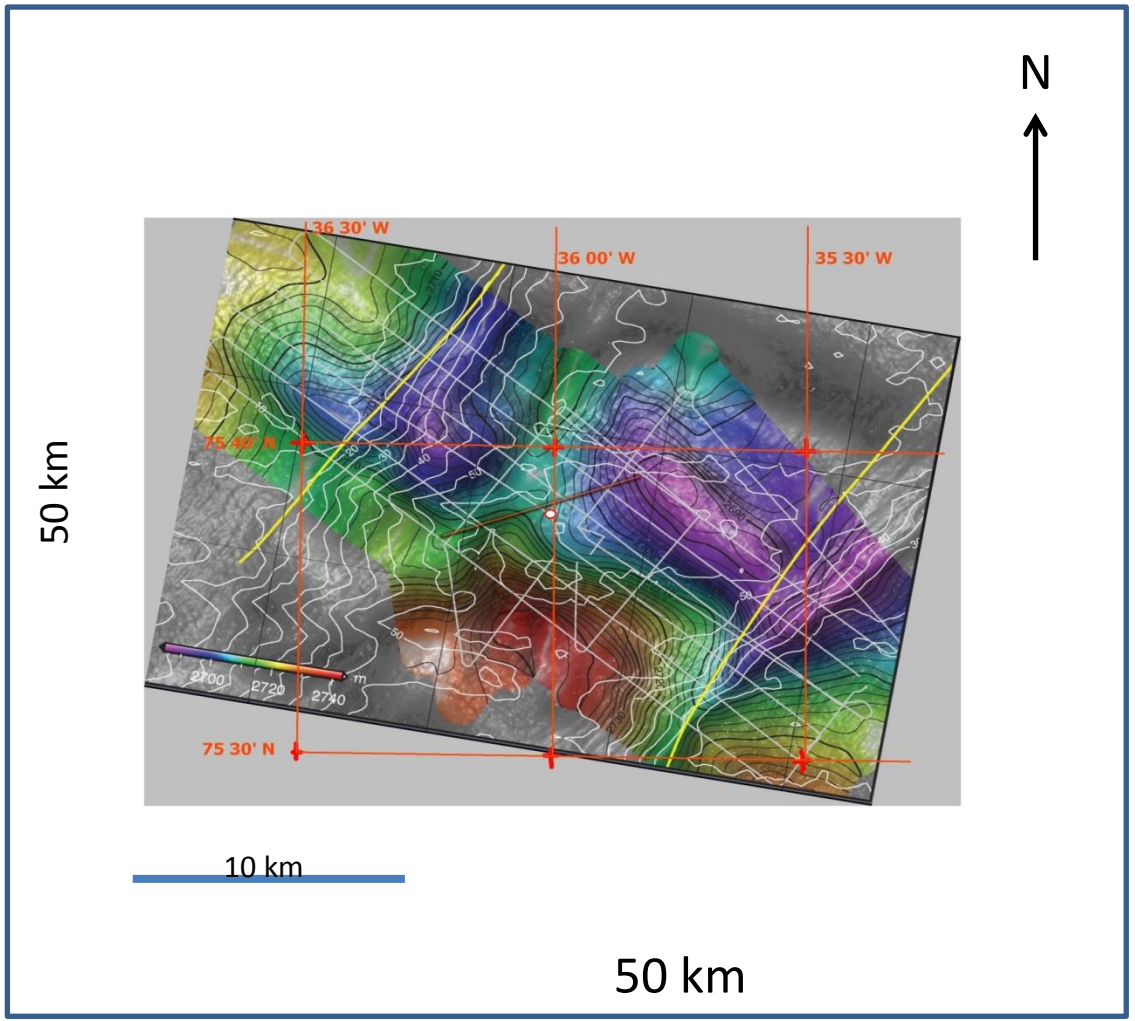
List of major purchases in comparison between NEEM and EGRIP

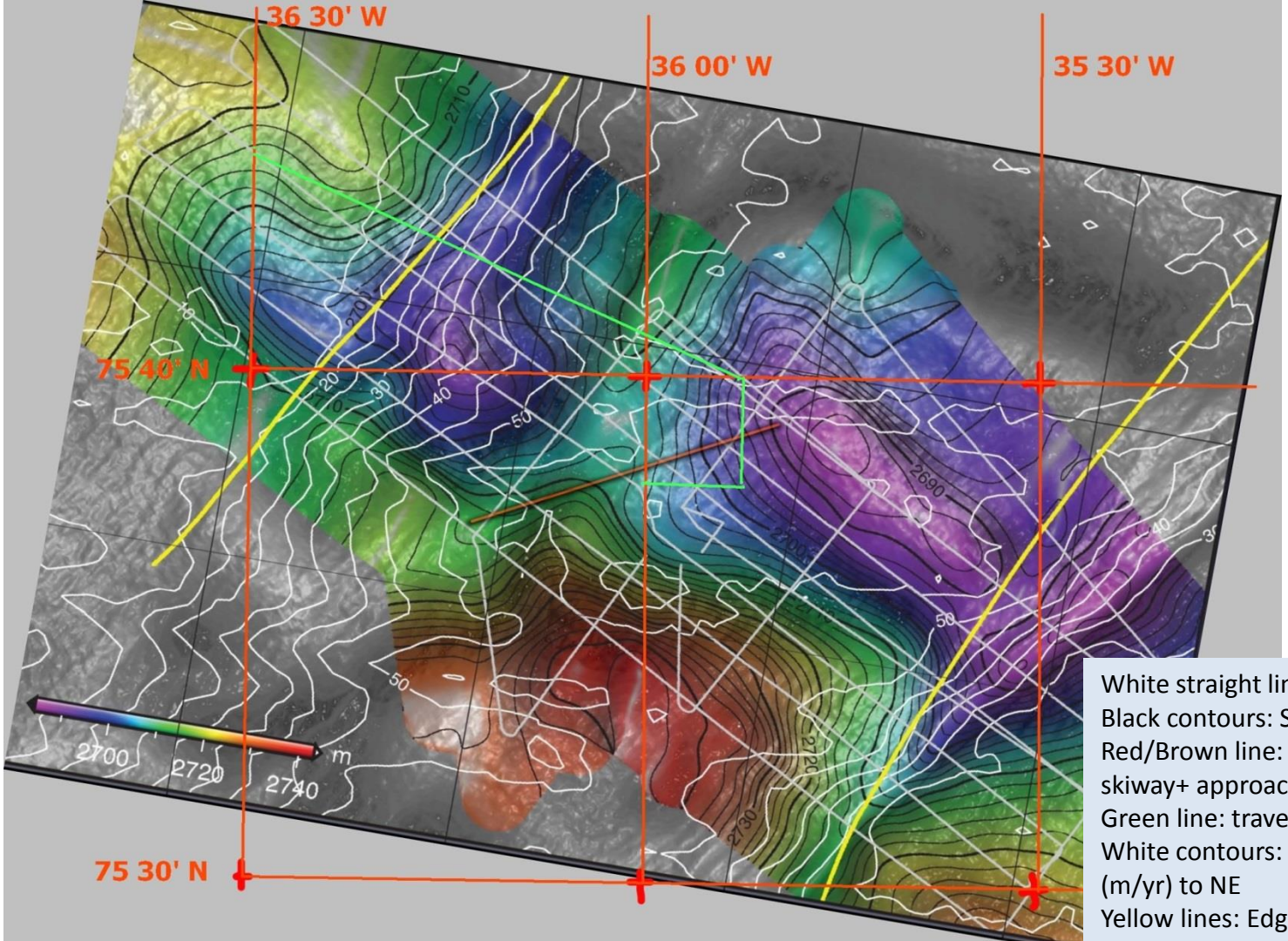
Item	NEEM price	EGRIP price	Comment
Main dome, incl sled	1500 kkr	0 kkr	dome is re-used
Hole Casing	140 kkr	200 kkr	
Lumber and plywoood	1000 kkr	300 kkr	balloon technique
Electrical system	300 kkr	100 kkr	re-use from NEEM
Main generator	290 kkr	60 kkr	overhaul and re-use from NEEM
Backup generator	70 kkr	70 kkr	new 45 KVA SDMO
Drilling fluid	1200 kkr	1500 kkr	new væske
Fuel	1300 kkr	2000 kkr	USA contribution?
Drill cable	200 kkr	300 kkr	new cable
Tracks for Flexmobils	500 kkr	0 kkr	
Pistenbully 300 Polar	3000 kkr	3000 kkr	Buy new Pistenbully
Weatherports	170 kkr	250 kkr	
Snowblower for PB		150 kkr	
New groomer	100 kkr	1000 kkr	New construction
winch	50 kkr	50 kkr	
Drill	1600 kkr	1600 kkr	
Snowmobils	350 kkr	200 kkr	
Viessmann cabins	280 kkr	100 kkr	
Toyota landcruiser	450 kkr	0 kkr	
Elevator	100 kkr	0 kkr	
Is core boxes	350 kkr	300kkr	
Is core storage	1000 kkr	400kkr	
Balloons	70 kkr	500 kkr	
3 x fuel tanks	255 kkr	0 kkr	
New forklift in SFJ	750kkr		
Total	14275 kkr	12830 kkr	
	2007 prices	2015 prices	

