

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), formerly VECO Polar Resources, and your group, documenting the logistics support you will receive.

## SECTION ONE: PROJECT INFORMATION

<b>Lead Principal Investigator</b>	Konrad Steffen
<b>Institute</b>	University of Colorado, Boulder, Cooperative Institute for Research in Environmental Sciences
<b>Project Title / Grant #</b>	Greenland Climate Network (GC-Net) (NASA AWS)
<b>NSF Program and Manager</b>	Other Agency - NASA, Dr. Seelye Martin
<b>CPS Project Manager</b>	Jason Buenning

### Logistics Summary

In 1995, the PI began installing a network of Automated Weather Sites (AWS) on the Greenland ice cap. Each year since then, a team of four to five travels to the project's sites via Twin Otter for maintenance, repairs, and upgrades. Additionally, the team tent-camps at Swiss Camp for several weeks to conduct more intensive measurements related to the state of the ice sheet. These include monitoring ablation in the Jakobshavn region (in collaboration with Dr. Jay Zwally [NASA-GSFC]); measuring accumulation variability, mass transfer, and surface energy balance; and, new at Swiss Camp in 2008, a UAV equipped with laser instruments to collect high-resolution data about surface water storage.

#### **AWS Maintenance:** (See the appendix for more information on site visits planned for 2008)

A team yearly visits some subset of the PI's AWS stations for data downloading and instrument upgrades/maintenance. Though the PI plans his itinerary ahead of time, weather and other issues sometimes require in-field changes to the plan. A team of five will begin the northern, Twin Otter-supported traverse from Qaanaaq in mid-April, and spend ~ 5-6 days servicing Petermann ELA, Humboldt, Thule, GITS, NEEM1, DMI, Tunu-N, NASA-U, and Summit. The team will overnight at Qaanaaq, Thule, Tunu-N and Summit.

The team will return to Kangerlussuaq after completing the northern work, and launch a day or so later on the southern Twin Otter-supported traverse, which consists of visits to Dye2, NASA SE, Saddle, and S-Dome. This work should be completed in about one full day's effort.

The researchers will also service a suite of AWS instruments when based at Swiss Camp after the Twin Otter-supported traverses.

For a map showing the planned traverses, see the appendix.

PFS note: Though this is a NASA project, NSF provides 50% of the logistics funding support for this effort.

#### **GPS Network Maintenance**

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 sequence Landsat TM, ASTER, and 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.

### Moulin Study

For a NASA study of englacial water flow through moulins, Dr. Alberto Behar, the PI and his graduate students will collect information on moulins prior to melt season by using a video-camera system developed by NASA/JPL, linked with a GPS system through an open moulin. The team will install a number of instruments in the sub-surface hydrological channels to monitor the physical properties of the ice and the onset of melt water flow within the ice sheet.

### UAV Data Collection

This NOAA-funded project uses a UAV based in Ilulissat to collect high-resolution laser data around Swiss Camp during the pre-melt and melt season. These data are used to calculate surface water storage on the ice sheet. The information contributes to the PI's sub-glacier hydrological modeling study ("GPS Network Maintenance," above). The PI's graduate student, John Adler, will fly the UAV in early May and again in July to collect the data in the second and final field season for this project.

### Media Visitors

In addition to science research, the PI will host a number of national and international media outlets. These groups make their own arrangements and pay for all expenses associated with their visits. The PI will coordinate these visits himself, and will use the media groups' airlift as supplemental support for his projects.

### Summit Station BSRN project maintenance

In addition, in 2008, the PI and one of the PI's students will spend about two weeks at Summit Station (traveling to/from via Kangerlussuaq) to maintain the Baseline Surface Radiation Network sensors and the 50m Swiss tower. CPS will document that field work in a separate season plan.

For each year of the grant,

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

For the complete CPS online project record for this grant, including science objectives, go to:

[http://www.vecopolar.com/arlss\\_reports/arlss\\_projectsdetail.asp?cbPropNum=NASAAWS](http://www.vecopolar.com/arlss_reports/arlss_projectsdetail.asp?cbPropNum=NASAAWS)

For up-to-date information on the project's schedule, please view the online [Greenland calendar](#)

([www.vecopolar.com](http://www.vecopolar.com) > Greenland > Calendars/Schedules).

