LARISSA

CONCEPT OF OPERATIONS DOCUMENT

2009, 2010 & 2012 SUMMER SEASONS

Cruise NBP10-01

PUQ Jan 2, 2010 – PUQ Mar 2, 2010

Ice Drill Camp

Rothera Jan 1, 2010 - Rothera Feb 15, 2010

United States Antarctic Program

National Science Foundation
PRSS 0000373

Offices of Corollary Responsibility:

Posted: ____

Printed in the U. S. A.

Information contained in this document may be subject to change without notice.

Raytheon Technical Services Company

Polar Services
7400 South Tucson Way
Centennial, Colorado
303.790.8606

Revision Change History

Rev	Date	Section	Author	Change Details
1	1/20/2009	All	Jenkins	Document draft
2	1/22/2009		Jenkins	-added dunk training schedule -added Biology meeting attendees -added NBP10-01 biology participants
3	1/29/2009		Jenkins	-added support request from NSF to BAS at Rothera Station -added mooring recovery/biology operations to 2012 goals -added Media section
4	2/26/2009		Jenkins	-added LMG09-03 Cruise dates -added 2012 Operational Goals -added link to BAS SITREP and photos from 2nd BAS recce flight to Bruce Plateau
5	3/18/2009		Jenkins	-added section on Approved BAS Support -added NBP-Based Science Sampling plans for the initial 10 days of NBP10-01Cruise -added itinerary information for deploying Nat'l. Geo. Team. P.22
6	4/28/2009		Jenkins	
7	4/30/2009		Jenkins	Mooring info added
8	5/20/2009		Jenkins	Terrestrial glacial geology and surface exposure dating section-- added. Cargo Shipping Dates --added
9	6/9/2009		Jenkins	-added BAS ROTHERA on Site Pier Support Requests -removed Media Team from Table 1 -added Table, Description and Weights: Terrestrial Cargo -added Table, Description and Weights: AMIGOS Cargo -added details to: LARISSA Air Support Fuel Requirements and Fuel Delivery -added details to: Helitack S-271

Rev	Date	Section	Author	Change Details
				Training -added details to: LARISSA Media Participants
10	6/24/2009	Concept of Operations for Marine Science Mission Plans and Protocols	Jenkins	-added Cryosphere and Oceans section
11	6/24/2009	Oceanography	Jenkins	-added Moorings section
12	6/24/2009	Marine Ecosystems	Jenkins	-added Research Objectives -added Collaboration with OPP ICEBERG Project (Dr. K. Smith, PI): -added Field Season Overview
13	6/24/2009	NBP10-01 Deck Lay Outs	Jenkins	-added NBP deck and lab space allocation drawings
14	7/2/2009	Science Operations Concept of Operations for 2009 - 2010 RV/IB Nathaniel B. Palmer	Jenkins	-added NBP10-01 Ships Complement (47 berths available)
15	7/2/2009	LARISSA Air Support Fuel Requirements and Fuel Delivery	Jenkins	-Added 2010 Helo fuel requirements and costs:
16	8/17/2009	Concept of Operations for Ice Core Drill Camp and IPR survey	Jenkins	-Added LARISSA Twin Otter Schedule (including potential work with POLENET)
17	8/17/2009	Vessel Based Communications	Jenkins	-Added Vessel Based Communications
18	8/17/2009	Excess Data Communications	Jenkins	-Added Excess Data Communications
19	8/17/2009	Media	Jenkins	-Added Media
20	8/17/2009	McMurdo Support for LARISSA	Jenkins	-Added McMurdo Support for LARISSA
21	9/23/2009	New section	Jenkins	-Added NBP10-01 Aircraft

Rev	Date	Section	Author	Change Details
				Mobilization/Demobilization
22	9/23/2009	2010 NBP10-01 LARISSA Project PI's and Science Event Numbers (SENs)	Jenkins	-Added international partners
23	9/23/2009	NBP10-01 Ships Complement (47 berths available)	Jenkins	-Added RPSC Science Support Staff and PHI Helicopter Flight Crew
24	9/23/2009	Concept of Operations for Vessel-Based Helicopter Operations	Jenkins	-Added Pre-Flight Aircraft Flight Schedules and Flight Documentation
25	9/23/2009	Concept of Operations for Terrestrial Science Mission Plans and Protocols	Jenkins	-Added Ice Core Bruce Plateau AMIGOS installation -Added Ridge Camera AMIGOS Installation
26	9/23/2009	Vessel Based Communications	Jenkins	-Added NBP10-01 Meta Data collection
27	9/23/2009	Excess Data Communications	Jenkins	-Added The supportable amount of traffic for excess data transmissions is 30MB a week
28	9/23/2009	Field Communications and Data Transmission	Jenkins	-Added Communication Equipment
29	9/23/2009	Concept for LARISSA Communication	Jenkins	-Added numerous topics under this heading (see TOC for complete list)
30	9/23/2009	LARISSA Air Support Fuel Requirements and Fuel Delivery	Jenkins	BAS Fuel Caches available for LARISSA
31	11/17/2009	Concept of Operations for Vessel-Based Helicopter Operations	Jenkins	Helicopter Crew Duty Schedule

Rev	Date	Section	Author	Change Details
32	11/17/2009	Excess Data Communications	Jenkins	-Outreach Programs -Remote Sensing Data Incoming -Marine Band Repeater
33	11/17/2009	McMurdo Support for LARISSA	Jenkins	14 survival bags for NBP10-01 and the Ice camp
34	11/17/2009	Preliminary NBP10-01 NBP Port Call Plan	Jenkins	Preliminary NBP10-01 NBP Port Call Plan

Table of Contents

List of Figures

List of Tables

Science Objectives

This interdisciplinary field program addresses the rapid, system-level changes now taking place in the Larsen B Embayment, Weddell Sea region of the Antarctic Peninsula, where the ice shelf underwent a spectacular collapse in 2002. Ice core scientists, glaciologists, oceanographers, marine geologists and biologists are collaborating to characterize the affects of the collapse on the marine ecosystem as well as on glacial dynamics and interactions between the ocean, ice, geology and biology. The project also aims to place these changes in the context of past changes in the region occurring on timescales ranging from decadal to the penultimate interglacial (125,000 years before present) when it is thought to have been warmer, and the sea level higher than today.