Budget for EGRIP

	2015	2016	2017	2018	2019	2020	Total
Transport to/from Greenland	900,000	1,200,000	840,000	770,000	550,000	350,000	4,610,000
Transport in Greenland	2,553,000	2,717,000	4,005,000	4,005,000	2,684,000	2,460,000	18,424,000
Personnel transport	600,000	1,000,000	1,100,000	1,100,000	900,000	840,000	5,540,000
Transport in Europe/US	220,000	30,000	25,000	80,000	50,000	10,000	415,000
Operations SFJ	180,000	250,000	670,000	760,000	250,000	310,000	2,420,000
Constructions NEEM	5,700,000	3,200,000	400,000	200,000	700,000	100,000	10,300,000
Field equipment	800,000	800,000	500,000	160,000	20,000	10,000	2,290,000
Salaries	2,400,000	3,200,000	3,500,000	2,950,000	2,300,000	2,300,000	16,650,000
Operation NEEM	1,300,000	2,000,000	2,200,000	1,600,000	950,000	600,000	8,650,000
Drill	100,000	900,000	550,000	300,000	150,000	540,000	2,540,000
Meetings + admin	200,000	110,000	260,000	240,000	160,000	15,000	985,000
Curator and ice core storage	200,000	200,000	200,000	200,000	200,000	200,000	1,200,000
							71,709,000

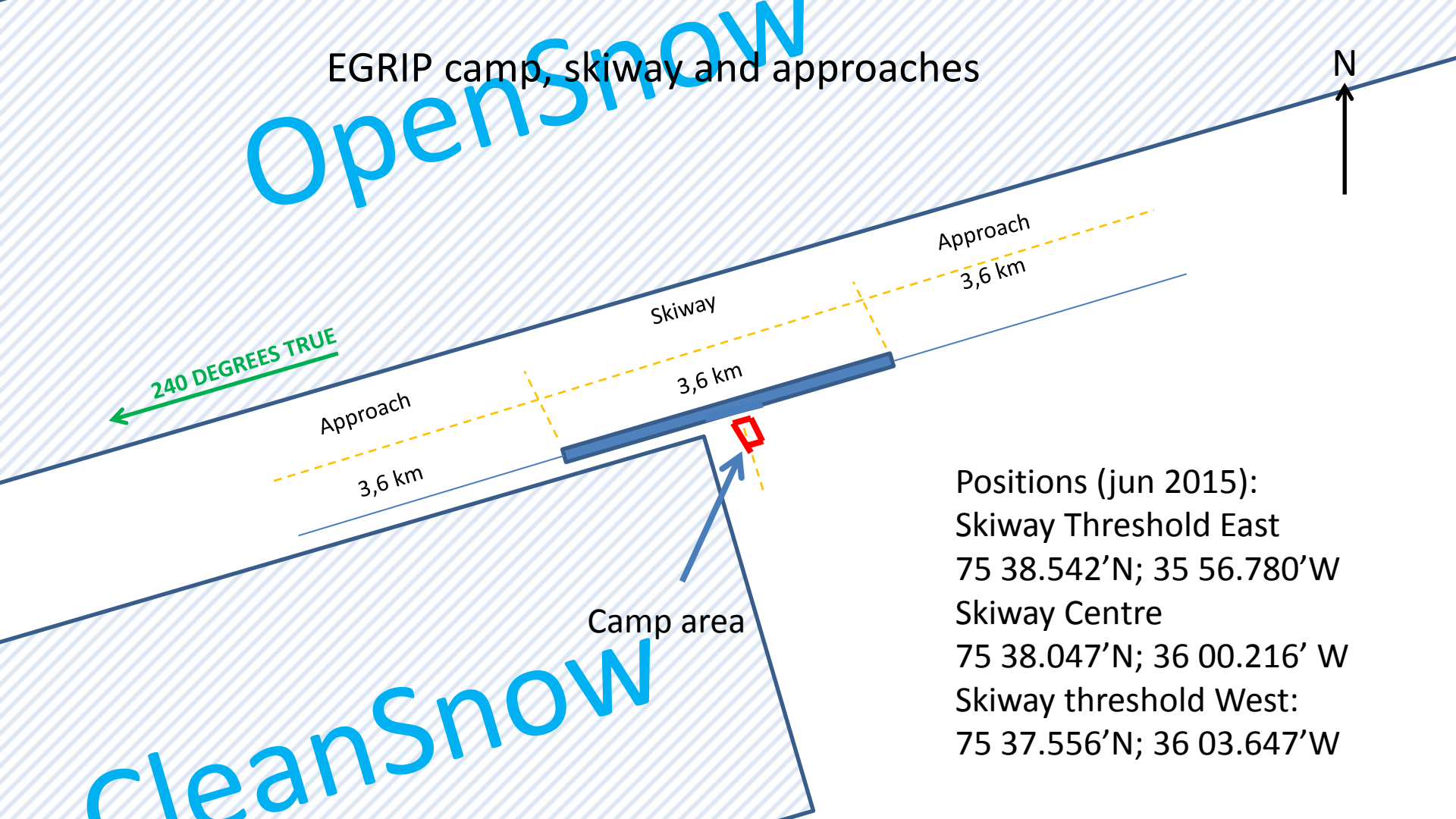
Map of 50 km x 50 km (roughly 1:250,000)





White straight lines: Radar tracks.
Black contours: Surface elevation
Red/Brown line: 36,000 feet skiway+ approach
Green line: traverse route.
White contours: Surface velocity (m/yr) to NE
Yellow lines: Edges of ice stream.