## SECTION TWO: SEASON FIELD PLANS

### Outstanding Actions and Notes

Issue	Responsibility	Date Completed
Review support plan for accuracy and distribute to all field team members	PI	2-20-2008
Obtain all necessary permits for fieldwork	PI	Koni submitted

Visit all hyperlinks and review all documents referred to in the support plan	Field Team Members	2-20-2008
Contact the GEOSummit Science Coordination Office (SCO) <a href="mailto:sco@summitcamp.org">mailto:sco@summitcamp.org</a> regarding your project's plans for the season	PI	Participated in telephone conference
Provide cost estimate for billable support  Develop a purchase order with CPS prior to field work Provide bill for actual support <b>Note: Actual costs likely will differ from those reflected in the cost estimate due to exchange rates and other influences.</b>	CPS  PI  CPS	Completed—see appendix
Provide cost estimate for interagency transfer Provide end of season actual costs	CPS CPS	2-29-2008
<b>Please note this important information for your field team: Notify field team that they must bring 2 forms of ID-including a valid passport- to enter Greenland.</b>	Field Team Members	Noted
Complete Critical Success Factors	PI	2-20-2008

## Allocations and Services

### Southern & Northern AWS Traverse

Quant/Unit	Item	Comments
1ea	Coleman Stove	
1gallon	Coleman fuel	
1ea	Kitchen box	5 person kitchen box
1	Iridium phones	Need one data port. Phone will be used at Swiss Camp too.
2	Snow shovels	Will return after AWS tour
1ea	Medical First Aid Kit, Remote	

### Swiss Camp Project

Quant/Unit	Item	Comments
2	Iridium phones	In addition to phone used on traverse
7	Arctic Oven tents	For media visits and additional crew
4	Sleeping Bag	For media visits
4	Sleeping Pad	For media visits
4	Cots	For media visits
4	Sleeping bag fleece liner	For media visits
1ea	Medical First Aid Kit, Remote	From AWS traverse
3 ea	Gasoline/Benzine – 55 gal drum	Need for put-in
6 ea	Propane (100 lb cylinder– European)	During pull-out flight
2 gallons	Two-cycle oil for skidoo fuel mix	
4 ea	12 oz synthetic chain case oil	For new skidoo

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

NSF supports 50% of the AWS work, with the exception of providing all Summit user days. The other NASA- and NOAA-funded work is cost-reimbursable on a direct-bill basis. Please see the Appendix for an estimated cost.

Other Services

Project Allocations	Comments
Clearances arranged for 109 <sup>th</sup> flights	
Clearances arranged for entry to Thule AFB	
User days in Kangerlussuaq-KISS	5 persons April 21 5 persons April 30 – May 2 2 persons May 5 (Zwally, Behar) 3 person May 17 (Zwally, Steffen, Behar) 4 persons June 5-7
Arrange AirGL Twin Otter support for Southern & Northern AWS traverse and Swiss Camp Put-in, April 24-May 5	For detailed schedule, see Appendix 2
Arrange lodging in Qaanaaq ~April 23 for Steffen + 4	
Arrange lodging at North Star Inn, Thule ~April 24 for Steffen + 4, and 3 person Twin Otter crew	
Arrange lodging in DMI ~April 25/26 for 3-person Twin Otter crew	Steffen +4 will camp at Tunu-N
Arrange lodging at Summit Camp April 27 for Steffen + 4, and 3-person Twin Otter crew	CPS doesn't charge for user days for NASA part of the work.
Arrange lodging at Hotel Hvide Falk in Ilulissat ~April 22 Steffen and 4 students on their way north to Qaanaaq	
Arrange commercial AirGL ticketing SFJ>JAV on April 22 & JAV>NAQ on April 23	
Arrange AirGL Twin Otter support for Swiss Camp Pull-out June 4	For detailed schedule, see Appendix 2
Warehouse space in Kanger for UAV	TBD

Location Information

Please visit <http://www.vecopolar.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.vecopolar.com> and navigate to Greenland > Calendars/Schedules.