Both helicopter support, based on the NBP, and USAP Twin Otter support, based out of Rothera Base (BAS) will be used in supporting this project.

Specifically the program will address (*main field activities indicated parenthetically*):

1. **Glacial dynamics upon ice shelf loss** *(Three high precision GPS stations deployed on glaciers; Five AMIGOS-Automated Met-Ice-Geophysics Observing Stations; satellite imagery [SPOT,ASTER,MODIS] and altimetry [ICESat] supported by related NASA project; ground penetrating radar (GPR) and GPS surveys at ice coring site and at select safe locations on Crane, Leppard or Flask Glaciers and on ice shelf; two PASSCAL seismic systems-ocean serviceable locations-for ice quake and long wavelength storm wave train detection).*

Note Field equipment installations via Bell helicopters and zodiacs based from the NBP.

2. **Ice sheet configuration in NW Weddell region at last glacial maximum** *(sea floor swath bathymetry and sub-bottom mapping to determine grounding line positions near SCAR Inlet and the Seal Nunatuks; sampling marine sediments to map facies via Kasten and Giant Piston Coring, geomorphology and exposure age dating of cobbles or erratics on Nunatuks [14 possible targets])*
3. **Regional glacial isostatic rebound rates** *(emplacement of three high precision GPS stations in bedrock on each of the east and west sides of the Peninsula)* Note: All field equipment installations via Bell helicopters based on the NBP.
4. **Role of grounding line in ice shelf stability** *(high-density core sampling across prominent grounding lines revealed upon ice shelf collapse)*
5. **Decadal to millennial climate records** *(about 500m ice core from the Bruce Plateau (-66.040 S, -64.000 W) using lightweight drilling equipment at a fixed camp.*
6. **Ocean/ice-shelf interactions and changed ocean circulation** *(seismic stations listed in item 1; Six ocean moorings, each with an Interocean S4 current meter placed at the expected depth of ice-shelf water and two SBE37 temp-salinity recorders and one or two temperature pressure recorders; conductivity temperature depth (CTD) and lowered acoustic Doppler [ADCP] current profiling at about 40 sites; in hull along track ADCP; water sampling. salinity, oxygen, nutrients, isotopes of water)*

7. **Altered surface productivity and benthic fluxes of organic matter and sediment** *(moored sediment traps on ocean moorings ??; satellite chl-a imagery from SeaWIFS and Aqua/MODIS; water-column sampling for particulate organic carbon, nitrogen and chlorophyll a; CTD, chl a fluorescence, irradiance and transmissometry profiling; marine sediment cores)*
8. **Phylogenetics, biogeochemistry and fate of unique sub-ice shelf benthic biota and colonization patterns following ice shelf collapse** *(contrast conditions at six stations forming transect from glacier edge to shelf margin via combination of ROV based surveys, ROV organism collection, ROV push cores for geochemical and microbiological sampling, (in collaboration with team from Ghent University, Belgium) five megacores at each site, trawls, Kasten cores to tap into organic rich shale-glacial till horizon, emplacement of permanent markers for future assessments. Note: there will be no radiotracer experiments as naturally occurring levels of C14 are to be measured in samples from this cruise.*
9. **Outreach** *(participation by three-person freelance media team allied with National Geographic)*

Operational Goals

2009, 2010 and 2012 Operational goals:

The logistical plan developed by the international partners is outlined below. The key components of the logistics necessary to complete the science goals are:

2009- 2010 LARISSA Seagoing operations

1. *AR/SV Laurence M Gould* support for LARISSA
2. *RV/IB Nathaniel B. Palmer* support for LARISSA
   - Delivery and recovery of ice camp cargo, field equipment and ice core freezers
   - Aircraft fuel transfer to Rothera station for USAP and BAS aircraft

2010 LARISSA Ice Drilling Field Camp

1. Fixed wing aircraft support
2. BAS support request

2009-2010 LARISSA Aircraft mobilization and demobilization

2012 Operational goals

Concept of Operations for LARISSA Seagoing Logistical Operations

2009 AR/SV Laurence M Gould support for LARISSA

The LMG09-03 cruise will provide logistical and transportation support for the installation of three LARISSA rebound GPS field units on the Western Antarctic Peninsula (WAP) this effort is part of the larger LARISSA field installation plan to study the regional glacial isostatic rebound rates.

LMG09-03 cruise dates: March 21 –April 10, 2009

LMG09-03 Participants:

Dr. Eugene Domack - Primary Investigator
Mason Fried - Field assistant
Bjorn Johns – UNAVCO technician

2009 site information for WAP geological rebound GPS installations

Duthiers Point; 64° 48' S 62° 49' W (This is app. 35 nm from Palmer Station.)

This is the point forming the south side of the entrance to Andvord Bay on the west coast of Graham Land. It is near, but not actually on, the Chilean base, Gabriel Gonzalez Videla. The site can be accessed from Aquirre Channel, the waterway between Lemaire Island and Graham Land. The site consists of an elevated bedrock bench of significant extent some 10 m above sea level, providing options for sitting the GPS station.

Petermann Island (Vernadsky); 65° 10' S 64° 10' W (This is app. 30 nm from Palmer Station.) This island is 1 mi long and lies 1mi SW of Hovgaard Island in the Wilhelm Archipelago, across from Vernadsky but still on western side of Penola Strait "fault zone".