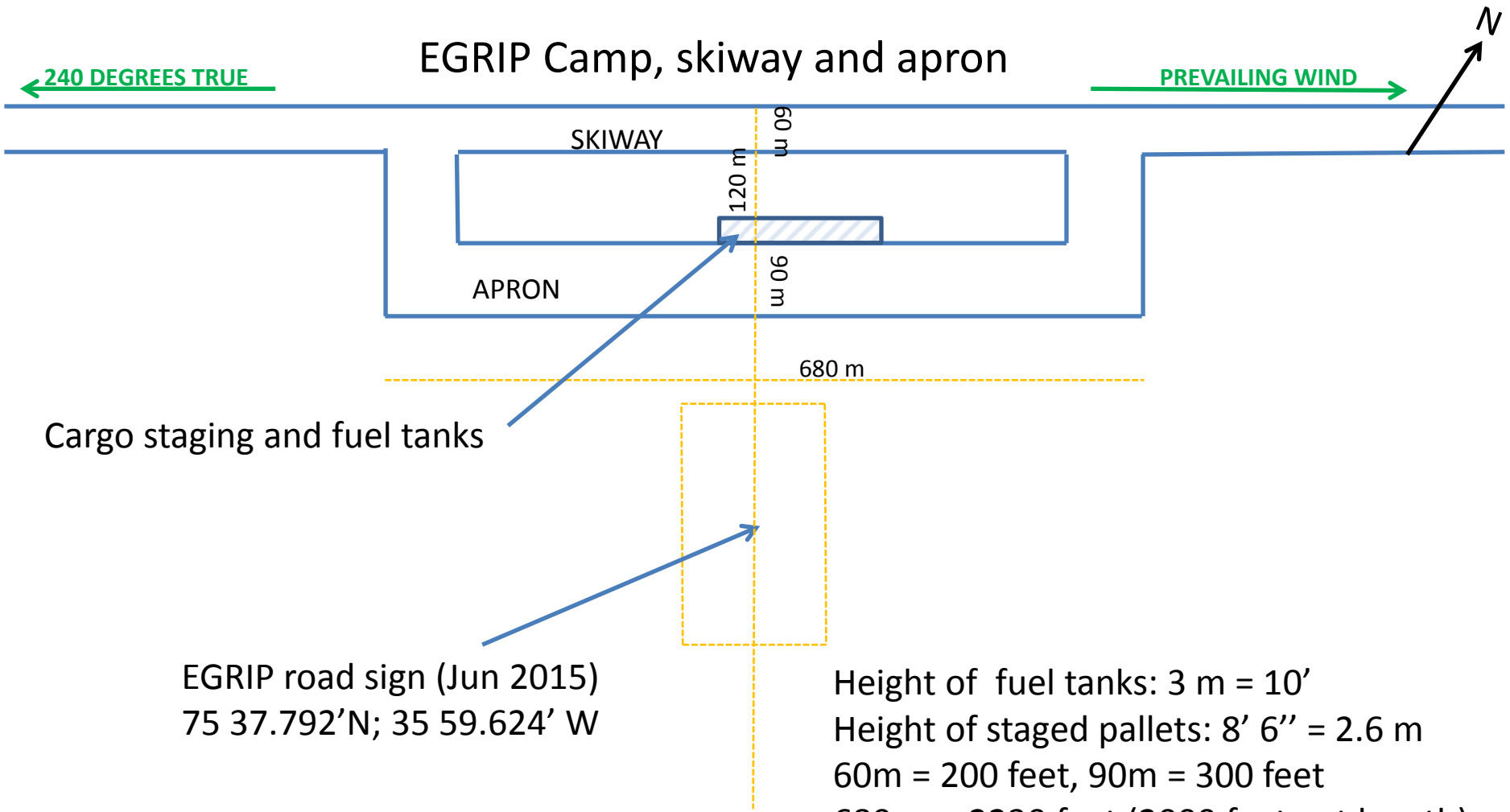
EGRIP camp, skiway and approaches



Positions (jun 2015):
Skiway Threshold East
75 38.542’N; 35 56.780’W
Skiway Centre
75 38.047’N; 36 00.216’ W
Skiway threshold West:
75 37.556’N; 36 03.647’W