Customs instructions are available on our website at <http://www.vecopolar.com> (go to Greenland > Customs)

Cargo List for AWS

Items from CU	More info:
6 boxes shipped on 2/22/08 to NY. These boxes were shipped on the Host Tenant flight up to SFJ and onward to Thule, (with additional gear waiting in Kanger) where Dr. Steffen and his AWS team will meet the gear and begin the AWS Twin Otter traverse.	2 med. Edaks, 2 small Edaks, 1 large Edak, and Tool box.

**Cargo List for Swiss Camp**

Items	Weight/Cube
List still forthcoming	

**Cargo List for UAV**

Items	Weight/Cube
2ea	53"L x 58"W x 24" Tall, weight 150 lbs each
4ea	26"L x 58"W x 24" Tall, weight 125 lbs each

**Support Schedule (for Twin Otter AWS schedule see appendix for the flight plan)**

Approx Date	Location	Activity
4/21/08	NY>SFJ	Steffen, Phillips, Sampson, McGrath, & Colgan to Kanger via 109 <sup>th</sup>
4/22/08	SFJ>JAV	Steffen, Phillips, Sampson, McGrath, & Colgan to Ilulissat
4/23/08	JAV>NAQ	Steffen, Phillips, Sampson, McGrath, & Colgan to Qaanaaq
4/24/08>5/2/08	Details below	AWS traverse and first Swiss Camp put-in
5/4/08	NY>SFJ	Zwally, Behar, & Adler to Kanger via 109 <sup>th</sup>
Early May & July	SFJ>JAV	John Adler to Ilulissat. Two trips potentially to be made (the researcher will plan his own travel in Greenland; hence CPS does not have much information on his itinerary between trips to Ilulissat).
5/5/08	SFJ>SC	Zwally & Behar put-in to Swiss Camp
~5/16/08	SC>SFJ	Steffen, Zwally, & Behar to Kanger via media flight TBD
5/18/08	SFJ>NY	Steffen, Zwally, & Behar to NY via 109 <sup>th</sup>
6/4/08	SC>SFJ	Phillips, Sampson, McGrath, & Colgan pull-out of Swiss Camp
6/7/08	SFJ>NY	Phillips, Sampson, McGrath & Colgan to NY via 109 <sup>th</sup>

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

**Field Team Information**

Name	Location	Date In	Date Out	Email
Konrad Steffen	Greenland	21 April	18 May	<a href="mailto:Konrad.steffen@colorado.edu">Konrad.steffen@colorado.edu</a>
Kevin Sampson	Greenland	21 April	7 June	<a href="mailto:Kevin.Sampson@colorado.edu">Kevin.Sampson@colorado.edu</a>
William Colgan	Greenland	21 April	7 June	<a href="mailto:William.Colgan@Colorado.EDU">William.Colgan@Colorado.EDU</a>
Thomas Phillips	Greenland	21 April	7 June	<a href="mailto:Thomas.Phillips@colorado.edu">Thomas.Phillips@colorado.edu</a>
Dan McGrath	Greenland	21 April	7 June	<a href="mailto:daniel.mcgrath@colorado.edu">daniel.mcgrath@colorado.edu</a>
Jay Zwally	Greenland	4 May	18 May	<a href="mailto:zwally@icesat2.gsfc.nasa.gov">zwally@icesat2.gsfc.nasa.gov</a>
Alberto Behar	Greenland	4 May	18 May	<a href="mailto:alberto.behar@jpl.nasa.gov">alberto.behar@jpl.nasa.gov</a>
John Adler	Greenland	4 May	12 July	<a href="mailto:john.adler@Colorado.EDU">john.adler@Colorado.EDU</a>

**Project Contact Information**
**Research Team**

Role	Name	Email	Phone / Fax
Principal Investigator	Konrad Steffen	<a href="mailto:konrad.steffen@colorado.edu">konrad.steffen@colorado.edu</a>	303.492.4524 / 303.492.1149

**Gear Shipping Address**

University of Colorado, CIRES, CB 216, Ekeley Building, Room 305, Boulder, CO 80309-0216 Tel: 303 492 4524
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**SECTION THREE: CPS CONTACT INFORMATION**
**CPS Team Members**