N.B. As of the date of this RSP there remains uncertainty as to just where with respect to Vernadsky this GPS installation will be sited.

Hugo Island (Santa Claus Island, Rock): 64° 57' S 65° 45' W (This is app. 44 nm from Palmer Station.) This is an isolated ice-covered island 1 mi long, with several rocky islets and pinnacles off its E. side. It is located off the W side of Antarctic Peninsula, app. 40 nm SW of Cape Monaco, Anvers Island. It is on one of these rocky islets that the station will be placed, near the AWS station.

2009 – 2010 RV/IB Nathaniel B Palmer LARISSA logistical support

The RV/IB Nathaniel B Palmer will be used for the transport and recovery of LARISSA Ice Core Drilling Camp cargo, equipment and two USAP -20°C freezers for the stowage of the ice cores produced at the camp. The delivery of the cargo and freezers will take place on NBP09-08. Punta Arenas, Chile to Rothera Station (BAS) Antarctica.

At the conclusion of the 2010 LARISSA field season the RV/IB Nathaniel B Palmer will return to Rothera station on NBP10-02 to recover the LARISSA Ice Core Drilling Camp cargo, equipment and two USAP -20°C freezers containing approx. 540 meters of ice core. The cargo and samples will be returned to Punta Arenas, Chile for shipment back to CONUS via the USAP cargo system.

2010 LARISSA Ice Drilling Field Camp Logistical support

Twin Otter Support

A USAP Twin Otter will be dedicated to the support of the Larissa Ice Core Drilling Camp. The plane will be transporting approx. 30, 500lbs of cargo, five grantees and one RPSC field rep. to the camp site located at: **66.037205 S 64.003112 W**. The plan is for the camp to be installed and conducting drilling by the 01 Jan 2010 for 45 days. By 15 Feb 2010, all cargo, equipment, ice cores, personnel and waste will be transported to Rothera, to await recovery by the RV/IB Nathaniel B Palmer in April 2010 on NBP10-02. (Weather dependent schedule)

Support Request from NSF to BAS at Rothera Station

BAS Rothera Station Air Transport Support Requests

Inbound flights

1. RPSC will require one or two inbound flights from Punta Arenas Chile to Rothera Station aboard BAS aircraft (DASH 7) in the beginning of December 2009. These flight(s) will bring in the IPR survey Team (3) and the LARISSA Ice Core Drilling Camp team (6) and their personal luggage
   - Dates for these flights: (See table 1 below)
   - Total number of passengers: nine; weight of luggage and PAX approx. 2790lbs

Outbound Flights

2. RPSC will require one outbound flight from Rothera Station to Punta Arenas, Chile aboard a BAS aircraft (DASH 7) in late December 2009. This flight will bring out the IPR survey Team (3) and their personal luggage.
   - Dates for these flights: (See table 1 below)
   - Total passengers: three; weight of luggage and PAX: approx. 930lbs
3. RPSC will require one outbound flight from Rothera Station to Punta Arenas, Chile aboard a BAS aircraft (DASH 7) in late February 2010. This flight will bring out the LARISSA Ice Core Drilling Camp team (6) and their personal luggage
   - Dates for these flights: (See table 1 below)
   - Total passengers: six; weight of luggage and PAX: approx.1860lbs

BAS Rothera Station on Site Accommodations Requests

10. The two NSF science parties (9) coming through Rothera in December 2009 will require housing, meals and communications for the time they are at Rothera Station. Total days at Rothera Station, approx 10-20 days.
11. The flight crew (3) (two pilots and one mechanic) of the USAP Twin Otter that will be based at Rothera Station (Early Dec 2009 to Feb 2010) for the time of the Ice Drilling field Camp efforts will require housing, meals and communications. Total days at Rothera Station, approx 65 days.

BAS ROTHERA on Site Air Operations Support Requests

1. A USAP Twin Otter and flight crew supporting the LARISSA Ice Drilling Camp will require permission to be based at the BAS station for the duration of the field camp efforts (Early Dec 2009 to Feb 2010, Approx. 65 days) including, hanger space for aircraft service.
2. Small amount of space for USAP twin Otter tools and spare parts stowage
3. Access to a fueling station and fuel system for the BAS on site storage fuel tanks
4. Aircraft Flight Following (AFF) and tower support for flight missions
5. Tower Radio comms for out going and incoming flights
6. Weather reporting for support flights to the LARISSA Field Camp
7. Emergency SAR and Medevac response by BAS aircraft with a medical team from the Stations Medical Facility
8. A outdoor location for cargo line, staging cargo, equipment and fuel for transport to the LARISSA Ice Camp
9. Temporary freezer storage space for frozen Ice Camp foods for approx. 5-14 days
10. Assist USAP flight crew with cargo handling and with loading of the USAP Twin Otter for flights to the Ice Camp.
11. Provide space and serviceable power for the two USAP freezers that will be brought into Rothera aboard the NBP and remain on site at Rothera to receive the ice cores retroed out from the Ice Camp by the USAP Twin Otter. The NBP will recover the Freezers in April 2010
12. Ice core handling and help with loading of the retroed ice cores into the USAP freezers after being delivered by the USAP Twin Otter for preservation until NBP recovers the USAP freezers in April 2010
13. RPSC requests that a BAS representative monitor (daily) the two USAP freezers that will be stowed on site at Rothera to confirm the freezers are maintaining -20C temperatures

