

Please review all of the following information, including the gear allocations and field team information, to ensure accuracy. This plan is an agreement between CH2M HILL Polar Services (CPS) and your group, documenting the logistics support you will receive.

PROJECT INFORMATION

Lead Principal Investigator	Konrad Steffen
Institute	University of Colorado, Boulder, Cooperative Institute for Research in Environmental Sciences
Project Title / Grant #	Surface Processes of the Greenland Ice Sheet Under a Warming Climate
NSF Program and Manager	Other Agency - NASA, Dr. Tom Wagner
PFS Project Manager	Susan Zager

LOGISTICS SUMMARY

This season plan addresses CPS support for a suite of projects carried out by the PI, the main two of which traditionally involve servicing a network of Automated Weather Stations (AWS) and glaciological experiments based from Swiss Camp, near the Jakobshavn Glacier. In 2009, the PI will spent about a month in Greenland, from mid-April until mid-May, working with a team of four to accomplish research on the following projects:

AWS Maintenance

The researchers will maintain the automatic weather station network. In the south, they will service the Dye-II, Saddle, NASA SE and S-Dome stations, and during the Swiss Camp put in the CP1 and NASA-U stations. While at Swiss Camp, the team will service the profile JAR2, JAR1, and CU/ETH. The AWS support flights are shown in the map included with the flight plan (see appendix). CPS note: Though this is a NASA project, NSF provides 50% of the logistics funding support.

Swiss Camp Research

The research team will continue the effort to monitor ablation along a transect from Swiss Camp to the ice margin. The Swiss Camp team will service eight receivers in the GPS network in collaboration with Dr. Jay Zwally (NASA-GSFC). They will continue to collect high-resolution surface topography data using Trimble Pathfinder differential GPS measurements along several transects in the lower ablation region. In addition, they will acquire a set of QuickBird satellite imagery during the onset of melt and the melt period to monitor the spatial variation and extent of snow fields, lakes, and surface hydrological channels in the ablation region.

Ground Penetrating Radar

This project has collected a number of ground penetrating radar (GPR) profiles along the western slope of the ice sheet (Jakobshavn and Kangerlussuaq region) in previous field seasons (1999, 2000, 2003). Data analysis showed that the accumulation could vary up to 40% between the trough and the ridge of the undulation. (Surface topography with scale length of several kilometers plays an important role for the spatial variability of accumulation, mass transfer, and surface energy balance.) The team repeated some of these GPR measurements during the spring 2007 field season along the same profiles to verify the recent accumulation changes and high percolation events in that region.

Media Visitors

In addition to science research, the PI will host two media visits in spring 2009:

- (a) MISCHIEF FILMS, Austrian documentary film about Albert Schweitzer. The crew will participate for one day and one night during the southern AWS maintenance trip.
- (b) National Geographic, documentary called "The Big Picture." The crew visits Swiss Camp May 3-5. They will organize their own helicopter flight from Ilulissat to Swiss Camp and back.

CPS will support the team by arranging travel/lodging for both the NSF-supported (50% of AWS work) and cost-reimbursable (all other NASA) portions of the fieldwork. NASA will pay for its portion of the support via a

combination of interagency funds transfer to NSF and a direct bill arrangement with CPS. CPS also will provide camping gear (including some for media visitors), fuel, safety and communications equipment. The PI will make all other arrangements himself and pay for them with NASA funds.

Note: The PI also receives CPS support for two other projects in Greenland, and the plan for these will be detailed in separate documents:

Boundary layer measurements at Summit Station

A team will return in 2009 to complete an AWS extension and upgrade (new satellite transmitter, new instruments) and for radiation tower extension and other activities. CPS will describe the support plan for this work in another document.

Moulin Depth and Drainage Pathway Monitoring

Steffen (co-PI) may conduct research for this experiment in mid/late August with Alberto Behar (PI). Plans are TBD.

For the complete CPS online project record for this grant, including science objectives, go to:
http://www.polar.ch2m.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=NASAAWS

For up-to-date information on the project's schedule, please view the online Greenland calendar (<http://www.polar.ch2m.com/> > Greenland > Calendars/Schedules).