Contact for	Name	Email	Primary Phone(s)
Greenland operations (project support)	Jason Buenning	<a href="mailto:jason@polarfield.com">jason@polarfield.com</a>	Denver: 303.638.6669
Greenland operations (On-island support)	Mark Begnaud	<a href="mailto:mark@polarfield.com">mark@polarfield.com</a>	Denver: 720.320.6160 Greenland: 011.299.524218
Greenland operations (project support)	Robin Abbott	<a href="mailto:robin@polarfield.com">robin@polarfield.com</a>	Denver: 303.748.8507
Summit operations	Sandy Starkweather	<a href="mailto:sandy@polarfield.com">sandy@polarfield.com</a>	Denver: 303.518.8714
Sat phones & comms	Roy Stehle	<a href="mailto:roy.stehle@sri.com">roy.stehle@sri.com</a>	Menlo Park: 650.859.2552
Medical & RMI	Kyli Olson	<a href="mailto:kyli@polarfield.com">kyli@polarfield.com</a>	Denver: 303.489.2151
Thule operations	Susan Zager	<a href="mailto:susan@polarfield.com">susan@polarfield.com</a>	Denver: 720.320.6159
Denver operations	Jill Ferris	<a href="mailto:jill@polarfield.com">jill@polarfield.com</a>	Denver: 720.320.6155
Scotia operations & customs	Earl Vaughn	<a href="mailto:earl.vaughn@gmail.com">earl.vaughn@gmail.com</a> <a href="mailto:vprscotia@hughes.net">vprscotia@hughes.net</a>	Scotia: 518.331.3103
Purchase orders	Jan Zanetell	<a href="mailto:Janet.Zanetell@ch2m.com">Janet.Zanetell@ch2m.com</a>	720.286.9168

**CPS Offices**

Denver	Kangerlussuaq	Scotia
CH2M HILL Polar Services Western Office 8110 Shaffer Parkway Suite 150 Littleton, CO 80127 Tel: 303.984.1450/1439 Fax: 303.984.1445	CH2M HILL Polar Services Attn: Name of Employee/Researcher Postboks 1015 DK-3910 Kangerlussuaq, Greenland Tel: 011.299.841598 Fax: 011.299.841599	Earl Vaughn C/O 109 <sup>th</sup> Aerial Port Bldg. 20 Stratton Air Base Scotia, NY 12302-9752 Tel: 518.331.3103 Fax: 518.334.2537

**Summit Station**

Summer
CH2M HILL Polar Services Attn: Name of Employee/Researcher - Summit Station C/O Earl Vaughn 109 <sup>th</sup> Aerial Port Bldg. 20 Stratton Air Base Scotia, NY 12302-9752 Tel: 518.331.3103 Fax: 518.334.2537

**Other**

Organization	Internet	Phone
Remote Medical International	<a href="http://www.remotemedical.com/">http://www.remotemedical.com/</a>	1.206.734.3430
Summit Science Coordination Office	<a href="http://www.geosummit.org">http://www.geosummit.org</a> <a href="mailto:sco@summitcamp.org">sco@summitcamp.org</a>	John Burkhart 209.658.7142

## SECTION FOUR: SAFETY, ENVIRONMENT, HEALTH and PERMITS

### 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@dpc.dk](mailto:phs@dpc.dk)

Telephone: +45 3288 0100

### Remote Medical International (RMI) Support

If you need medical advice/assistance, don't 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 website <http://www.vecopolar.com/> and navigate to Medical>Remote Medical Services/Kits.

RMI contact information:

Phone: 206.734.3430

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
<b>NASA SWISS CAMP</b>
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)
<b>AWS SUPPORT</b>
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.