BAS ROTHERA Onsite Pier Support Requests

1. The RV/IB Nathaniel B Palmer will need permission to come alongside the Rothera pier in early December 2009 and secure for camp cargo offloading. Ice camp cargo that is to be offloaded at Rothera is approx 30,000lbs of supplies, equipment and fuel shipped in two standard 20 foot shipping container. In addition two 20 foot USAP -20°C freezers for Ice Core samples will be delivered.
2. The RV/IB Nathaniel B Palmer will need permission to come along side the Rothera pier in late April 2010 and secure for camp cargo and sample freezers recovery. Camp cargo to be loaded is approx 30,000lbs secured in two standard 20 foot shipping container. In addition the two 20 foot USAP -20°C freezers full of 540 meters of ice cores will be loaded.
3. Assistance by Rothera staff with line handling, fuel transfer and offload of cargo will be required

Approved BAS Support

Table 1: BAS DASH 7 Flight Schedule for LARISSA Ice Camp and IPR survey Air Transport to and from Rothera Station

Southbound	
IPR Survey Team Southbound Flight Departs Punta Arenas 5-Dec-09	**ICE CAMP DRILL TEAM Southbound Flight Departs Punta Arenas 18-Dec-09**
IPR 1 Ted Scambos	LARISSA driller 1 Benjamin Vicencio Maguina
IPR 2 Rob Bauer	LARISSA driller 2 Ellen Mosley-Thompson
IPR 3 Erin Pettit	LARISSA driller 3 Victor Zagorodnov
	LARISSA driller 4 Roberto Filippi
	LARISSA driller 5 Vladimir Mikhalenko
	LARISSA driller 6 Thai Verzone
Northbound	
IPR Survey Team Northbound Return Flight To Punta Arenas 17-Dec-09	**ICE CAMP DRILL TEAM Northbound Return Flight To Punta Arenas 22-Feb-10**
IPR 1 Ted Scambos	LARISSA driller 1 Benjamin Vicencio Maguina
IPR 2 Rob Bauer	LARISSA driller 2 Ellen Mosley-Thompson
IPR 3 Erin Pettit	LARISSA driller 3 Victor Zagorodnov
	LARISSA driller 4 Roberto Filippi
	LARISSA driller 5 Vladimir Mikhalenko
	LARISSA driller 6 Thai Verzone

NBP10-01 Aircraft Mobilization/Demobilization

1. The shipment and importation of the two Bell 206 L-3 aircraft from CONUS to PUQ (Punta Arenas)
    a. Customs issues: Helos will be shipped via steam ship (from San Antonio to Houston to PA), via Hamburg Sud shipping lines.
    b. Containers to arrive PA ~ November 16. in 2- 40 foot containers; Hazmat material (break-bulk cargo – Class 3) will be shipped separately. The containers belong to PHI and their storage for ~ 8 wks (duration of the cruise) in PA will be arranged by AGUNSA. If PHI is going to use wooden crates in the containers, the **crates need to be stamped** by Agriculture (out of Houston, TX) showing they've been inspected or treated/fumigated.
    c. Temporary import permit and flight permit (to the NBP from the recommisions site) will be arranged by AGUNSA (Milenko) with the local PA port authorities (Milenko to verify there are no flight obstructions to the helos in the local area).
    d. PHI to provide AGUNSA with which helos will be in what containers.
    e. Bills of lading need to be to AGUNSA well in advance.
    f. PHI 5-7 days to re-assemble the Helos once they're extracted from the containers.
    g. **Ship (NBP) arrives PA ~ 20 Dec** and PHI to load the aircraft aboard ship December 27. PHI would like to board ship soon as it gets in port to do all the preliminary work they'll need to accomplish in order to receive the Helos onboard ship. PHI personnel due arrival PA ~ 16 Dec. **The pilots that will be coming from McMurdo Station will need to depart MCM ~ 13 Dec.** PHI would like to have the helium for the helo floats to be available in PA; otherwise, they'll have to ship large amount of bottles. Helium is available in PA, and Milenko needs to know the volume needed (1 cyl, "H" size) and what kind of connections (US or metric) PHI needs to hookup the Helium lines.
2. Stowage of aircraft prior to cruise if needed
    a. Storage of aircraft in PA for ~ 2 wks, arranged via BAP (local aircraft services company in PA.
3. Transport of aircraft from PUQ **port to** PUQ **airport** for recommissioning
    a. Containers with helos inside will pass customs in the port area and then be cleared to be shipped via truck to the storage area near the pier. PHI will need a 2-tonne forklift with at least 8 ft tines to move the containers from shipside to the reconfig. area.
4. Unloading of aircraft from their containers
    a. In the Helo reassembly area, PHI will need a structure capable of supporting 2 tons. PHI is bringing a hoisting mechanism. This reassembly and storage area will be at the PA warehouse which should minimize all the customs issues.

5. Document/permit requirements and permissions needed for the flights from PUQ airport to NBP at the Prat pier
    a. Aircraft will fly onboard. They will then have to be deconfig'd. for ship's transit to station; will take ~ go directly to the ship's hangar, so the hangar will need to be clear of any other material. Plus, PHI will need the ship's welder to outfit the deck with required tie down points and other such attachments/lockdown pts.
6. Fueling the NBP with aviation fuel for the cruise
    a. Helo fuel: 7400 Gallons will be loaded aboard the NBP January 1 2010,
    b. Fuel grade: TBD