OpenSnow
CleanSnow

EGRIP Camp, skiway and apron

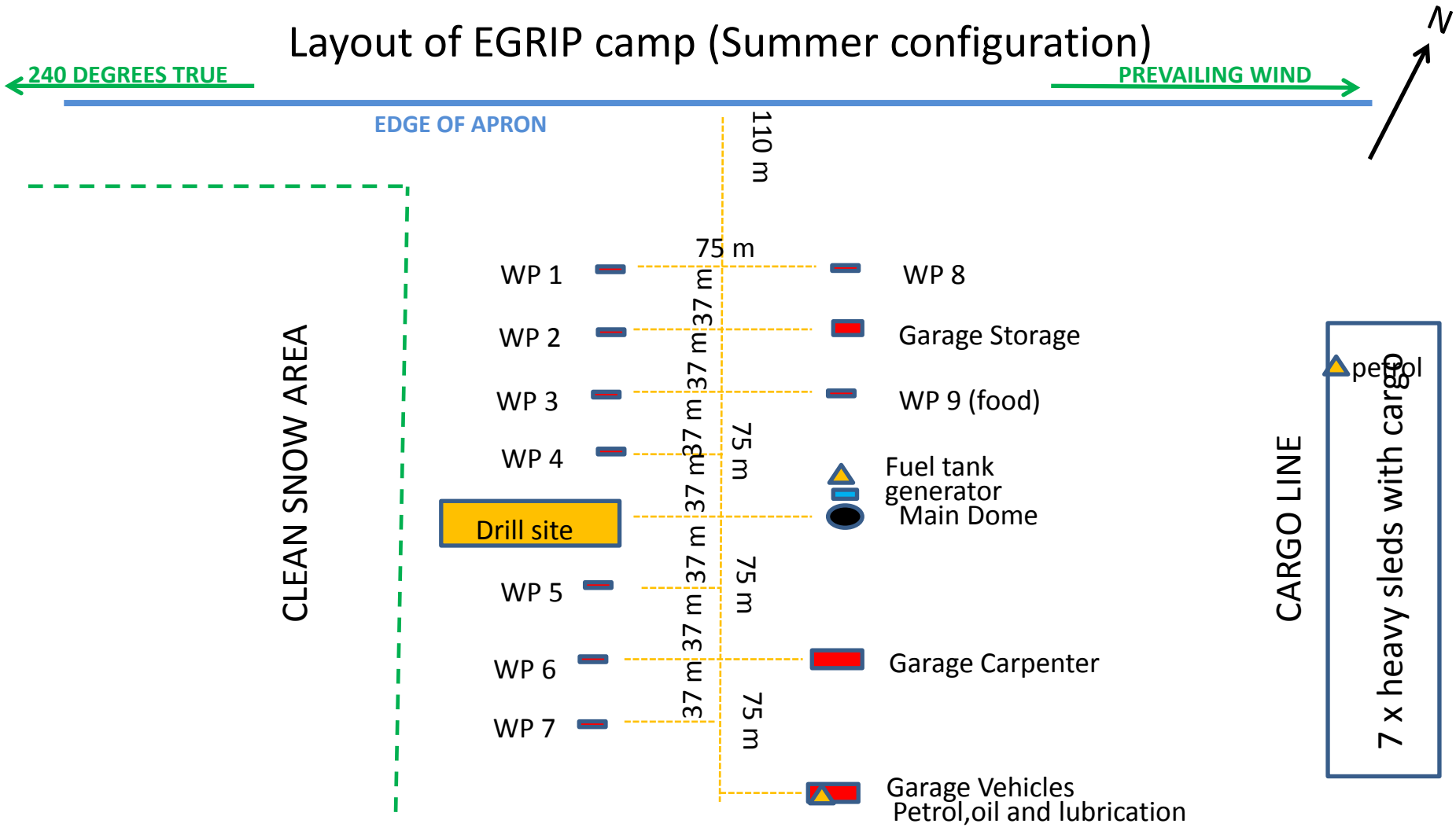


Cargo staging and fuel tanks

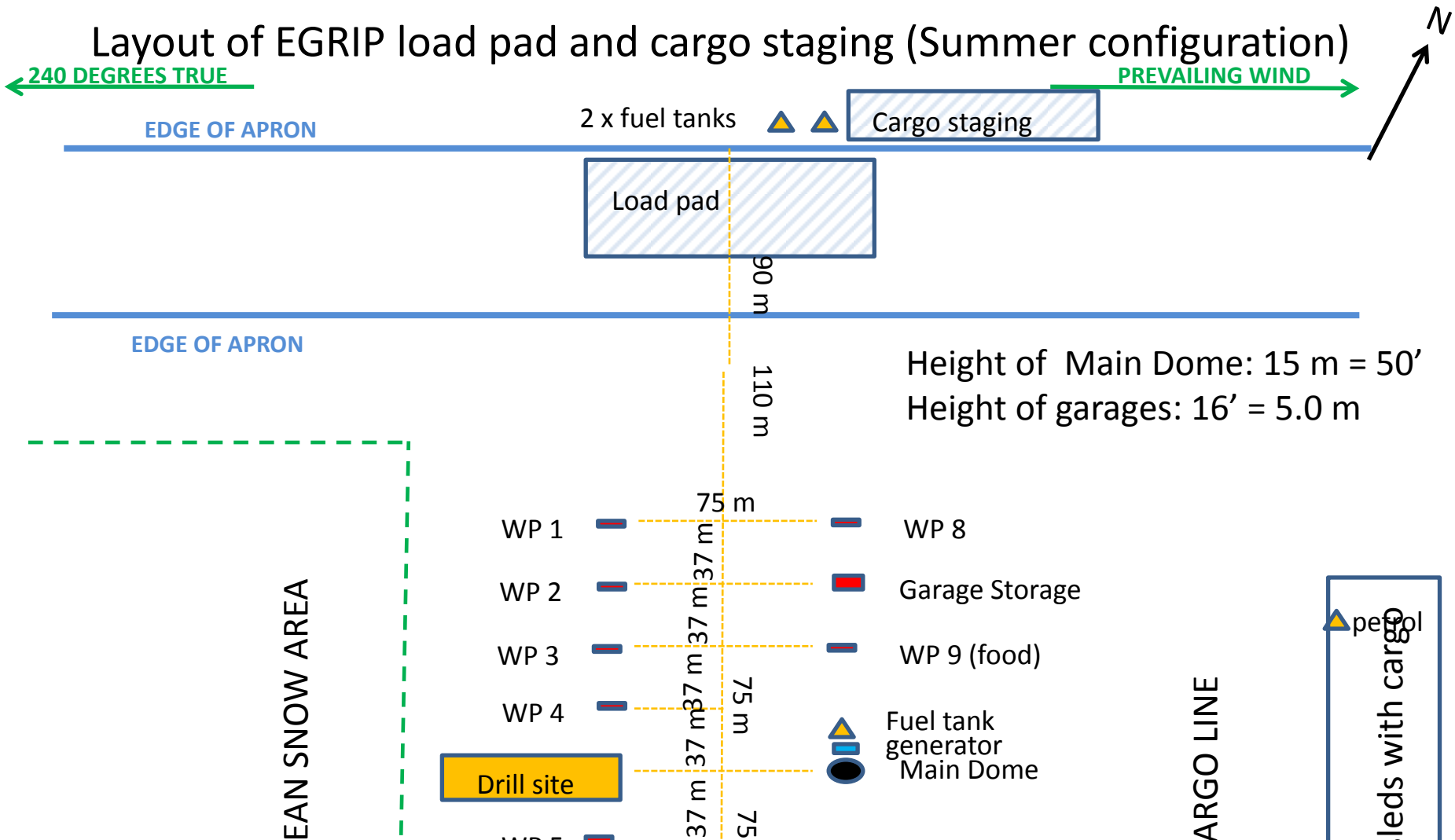
EGRIP road sign (Jun 2015)
75 37.792'N; 35 59.624' W

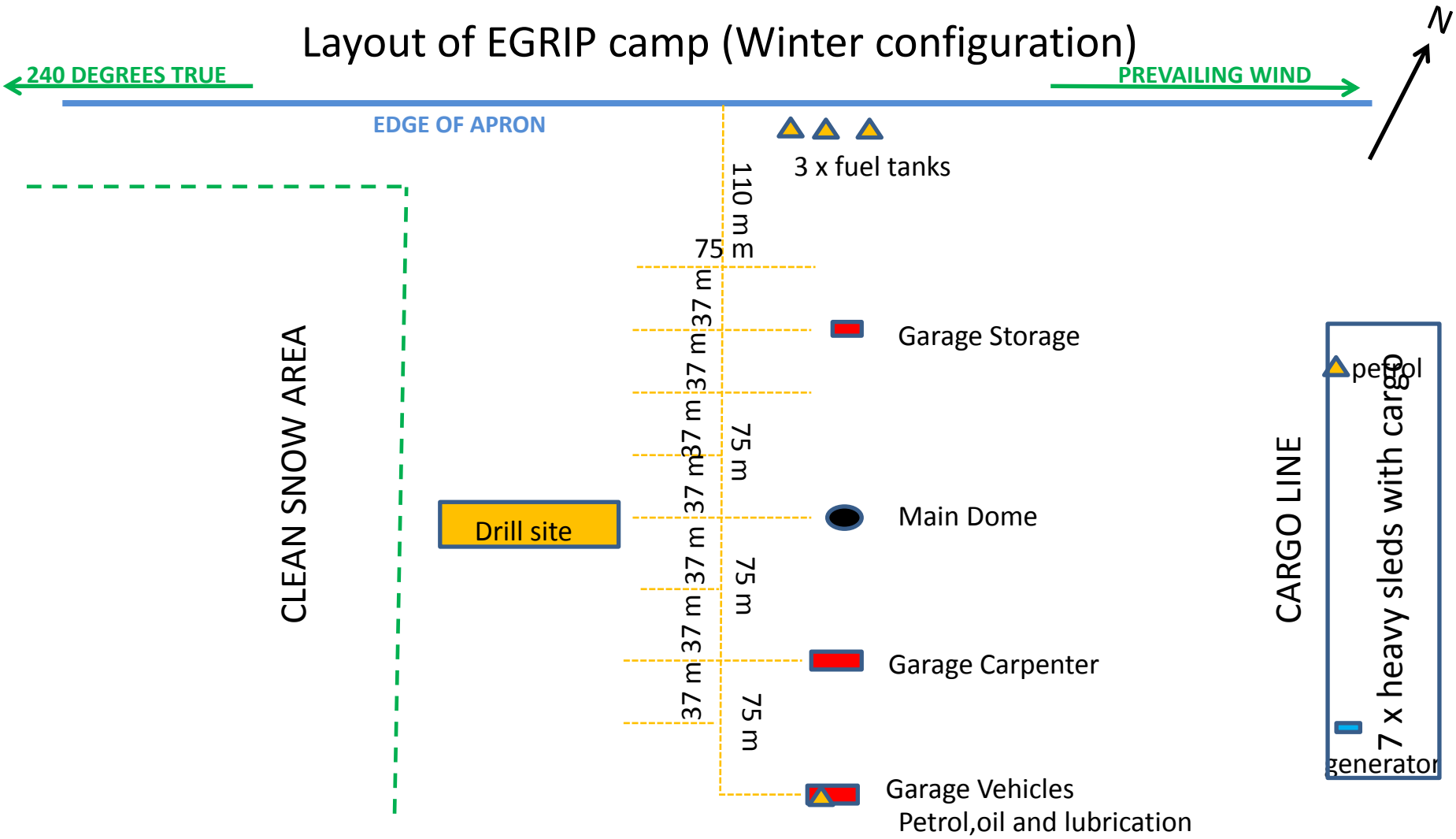
Height of fuel tanks: 3 m = 10'
Height of staged pallets: 8' 6'' = 2.6 m
60m = 200 feet, 90m = 300 feet
680 m = 2230 feet (2000 feet net length)

Layout of EGRIP camp (Summer configuration)



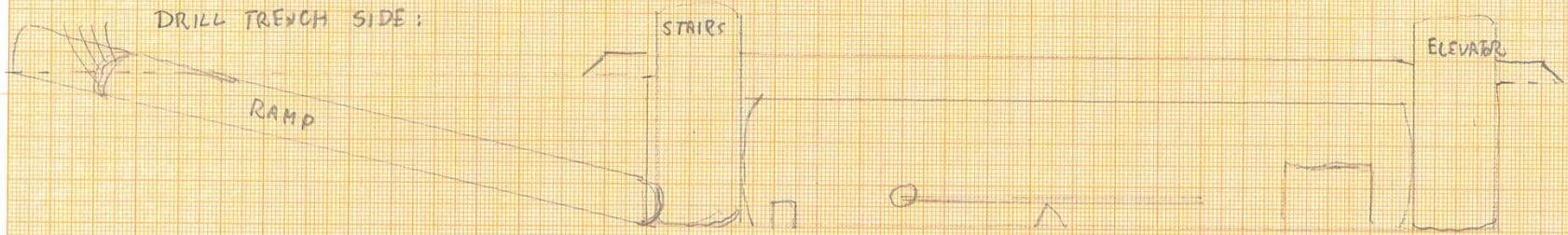
Layout of EGRIP load pad and cargo staging (Summer configuration)