## **Appendices**

Flight Schedule  
Planned station visits  
Map showing site locations

**NORTHERN TRAVERSE (4346 km)**

<i>Flight path</i>	<i>Distance (km)</i>	
24 April, 2008, Northern AWS traverse, Steffen, Philips, Colgan, McGrath, Sampson		
Qaanaaq–Petermann ELA	380	Download data, exchange batteries: 2 hour stop
Peterm. ELA - Humboldt	50	Download data, extend tower: 4 h
Humboldt - Thule	355	
<b>Total</b>	<b>785</b>	<b>~3.5 hours</b>
25 April 2008, Northern AWS traverse: 5 PAX		
Thule –GITS	210	Download data, 1 hour
GITS – NEEM1	250	download data, 1 hour
NEEM1 – Tunu-N	400	extend tower, pax overnight
Tunu-N-DMI	395	Pilot stay overnight
<b>Total</b>	<b>1255</b>	<b>~ 5.6 hours</b>
26 April 2008, Northern AWS traverse; bad weather day		
27 April, 2008, Northern AWS traverse, 5 PAX		
DMI – Tunu-N	395	pick up 5 pax
Tunu-N – NASA-E	351	Download data, 1.5 h
NASA-E – Summit	380	Overnight, download AWS
<b>Total</b>	<b>1130</b>	<b>~ 5.0 h</b>
28 April, 2008, Northern AWS traverse, 5 PAX		
Summit - NASA-U	381	Download 1.5 h
NASA-U – CP1	450	Download 1.5 h
CP1 – SFJ	345	
<b>Total</b>	<b>1176</b>	<b>~ 5.2 h</b>
29 April 2008: Kangerlussuaq bad weather or rest day		

**SOUTHERN AWS TRAVERSE (1289 km)**

<i>Flight path</i>	<i>Distance (km)</i>	
30 April 2007: southern AWS traverse, 5 PAX		
SFJ – Dye2	202	Download data only, 1.5 hour
Dye2 – NASA SE	167	Download data: 1.5 hour stop
NASA SE – Saddle	104	Download 1.5 h
Saddle – S-Dome	316	Download 1.5 h
S-Dome – SFJ	500	
<b>Total</b>	<b>1289</b>	<b>~ 5.8 hours</b>

**SWISS CAMP TOUR (1944 km)**

<i>Flight path</i>	<i>Distance (km)</i>	
2 May, 2007: 5 pax and cargo flight for Swiss Camp (Steffen, Colgan, Sampson, McGrath, Philips)		
SFJ – Swiss Camp	289	Cargo and PAX
Swiss Camp – SFJ	289	old skidoo and trash out
<b>Total</b>	<b>578</b>	<b>~ 2.5 hours</b>
5 May, 2008: 2 pax with cargo for Swiss Camp (Zwally, Behar)		
SFJ – Swiss Camp	289	Cargo and PAX

Swiss Camp – Up50	50	GPS station, download data
Up50 – N70	90	GPS station, download data
N70 – Swiss Camp70		
Swiss Camp – SFJ	289	empty fuel drums out
<b>Total</b>	<b>788</b>	<b>~ 3.5 hours</b>

4 June, 2007, 2003: 4 PAX with cargo for Swiss Camp (Philips, Colgan, McGrath, Sampson)

SFJ – Swiss Camp	289	fuel for next season (propane)
Swiss Camp – SFJ	289	PAX and cargo
<b>Total</b>	<b>578</b>	<b>~ 2.5 hours</b>

**Note:** The Steffen/Zwally/Behar take-out planned for ~16 May will be arranged via flights of opportunity provided by media visitors. The PI will make these arrangements.

<b>Project:</b>	<b>AWS</b>	<b>&amp; Swiss Camp</b>	<b>Total</b>
<b>Distance (km)</b>	<b>5635 km</b>	<b>1944 km</b>	<b>7,579 km</b>

### NASA AWS Site Visits 2008

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
Summit	72° 34' 46" N	38° 30' 19" W	3208
DYE-2	66° 28' 50" N	46° 16' 59" W	2099
Saddle	65° 59' 59" N	44° 30' 04" W	2499
S Dome	63° 08' 56" N	44° 49' 02" W	2901
GITS	77° 08' 15" N	61° 02' 28" W	1869
NASA U	73° 50' 29" N	49° 30' 25" W	2334
NASA SE	66° 28' 45" N	42° 29' 56" W	2373
Humboldt	78° 31' 37" N	56° 50' 10" W	2000
Petermann ELA	80° 05' 02" N	58° 04' 02" W	1180
NEEM	77° 30' 09" N	50° 52' 27" W	2450
Qaanaaq	77° 29' 14" N	69° 23' 19" W	0
Thule	76° 31' 49" N	68° 44' 07" W	0
Up50	69° 44' 51" N	48° 07' 46" W	1700
N70	70° 12' 22" N	49° 30' 01" W	1169