OUTSTANDING ACTIONS AND NOTES

Issue	Responsibility	Date Completed
Review support plan for accuracy and distribute to all field team members	PI	
Obtain all necessary permits for fieldwork	PI	DPC reference no. 09-233
Visit all hyperlinks and review all documents referred to in the support plan	Entire field team	
Develop a purchase order with CPS prior to field work for direct-bill Jay Zwally helo flight (and any late-season support (TBD))	PI/CPS	
Provide bill for actual costs	CPS	
Provide cost estimate for interagency transfer Provide end-of-season actual costs	CPS	
Note: Passports are required for Air National Guard and international travel. It is a good idea to bring two IDs and to pack a copy of your passport in case the original is lost.	Entire field team	
Complete Critical Success Factors	PI	
Determine what, if any, research will be conducted in August and arrange support/billing; then document in another issuance of plan PRN	PI, CPS	TBD

ALLOCATIONS AND SERVICES

Allocations from Inventory, AWS Traverse

Quant/Unit	Item
1 ea	Coleman stove
1 gal.	Coleman fuel
1 ea	Kitchen box, 5 person
1	Iridium phone, with data port

2	Snow shovels
1	Med kit, remote

Allocations from Inventory, SWISS Camp

Quant/Unit	Item
2	Iridium phones (additional to AWS)
4	Arctic Oven tents
1 ea	Med Kit, remote
3 ea	Gasoline/benzene, 55 gal.
6 ea	Propane, 100 lb. Cylinder
2 gal	2-cycle oil for skidoo mix
4 ea	12 oz. Synthetic chain case oil

For more information on satellite phones, radios, manuals and other field communications support, please visit the CPS communications website at <http://vpr.sri.com>.

CPS will provide the following support, and about 50% of costs will be recouped via an interagency funds transfer between NASA and NSF.

Other Services

Project Allocations	Comments
Clearances arranged for 109 th flights	
User days in KISS	For AWS and Swiss Camp
AirGreenland Twin Otter charter	50% of AWS maintenance site visits paid by NSF; remainder, for Swiss Camp work, paid by NASA
AirGreenland helicopter charter, Swiss Camp	Additional helo to Swiss Camp on May 9 (J. Zwally pull-out), direct bill to CU
Fuel	Paid by NSF; see allocations from inventory, above
Remote medical call-in service	Further information in safety section below

LOCATION INFORMATION

Please visit <http://www.polar.ch2m.com/> and navigate to the Greenland menu for en route and location-specific Greenland information. Prior to deployment, your entire field team should be familiar with the content of the *Greenland Guide* and, if traveling to Summit, with the guidelines provided in the *Summit Users' Guide*. Both are available electronically via our Web site's Greenland menu.

CARGO AND CUSTOMS

All cargo required for your project should arrive in Scotia, NY, **no later than 2 weeks prior** to the desired northbound Air National Guard (ANG) flight, must be entered into our online Cargo Tracking System, and must be properly registered with Customs.

For the most current ANG flight schedule go to <http://www.polar.ch2m.com/> and navigate to Greenland > Calendars/Schedules.

Customs instructions are available on our Web site at <http://www.polar.ch2m.com/> (go to Greenland > Customs). More information is available via the *Greenland Guide*, under Greenland on the CPS site.

The following is our current understanding of your overall cargo requirements:

Cargo List

Items	Weight/Cube
Submitted itemized cargo list via CTS system	

SUPPORT SCHEDULE, AWS MAINTENANCE

Approx Date	Location	Activity
19 Apr 09	NY > SFJ	Researchers arrive in Kangerlussuaq (Colgan, McGrath)
20 Apr 09	SFJ	Researchers prepare for fieldwork
20 Apr 09	CPH > SFJ	Steffen arrives with Air Greenland
21 Apr 09	SFJ > NASA SE, Saddle > SFJ	AWS maintenance flights
22 Apr 09		Weather day.
23 Apr 09	SFJ > Saddle, S-Dome, UAK,	AWS maintenance, camping overnight
24 Apr 09	UAK > S. Dome > Dye2 > SFJ	AWS maintenance
25 Apr 09		Weather day
26 Apr 09		Weather day
27 Apr 09	CPH > SFJ	J. Zwally arrives with Air Greenland
27 Apr 09	SFJ-Swiss>NASA U > UPN>SFJ	AWS maintenance & cargo to Swiss Camp
28 Apr 09	SFJ > Swiss > NASA U > UPN > CP1 > Swiss > SFJ	AWS maintenance & cargo to Swiss Camp

SUPPORT SCHEDULE, SWISS CAMP

Approx Date	Location	Activity
09 May 09	Ilulissat > Swiss > Ilulissat	J. Zwally leaves with Helicopter
18 May 09	SFJ>Swiss> Up50>Swiss>SFJ	Fuel, gases in, pax out (Steffen). *** TO shared with Harper project
19 May 09	SFJ>Swiss>SFJ	Fuels in, cargo + remaining pax out
19 May 09	SFJ>Summit	Steffen via 109 th .
21 May 09	SFJ>NY	Colgan, McGrath leave via 109 th .