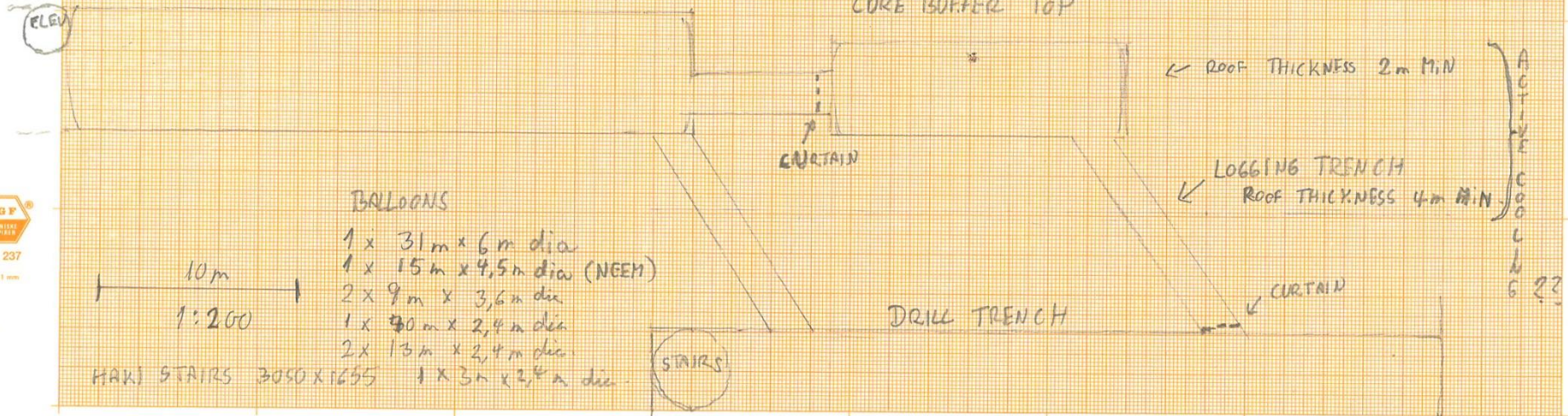

Layout of EGRIP camp (Winter configuration)
240 DEGREES TRUE
PREVAILING WIND
N
EDGE OF APRON
3 x fuel tanks
110 m
75 m
37 m
37 m
37 m
37 m
75 m
37 m
37 m
75 m
37 m
37 m
75 m
CLEAN SNOW AREA
Drill site
Garage Storage
Main Dome
Garage Carpenter
Garage Vehicles
Petrol,oil and lubrication
CARGO LINE
petrol
7 x heavy sleds with cargo
generator

DRILL TRENCH TOP :

DRILL TRENCH SIDE :



SCIENCE TRENCH TOP:



BALOONS

1 x 31m x 6m dia
1 x 15m x 4,5m dia (NEEM)
2 x 9m x 3,6m dia
1 x 30m x 2,4m dia
2 x 13m x 2,4m dia
1 x 3m x 2,4m dia

10m
1:200

HAKI STAIRS 3050 x 1655

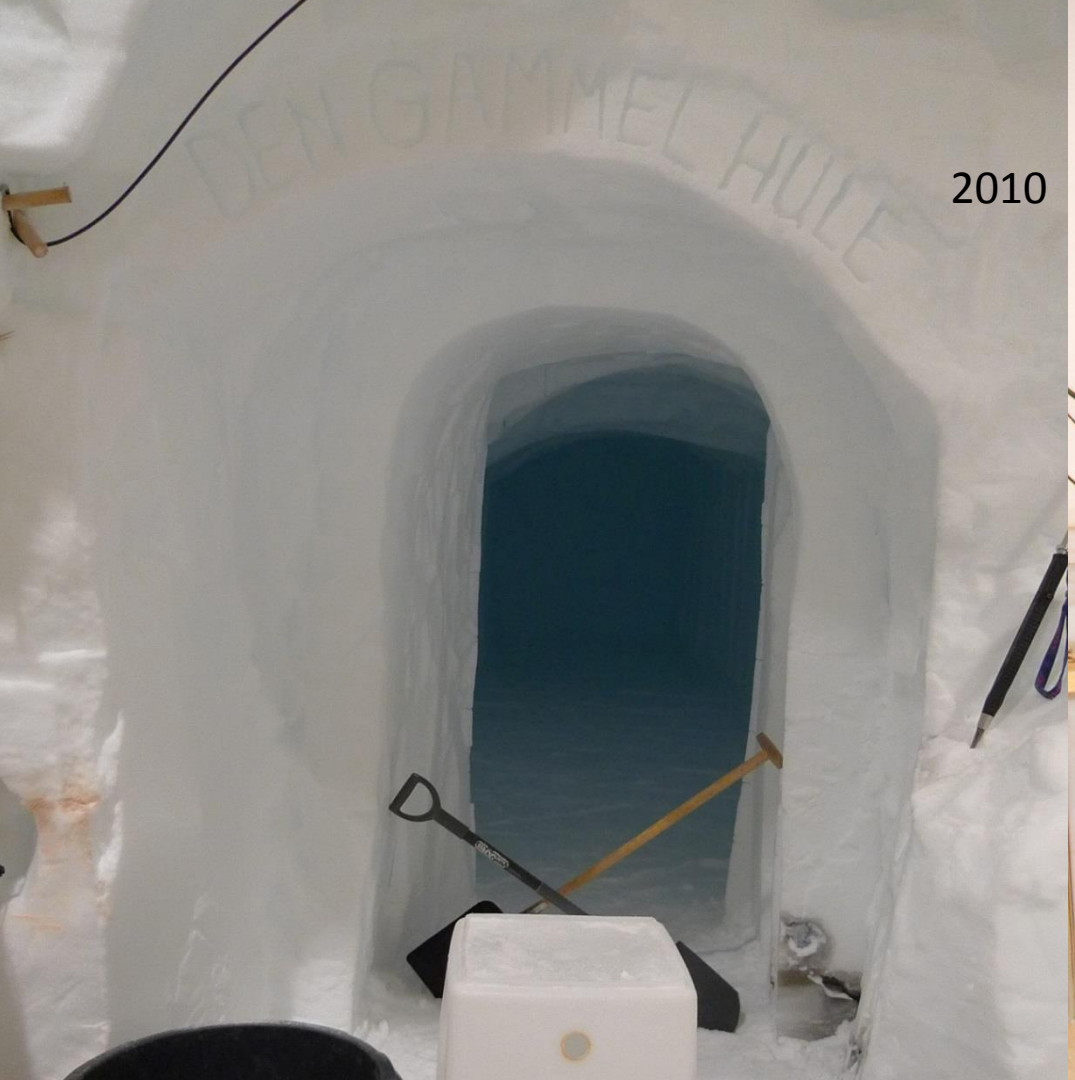
Balloon trenches.