Table 2: Timeline for aircraft shipment and deployment to the NBP

Nathaniel B. Palmer Ice Breaker Project 2009/2010

Aircraft N215PH and N219PH

Time Line

Date	Event	Remarks
Monday, October 12, 2009	Comply with Pre-Disassemble Inspections	See Spreadsheet (Pre-Disassembly Actions)
Thursday, October 15, 2009	Disassemble aircraft	See Spreadsheet (Disassemble/Remove)
Sunday, October 18, 2009	Load containers	
Wednesday, October 21, 2009	Shipping containers depart LFT	
Friday, October 23, 2009	Shipping containers need to be in Houston. TX	
Tuesday, October 27, 2009	Vessel departs Houston, TX	Booking no: 9JAXUC4471 Vessel: Cap San Antonio
Saturday, October 31, 2009	Vessel arrives in San Antonio, Chile	
Wednesday, November 04, 2009	Vessel departs San Antonio, Chile	
Monday, November 28, 2009	Vessel arrives in Punta Arenas, Chile	
Tuesday, December 15, 2009	Crew departs LFT	
Wednesday, December 19, 2009	Crew arrives in Punta Arenas, Chile	
Thursday, December 17, 2009	Move containers to EPA warehouse	
Friday, December 18, 2009	Offload aircraft and begin to rebuild Aircraft	
Sunday, December 20, 2009	NBP arrives into Port of Punta Arenas, Chile	
Tuesday, December 22, 2009	Crew moves from hotel to NBP	
Tuesday, December 22, 2009	Start moving supplies to NBP	
Sunday, December 27, 2009	Move aircraft to NBP in the AM	Weld M/R Hub and Blade Mount Fixtures to Hangar Deck
Thursday, December 31, 2009	Prepare aircraft for voyage across the Drake	Remove M/R Hub and Blade. Tie down aircraft
Saturday, January 02, 2010	NBP departs the Port of Punta Arenas, Chile	
Wednesday, March 02, 2010	NBP returns to the Port of Punta Arenas, Chile	

2012 Operational Goals:

A second LARISSA cruise of approx. TBD-days will occur on the *RV/IB Nathaniel B Palmer* in January – February 2012. This cruise will be an equipment recovery cruise. All of the installed equipment including moorings and terrestrial field equipment will be recovered on this cruise. Contracted helicopter support will be required for this cruise.

In addition to equipment recovery there will be a science component. Marine Biology and Geology operations will include complete mooring recovery, sediment coring, sampling and bottom camera imagery, multi-beam survey and CTDs at the mooring stations.

Note The plan to recover the remaining field equipment installed on the continent during a 2013 KORDI cruise on the vessel *RV/IB ARAON* is still on the table. In the event a complete collaborative effort can be arranged the original plan to use the KORDI vessel may still be feasible.

Science Operations

Concept of Operations for 2009 - 2010 *RV/IB Nathaniel B. Palmer*

59 days of ship-based fieldwork will make use of technologies aboard the *RV/IB Nathaniel B. Palmer*, as well as PHI helicopter support, to gain access to the Larsen B Embayment and a wide range of glacial systems adjacent to the Larsen Ice Shelf system (see Figure 1) At both these locations vessel-based sampling equipment and ice-based dynamic and long-term monitoring systems will be deployed.

NBP10-01 Cruise dates: January 2, 2010 – March 2, 2010

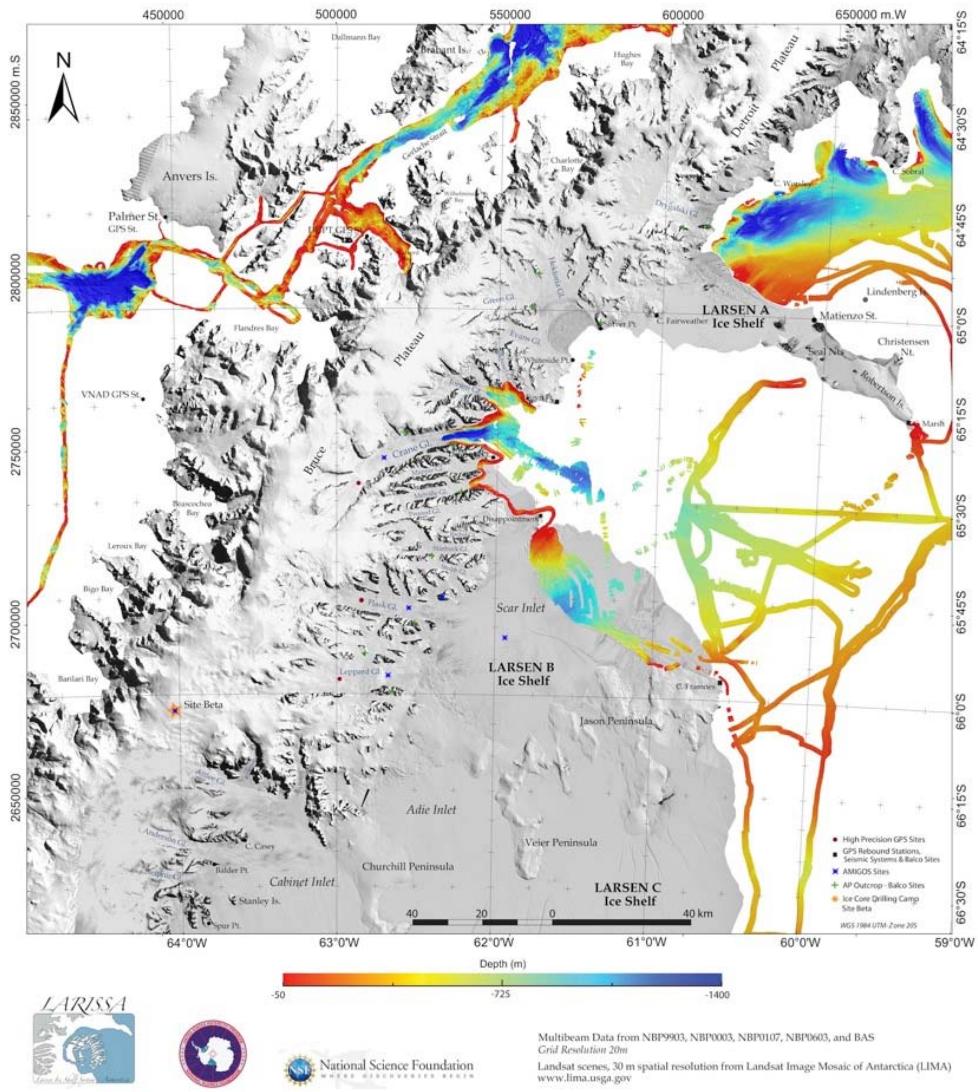

Figure 1: LARISSA Sampling Plan

2010 NBP10-01 LARISSA Project PI's and Science Event Numbers (SENs)

Marine & Quaternary Geosciences

Eugene Domack, C-515-N (Chief Scientist)
Amy Leventer
Stephanie Brachfeld
Scott Ishman
Julia Smith Wellner
Greg Balco