For the most up-to-date information on the project's schedule, please view the online Greenland calendar (<http://www.polar.ch2m.com/> > Greenland > Calendars/Schedules).

FIELD TEAM INFORMATION, AWS + SWISS AMP

Name	Location	Date In	Date Out	Email
Colgan, William	Kangerlussuaq	19 Apr 09	28 Apr 09	William.Colgan at Colorado.edu
	Swiss Camp	28 April 09	19 May 09	
McGrath, Daniel	Kangerlussuaq	19 Apr 09	28 Apr 09	daniel.mcgrath at colorado.edu
	Swiss Camp	28 Apr 09	19 May 09	
Steffen, Konrad	Kangerlussuaq	20 Apr 09	28 Apr 09	konrad.steffen at colorado.edu
	Swiss Camp	28 Apr 09	18 May 09	
	Summit Station	19 May 09	1 Jun 09	
Zwally, Jay	Kangerlussuaq	4/27/2009	5/11/2009	zwally at icesat2.gsfc.nasa.gov

PROJECT CONTACT INFORMATION

Research Team

Role	Name	Email	Phone / Fax
Principal Investigator	Konrad Steffen	above	303.492.4524 /303.492.1149

CPS Team Members

Contact for	Name	Email	Primary Phone(s)
Greenland planning/project support	Susan Zager	Susan@polarfield.com	Denver: 303.638.6669
Greenland on-island support	Mark Begnaud	Mark at polarfield.com	Denver: 720.320.6160 Greenland: 011.299.524218
Greenland on-island support, Cargo	Ed Stockard	Ed at polarfield.com	Greenland: 011.299.524281
Scotia operations & customs	Earl Vaughn	Earl Vaughn at gmail.com	Scotia: 518.331.3103
Sat phones & comms	Roy Stehle	Roy Stehle at sri.com	Menlo Park: 650.859.2552
RMI	Kyli Olson	Kyli at polarfield.com	Denver: 303.489.2151
Purchase orders	Steve Heiman	Steve Heiman at ch2m.com	Tel: 720.286.2277 Fax: 720.286.9287

CPS Offices

Denver	Kangerlussuaq	Scotia
CH2M HILL Polar Services 8110 Shaffer Parkway Suite 150 Littleton, CO 80127 Tel: 303.984.1450/1439 Fax: 303.984.1445	CH2M HILL Polar Services Postboks 1015 DK-3910 Kangerlussuaq, Greenland Tel: 011.299.841598 Fax: 011.299.841599	Earl Vaughn C/O 109 th Aerial Port Bldg. 20 Stratton Air Base Scotia, NY 12302-9752 Tel: 518.344.2635 Cell: 518.331.3103 Fax: 518.344.2537

Other

Organization	Internet	Phone
Remote Medical International (RMI) (see below for Remote Telemed #)	http://www.remotemedical.com/	Office: 800.597.4911

SAFETY, ENVIRONMENT, HEALTH and PERMITS

All science teams planning to conduct research in Greenland must complete an **annual application** in order to obtain approval from the Danish Polar Center (DPC). The application forms are available from the DPC at <http://www.dpc.dk/>. Applications are submitted directly through the DPC. For assistance with the application process, contact:

Poul Henrik Sorensen
 E-mail: phs at dpc.dk
 Telephone: +45 3288 0100

If you need medical advice/assistance, do not hesitate to contact Remote Medical International (RMI) using the card included with the medical kit or the information below. Be sure that each team member knows where the kit is located and understands how to use the RMI service in the field. For further information on RMI, please visit our Web site <http://www.polar.ch2m.com/> and navigate to Medical>Remote Medical Services/Kits.

RMI 24/7 Telemed Service

Primary: 206.734.3430
 Alternate: 360.754.9805
 Member ID: CH2M HILL Polar Services

CRITICAL SUCCESS FACTORS

Please list the factors that are most important for the success of your science. We track these factors in order to measure the success of CPS' support. Examples might be the availability of the helicopter or camp gear.