Picture: Balloon trench at NEEM 2012 (4.5m diameter x 19.5 m long)

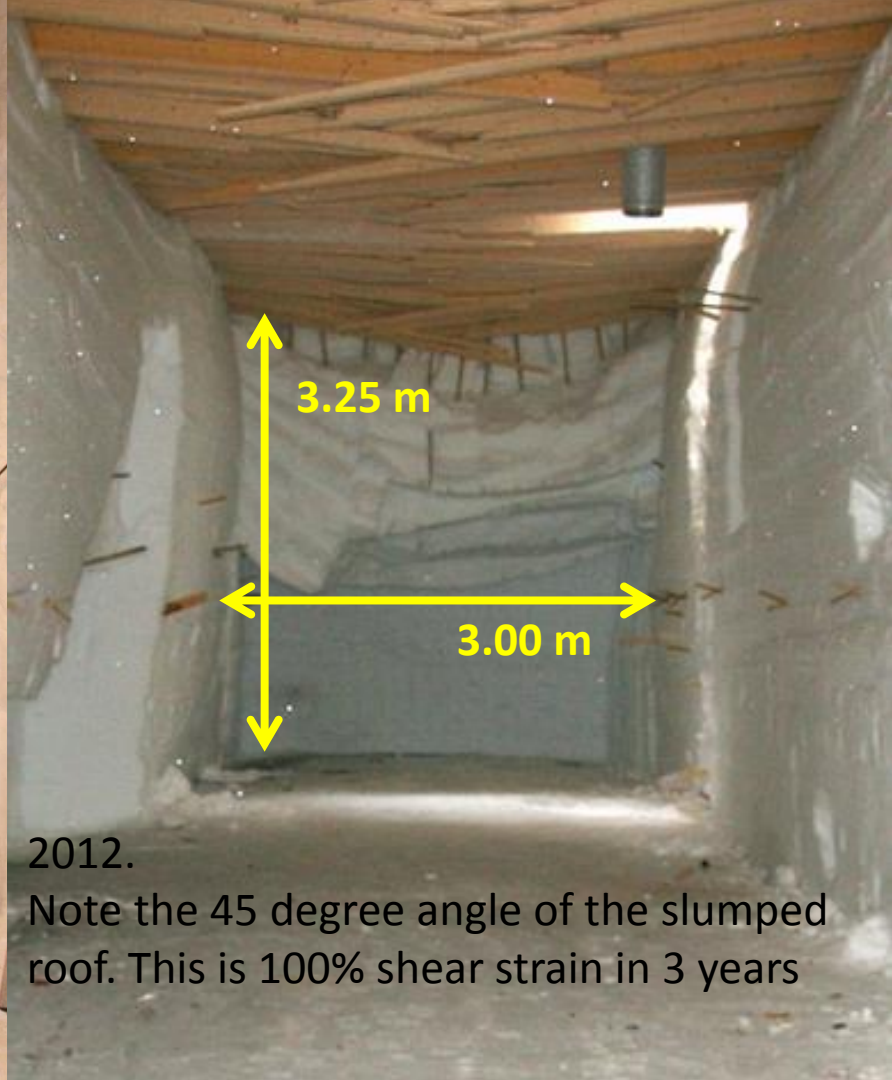
Firn is always compacting and flowing.