Cryosphere & Oceans

Ted Scambos, C-514-N
Bruce Huber (Co-Chief Scientist)
Erin Pettit
Ellen Mosley-Thompson
Lonnie Thompson
Martin Truffer
Arnold Gordon

Marine Ecosystems

Maria Vernet, C-246-N
Cindy Van Dover
Craig Smith
Mike McCormick

International Partners

Belgium-Ghent University
Argentina-Argentine Antarctic Institute
Ukrainian, National Antarctic Scientific Center in Kiev
Korean Polar Research Institute

NBP10-01 Ship's Complement (47 berths available)

Glaciology
- Ted Scambos
- Erin Pettit
- Martin Truffer
- Terry Haran
- Ronald Ross

Physical Oceanography
- Bruce Huber (**Co-chief Scientist**)
- Debra Kate Tillinger

ROV (Belgium)
- Dries Boone
- Lieven Naudts
- Katrien Heirman

Quaternary Geology
- Greg Balco

Marine Geology
- Eugene Domack (**Chief Scientist**)
- Stefanie Brachfeld
- Scott Ishman
- Amy Leventer
- Yuribia Munoz
- Caroline Lavoie
- Kim Roe

Marine Biology
- Maria Vernet
- Craig Smith
- Dave Honig
- Mike McCormick
- Laura Grange
- Mattias Cape

Korean Participants
- Sun Mi Jeong
- Ku-Chul Yu

National Geographic
- Doug Fox
- Maria Stenzel
- Sarah Park

Total **29**

RPSC Science Support
RPSC

Adam Jenkins	MPC
Ross Hein	MT Lead
Jeremy Lucke	MT
Mike Lewis	MT
Buzz Scott	MT
Dan Powers	MT
Cindy Dean	MST
Cooper Guest	MST
Lindsey Ekern	MST Lead
Andy Nunn	ET Lead
Sheldon Blackman	ET
Paul Huckins	IT Lead
Dmitriy Tizon	IT
Kathleen Gavahan	IT Multibeam
Total	**1 4**

PHI Helicopter Flight Crew
Chris Dean- pilot
Barry James – pilot
Jay Cox - Mechanic
Randy Perrodin - Mechanic

Total **4**

RV/IB Nathaniel B Palmer-Based Science Sampling Efforts

1. Belgian Cherokee ROV survey and biological sampling
2. Multibeam survey
3. Jumbo Piston Coring sampling
4. Megacorer sampling
5. Box corer sampling
6. Kasten corer sampling
7. CTD water sampling
8. Nutrients analysis (approx. 1620 samples)
9. Recovery and deployment of sediment trap and instrumented moorings
10. Side Scan Sonar
11. Blake and otter trawling
12. Yoyo (pogo) camera transects
13. SCUD surveys
14. Hull mounted ADCP and CTD mounted ADCP

The Initial 10 Days of NBP10-01Cruise

Table 3: RV/IB Nathaniel B Palmer-Based Science Sampling Plans for the Initial 10 Days of NBP10-01Cruise

Date:	Location	Operations and objectives
1/6/10	Antarctic Sound	Conduct velocity test/calibration of multibeam across Jeon Jaegyu Knoll (a volcanic seamount) in Antarctic Sound, crossing lines over the feature (sea state permitting) required time 3.5 hours Test comparison of Bathy2000W and Knudsen Chirp over Vega Drift sediment sequence, Prince Gustav Channel in route (slow speed to 6 kt) Retrieve bone lander mooring near Vega Island , 63° 45.95'S, 56° 49.64'W, 644 m depth (required time on site 2 hours)
1/7/10	Arrive off Robertson Island, early AM	Multibeam and sub bottom Chirp sonar along cruise track into and along the southern flank of the Seal Nunatak edifice to define grounding line. Continue dual pass of ship track into Hektoria Basin, and swath map into Hektoria Basin, Evans and Hektoria Glacier inlet (ice permitting). Run high frequency sonar (SIMRAD) over mooring (Hektoria, location from LMG05-5).
1/8/10	Hektoria Basin	If mooring is located, retrieve mooring. Collect jumbo (6m) Kasten core from Hektoria Basin. Continue Multibeam and Chirp survey (double lines) to south into and around Hektoria/Evans trough to connect to Cold Seep Basin and Crane fjord. Define grounding lines along mid-coastal region between Evans and Jorum inlets.
1/9/10	Crane Trough/Fjord	Ready helo and deploy helo for installation of repeater station on ridge crest, SE side of Crane "Fjord". Balco participates to recon. ridge and sites for sampling. (mission statement and exact location lacking for this deployment) Ready helos and deploy helos for AMIGOS sites in Crane glacier region. Conduct CTDs, digital bottom camera (ten stations) across outer trough while flights move on and off Palmer.
1/10/10	Crane Trough/Fjord	Deploy helos and AMIGOS sites in Crane glacier region. Deploy Crane Trough Mooring in between flight schedules as permitted. Continue bottom camera stations in Crane Fjord/Glacier frontal position (head of fjord). Balco participates in later cargo flights to conduct recon. of Crane