Factors
NASA SWISS CAMP
Planning field season prior to field deployment
Purchasing fuels and gas for field camp
Cargo shipment via 109th to/from SFJ
Logistics support arranging Twin Otter charter
Logistics support in Kangerlussuaq prior to field work
Communication support during AWS maintenance in the field
Office support at KISS (email, fax, phone)
AWS SUPPORT
Planning field season prior to field deployment
Cargo shipment via 109th to/from SFJ
Logistics support arranging Twin Otter charter
Logistics support in Kangerlussuaq prior to field work
Field equipment and camp equipment support
Communication support during field project
Office support at KISS (email, fax, phone)
Post-expedition briefing and feed back

GOVERNMENT AND PERFORMANCE REPORTING ACT OF 1993 (GPRA)

NSF/OPP requires your help in complying with the Government Performance and Reporting Act of 1993 (GPRA). One measure of CPS' performance is a "facility-performance metric" which counts the number of productive days your project has in the field while relying on CPS facilities or support. Please keep track of any "lost days" and report these to us at the end of the season.

APPENDIX

Flight Plan

University of Colorado – 2009 Greenland Field season
Tentative flight schedule for Twin Otter

19 April: Arriving from CONUS with 109th

AWS Maintenance (5773 km, 25.6 hours)

Flight path ***Distance (km)***

21 April, 2009: southern AWS traverse, (Steffen, McGrath, Colgan, xx) 4 PAX

SFJ – NASA SE	363	Extend tower 4 h
NASA SE – Saddle	104	Extend tower, overnight
Saddle – SFJ	295	Twin returns
Total	762	~ 3.6 hours

22 April, 2009: bad weather day

23 April, 2009: southern AWS traverse, 4 PAX

SFJ – Saddle	295	Twin Otter pick up
Saddle – S-Dome	316	Extend tower 4 h, overnight
S Dome – Narsassuaq	220	Pilot overnight
Total	831	~ 3.6 hours

24 April, 2009: southern AWS traverse, 4 PAX

Narsassuaq – S Dome	220	Twin Otter pick up
S Dome – Dye-II	376	Extend tower, 4 h
Dye-II – SFJ	202	
Total	789	~ 3.5 hours

25 April, 2009: bad weather day

26 April, 2009: bad weather day

27 April, 2009: northern AWS traverse & cargo to Swiss Camp, 4 PAX

SFJ – Swiss Camp	289	Cargo and PAX
Swiss Camp – NASA U	472	Tower extension, overnight
NASA U – Upernavic	200	Twin Otter, refuel
Upernavic – SFJ	600	Twin Otter return
Total	1561	~7.0 hours

28 April, 2009: northern AWS traverse & cargo to Swiss Camp, 4 PAX

SFJ – Swiss Camp	289	Cargo and 1 PAX (Zwally, stays at camp)
Swiss Camp – NASA U	472	pick-up PAX
NASA U – Upernavic	200	Twin Otter, refuel
Upernavic – CP1	485	download 1 hour
CP1 – Swiss Camp	95	4 PAX stay at Swiss Camp
Swiss Camp – SFJ	289	Twin Otter return
Total	1830	~8.1 hours

SWISS CAMP (1256 km, 5.9 hours)

Flight path ***Distance (km)***

19 May, 2009: 3 PAX with cargo for Swiss Camp (Steffen, Zwally, Colgan)
 SFJ – Swiss Camp 289 fuel for next season (propane, gas)
 Swiss Camp – Up50 50 GPS station, download data
 Up50 – Swiss Camp 50 pull out cargo and PAX
 Swiss Camp – SFJ 289 empty fuel drums out
Total **678** **~ 3.0 hours**

19 May, 2009: 2 PAX and cargo Swiss Camp (McGrath,xx)
 SFJ – Swiss Camp 289 fuel for next season (propane)
 Swiss Camp – SFJ 289 PAX and cargo
Total **578** **~ 2.5 hours**

21 May: Leaving south to CONUS with 109th

Project:	AWS	& Swiss Camp	Total
Distance (km)	5773 km	1256 km	7029 km
Twin Otter time (hours)	26 hours	6 hours	32 hours

Station Name	Latitude	Longitude	Altitude (m)
Swiss Camp	69° 33' 49" N	49° 20' 09" W	1122
Crawford Pt.	69° 52' 37" N	47° 00' 12" W	2004
DYE-2	66° 28' 50" N	46° 16' 59" W	2099
Saddle	65° 59' 59" N	44° 30' 04" W	2499
NASA SE	66° 28' 45" N	42° 29' 56" W	2100
S Dome	63° 08' 56" N	44° 49' 02" W	2901
NASA U	73° 50' 29" N	49° 30' 25" W	2334
Up50	69° 44' 51" N	48° 07' 46" W	1700