2010

2012

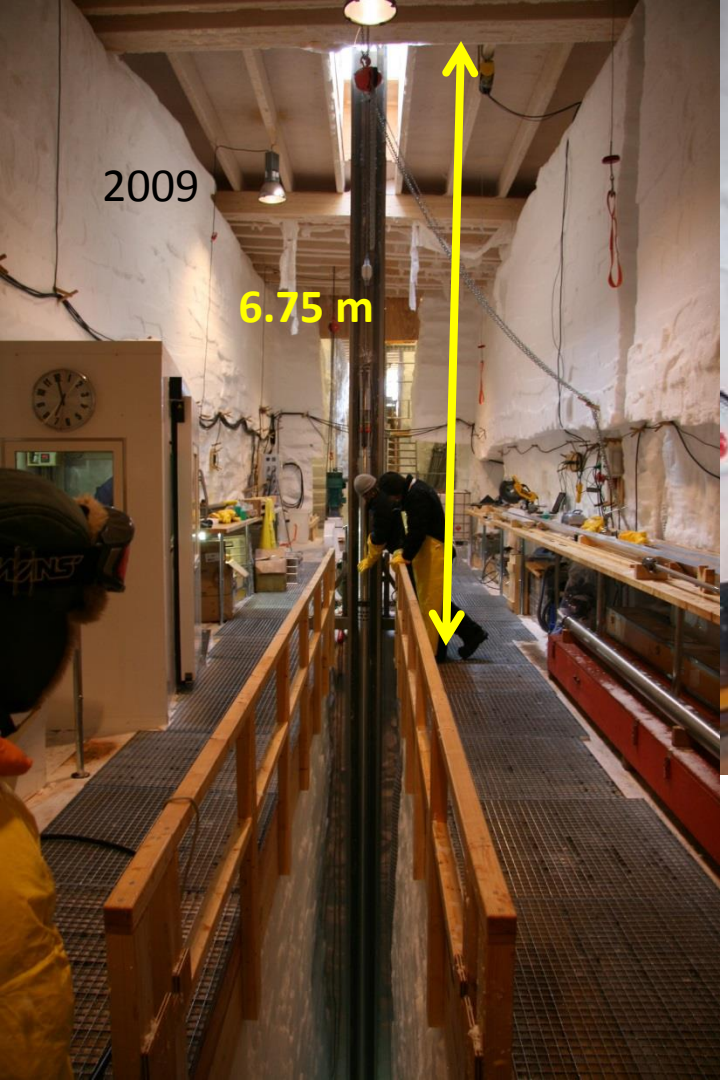


2009

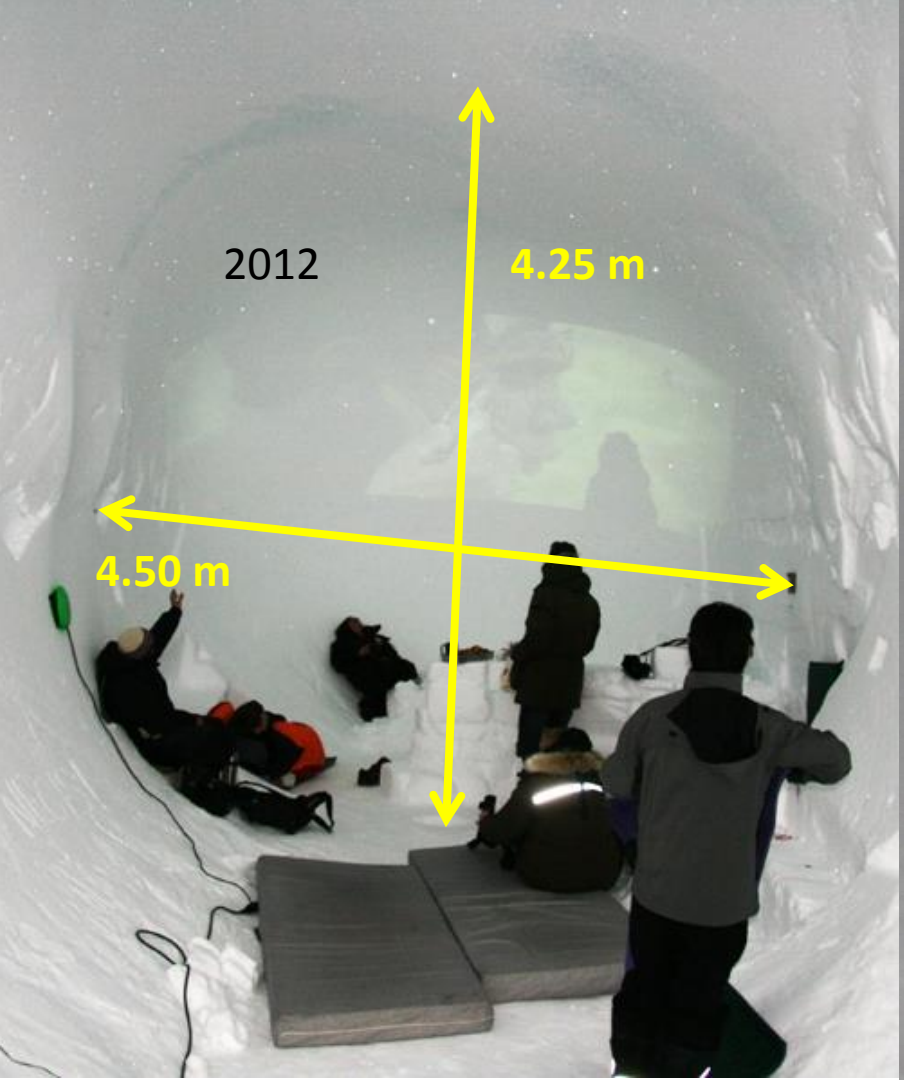


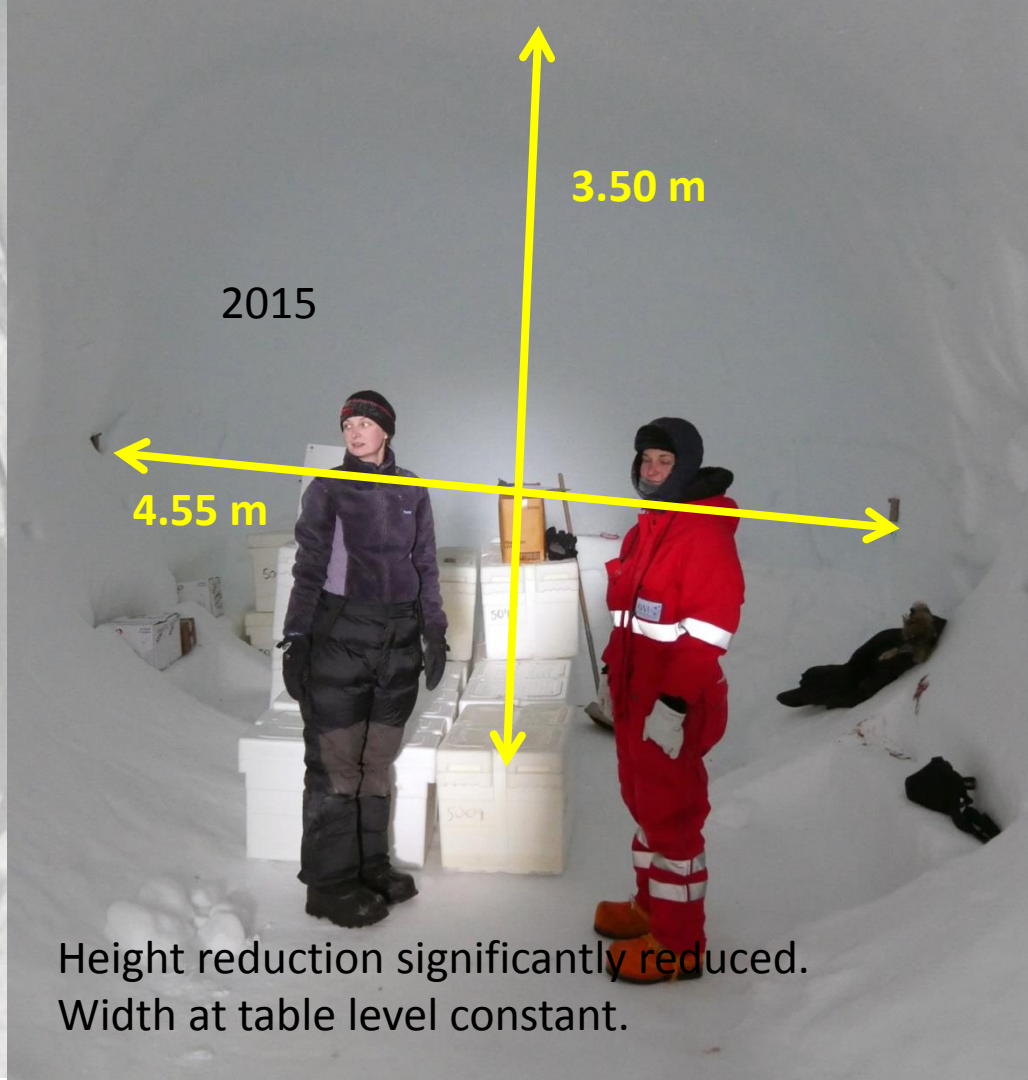
2012.

Note the 45 degree angle of the slumped roof. This is 100% shear strain in 3 years

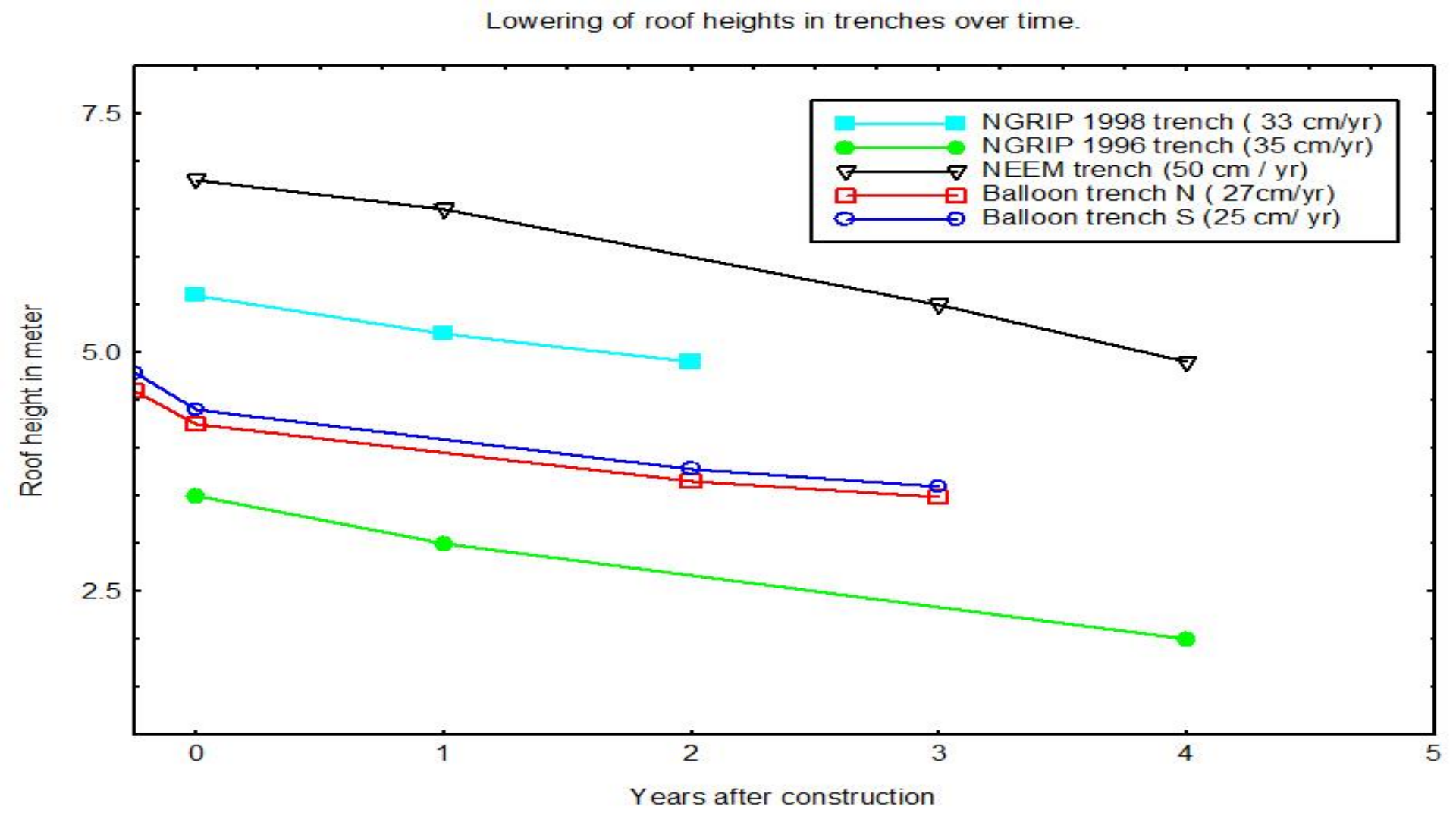


Drill trench in 2009 and 2012. Note, how the walls are slumping in on the tables. Change in width at table height is considerable.





Height reduction significantly reduced.
Width at table level constant.


Lowering of roof heights in trenches over time.
NGRIP 1998 trench (33 cm/yr)
NGRIP 1996 trench (35 cm/yr)
NEEM trench (50 cm / yr)
Balloon trench N (27cm/yr)
Balloon trench S (25 cm/ yr)
Roof height in meter
7.5
5.0
2.5
0
1
2
3
4
5
Years after construction

EGRIP 2016 timeline proposal: 16.September 2015

Here is the proposed timeline for EGRIP. We do not yet know the flight dates; but will assume a flight period every three weeks.
FOM period: FOM office should open one week in advance of put in and close one week after pull-out.
EGRIP: There is no reason to arrive before 1 May to camp.