Date:	Location	Operations and objectives
		settings for sampling.
1/11/10	Crane Trough Fjord	As above to complete AMIGOS in Crane glacier region. Bedrock and boulder sampling by Balco on "Crane" promontories.
1/12/10	Crane Trough Fjord	Shuttle to ice core camp site Beta via helos to drop off National Geographic and AMIGOS team, install AMIGOS (assume cargo transport of AMIGOS is done via USAP twin otter out of Rothera, prior to personnel deployment via ship board helos). Return National Geographic team to Palmer at end of day. Ship is conducting multibeam, and collecting bottom sediment cores, CTDT work, possible mooring deployment if not completed on 1/10.
1/13/10	Cold Seep Basin	Multibeam to fill out and define backscatter and deploy mud scud video bottom survey along length of basin. Collect digital bottom images back across scud line as determined by video result. Ready ROV system for deployment, test of GAPS system. Retrieve AMIGOS team with <u>one</u> helo from ice core Site Beta.
1/14/10	Cold Seep Basin	Deploy ROV as determined by video results and pre-existing information near to best active seep site. Collect mega cores as guided by on line video system.
1/15/10	Cold Seep Basin	Deploy mega core system to collect biological samples. Bottom trawls, and box cores. Biological sampling. Collect a Kasten core on west-northwest end of Cold Seep Basin.
1/16/10	Cold Seep Basin	Conduct CTD and deploy mooring in Cold Seep Basin. Extend Multibeam mapping around periphery.
1/17/10	SCAR Inlet	Multibeam map to SCAR inlet and deploy video scud camera survey (early AM). Ready Helos for flight operations in support of AMIGOS sites in near Leppard Glacier. Deploy helos (late AM-PM).

Concept of Operations for Marine Science Mission Plans and Protocols

Marine Geology and Geophysics

1. GPS rebound stations - deployment of 3 cGPS stations on western side of Antarctic Peninsula (completed during LMG0903); deployment of 3 cGPS stations in Larsen Embayment (Robertson Island, Foyn Point, Cape Framnes) to be deployed
2. Land-based Geomorphology and cosmogenic exposure age dating – as outlined by Greg Balco, in and around Larsen B embayment
3. Jumbo Piston Coring (JPC) – 1 or 2 JPCs (80 ft length) in both the Hektoria Basin and Crane Glacier Fjord regions, with the possibility of 1-2 additional JPCs depending on sub-bottom profiling data. The overall scientific objectives driving the collection of cores from these two regions are (1) to evaluate a longer term history of the Larsen Embayment, perhaps extending back to the penultimate interglacial (Hektoria) and (2) to test hypotheses concerning processes governing sediment deposition associated with deeply carved glacial troughs like the Crane Glacier Fjord region. Each JPC will be paired with a Kasten Core to insure recovery of complete stratigraphy. Also Jumbo Kasten Core in Crane Glacier and Hektoria Basin region.
4. Kasten coring – high-density Kasten coring will be tied closely to swath mapping data. These cores will be strategically located with several goals in mind. First, suites of cores will be taken to develop a chronology for the glacial history of the region; their spatial distribution in any specific region will be dependent on the identification of sea floor features as imaged in the swath mapping, for example, grounding line features such as moraines. Suites of cores will also be collected to develop an understanding of the processes leading to the deposition of sedimentary laminations associated with cores close to GLZs and to monitor changes in lithogenic and biogenic sediment flux associated with ice shelf disintegration. Coring will be done in both the Larsen B embayment and at sites in the Larsen C Trough. Note as well that coring will be done at sites of mooring deployments. Kasten coring LGM grounding line zone at edge of shelf.
5. Swath mapping
   (a) entire Larsen B Embayment - Targets of special interest include (but are not limited to) Hektoria Basin and GLZ, Crane Glacier Fjord and GLZ, SCAR Inlet Trough, southern bank of the Seal Nunataks – these swath maps will be used to guide subsequent coring efforts. 3.5 kHz sub-bottom profiling data will be collected at the same time as swath mapping; ship's speed may need to be adjusted to optimize collection of high quality data.
   (b) Swath mapping the Larsen C Ice Shelf trough - with an objective of defining existence/location of trough. These data will guide coring efforts as well as assist in selection of mooring location.
   (c) Swath mapping LGM grounding line zone – edge of shelf
6. Mooring deployments – with Physical and Biological Oceanography (refer to document with mooring/CTD locations from LDEO May 2008 meeting).

Including 18 sediment traps

7. ROV missions - We will subsample from bottom sampling via Megacorer and Smith-Mac Grab (SMG). In addition to sub-sampling cores recovered with biological work as the primary objective we will do the following:

    (a) Collection of coral hard ground coral specimens at Cape Framnes for isotopic analysis – bivalve microstratigraphy

    (b) Collection of cold seep bivalve sample(s) for isotopic analyses

    (c) Run ROV along Crane Glacier GLZ to image dendritic drainage systems on both sides of GLZ

8. Bottom photography – still bottom photography will precede ROV deployments along Crane Glacier GLZ and as opportunistic evaluation of sediment type on a continual basis
9. MUDSCUD – precursor to ROV missions especially across Crane Glacier GLZ (grounding line zone) and Cold Seep Basin, SCAR Inlet Trough and Larsen C Trough
10. Sidescan sonar – if available run across Crane Glacier GLZ and as complement to each MUDSCUD deployment; also deployment in Crane Fjord and Hektoria Basin
11. CTDs – with Physical and Biological Oceanography (refer to document with mooring/CTD locations from LDEO May 2008 meeting).