Camp opening: We need at least 4-5 days to make the skiway ready for 2nd and 3rd flight. Skiway upgrade and certification. Fast electrical connections to garages. Cleaning up cargoline. Weatherstation. Communication. Main dome repair and activation. Cargo: Westa snowblower, balloons, timber, weatherports. NOTE: We need a 2 week flight period here.

Heating, snowmelter: Install, pipes and power lines to main dome, mark and build cable well. Install permanent cables along garage and main dome side of camp.

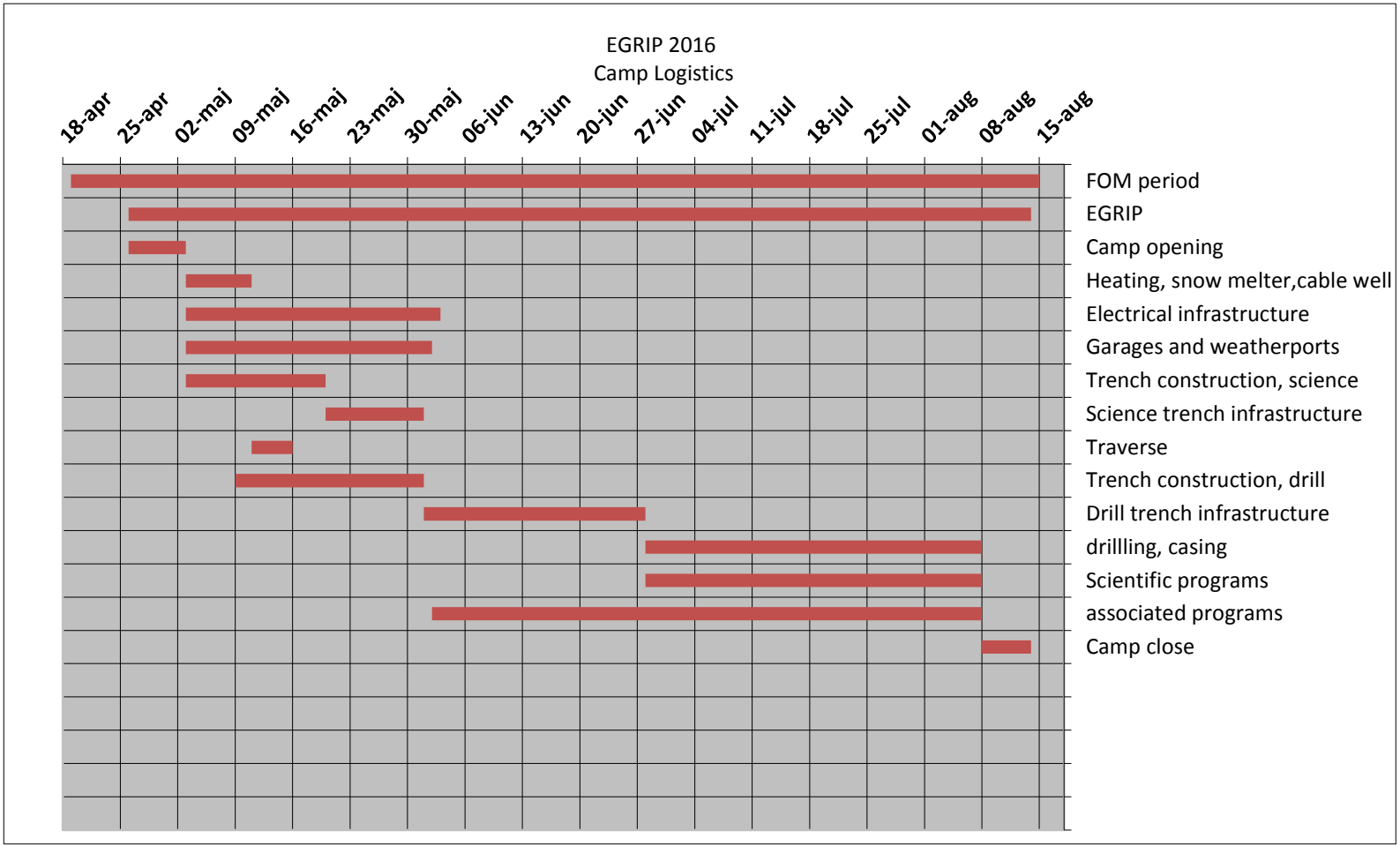
Science trench:	1 day to mark, 5 days to blow, 1 day to inflate, 3 days to back fill, 3 days to harden, 3 days to deflate and trim. 1 x 4m x4m wooden floor/lid for elevator shaft and elevator (pop-up tent on top?). 2x 400 mm ventilation tubes mounted before backfilling.
Traverse:	2 x PB to traverse point (2 x 135 km). 2 days to point. 1 day at site. 2 days return.
Drill trench:	1 day to mark. 5 days to blow. 1 day to inflate. 3 days to back fill. 3 days to harden. 3 days to deflate and trim. 2 x 4m x 4m wooden floor/lid for elevator shaft, stairwell, elevator and stairs (pop-up tents on top?). 2 x 400 mm ventilation tubes mounted before back filling. NOTE: Blowing should be done in two stages: 1.) Down to 3.2 m should be done while backfilling the science trench and tunnels to provide the snow for this operation. 2.) After traverse, continue below 3.2 m depth.

Electrical infrastructure:	Electrical infrastructure on dome side first, then drill side of main street. Science and drill trenches. Powerlines to weatherport points.
Garages and WP:	Extra WP and garage construction. Two 12 x 20 WP (one of them, Freshie shack) and 1 x 10 x 10 WP from Kanger. Renland drill tent and kitchen. Renland 10 x 10 extension as WP. Cooks freezer balloon trench? This point depends on arrival time of Renland cargo in Kanger. Beds and matresses. By end of 2016, EGRIP should have 2 x 10 X 15 WP (already on sled), 1 x 12 x 20 WP quarters, 1 x Renland kitchen as quarters, 2 x 10 x 10 (Stapi and Renland ext.) quarters and two new 12 x 20 WPs. WP capacity will be 18 (max. 36).

Note: Two new WPs demand two extra power points. This is possible towards the apron, as apron will be reduced from 400 feet width to 300 feet. After this, EGRIP capacity will be: 18 (36) in WP, 2 (2) x in tomatoes, 3 (6) in Main dome. Total cap 23(42).

Drill trench infrastruture	Floor, inclined trench, drillers workshop, tables, pilot drilling, rails, winch, tower, drillers cabin (new one to be purchased), ventilation, lighting, roof over elevator shaft and stairwell + 2 tents (pop-up?), elevator, staircase.
Science trench:	Roof over elevator shaft + tent (pop up?) lighting, tables, power, Viessman cabin (test), saws, new Steinweg elevator.
Drilling and casing:	pilot hole, reaming, casing.
Science programs:	Should begin when weatherports are up, and camp can support.
Associated programs:	Other flights and other groups only after camp is fully operational.
Camp close:	10 days to take down and stow WPs and close all systems.

Flight dates:		
EGRIP 2016	26-Apr	
	30-Apr	
	01-May	
	03-May	
	02-Jun	
	06-Jun	
	08-Jun	
	09-Jun	
	25-Jun	
	26-Jun	
	28-Jun	
	14-Jul	
	20-Jul	
	08-Aug	
	11-Aug	
	14-Aug	


EGRIP 2016
Camp Logistics
18-apr
25-apr
02-maj
09-maj
16-maj
23-maj
30-maj
06-jun
13-jun
20-jun
27-jun
04-jul
11-jul
18-jul
25-jul
01-aug
08-aug
15-aug
FOM period
EGRIP
Camp opening
Heating, snow melter,cable well
Electrical infrastructure
Garages and weatherports
Trench construction, science
Science trench infrastructure
Traverse
Trench construction, drill
Drill trench infrastructure
drillling, casing
Scientific programs
associated programs
Camp close