    Sediment transport near edge of calving line front

    Filtering of sediment from water bottle sampling

12. Short term mooring with CTD

    Crane Trough and/or Hektoria Basin

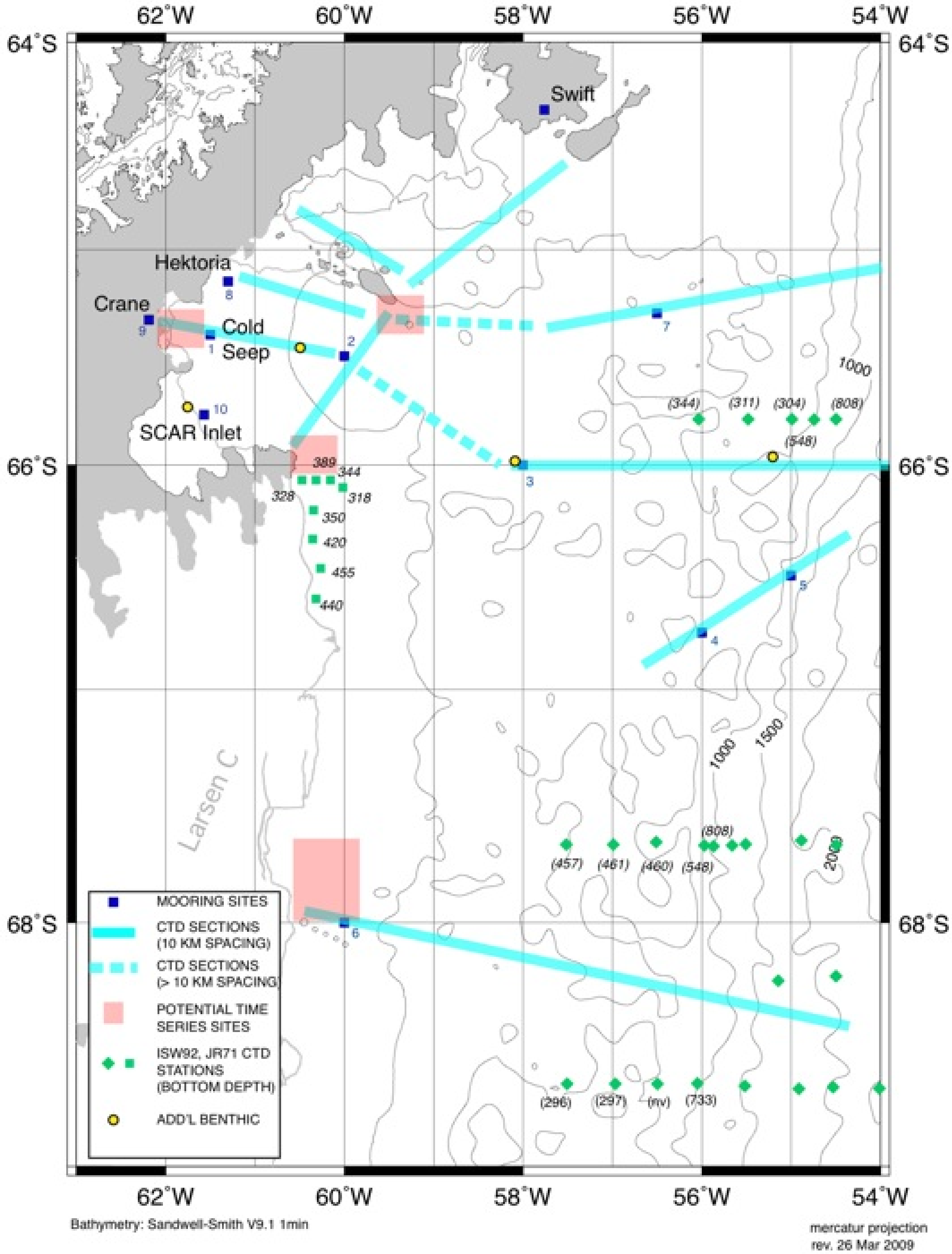

Figure 2: Marine Geology and Geophysics sampling plan for NBP10-01

Cryosphere and Oceans

LARISSA Cryosphere and Ice Core Field Objectives for NBP10-1 and Ice Core Site

Climate Ice Core – The recovery of an ice core to bedrock (~450 meters) on the ice ridge atop the Antarctic Peninsula (AP) at Bruce Plateau will be complemented by several shallow cores for rare-component measurements and to assess spatial variability. The high temporal resolution analyses of numerous chemical and physical constituents will place the current warming into a longer term perspective (is it unique?). These data will reveal the nature of the coupling (or decoupling) of the AP climate regime with that of the rest of the continent, the magnitude of early Holocene warmth, the nature of climate conditions during the last glacial stage (if present), and will possibly contribute to efforts to reconstruct the regional history of the ice shelf disintegration.

a. GPR and GPS survey of the Ice Core Site – Prior to drill camp put-in, a site selection survey using shallow and deep radars, and campaign GPS at Bruce Plateau site. Survey of ice thickness and bedrock shape using 2 to 5 MHz radar; survey of local accumulation variations using 25 and 250 MHz radars; survey of topography and emplacement of GPS-surveyed stakes for local velocity assessment. Approximately 50 km of survey lines within the 8 by 8 km site area.

AMIGOS stations - deployment of 5 (possibly 6) Automated Met-Ice-Geophysics Observing Systems at selected sites: on glacier trunk areas both north and south of the Scar Inlet Shelf front; on Scar Inlet Shelf itself; on a suitable ridge location overlooking active shelf and glacier areas; and at the Ice Core Camp on Bruce Plateau. Objectives are year-round weather/climate information, observation of surface melting and crevassing; measurement of ice flow with on-board GPS; firn temperature and melt detection; high-resolution photography from ridge site; weather data and deep firn temperature profile at ice core site. Resurvey of GPS stake grid at ice core site for local ice motion.

cGPS Installations on Glaciers – deployment of three cGPS units on selected glacier sites for detailed, high-temporal-resolution, cm/day-scale accuracy ice motion measurements to observe glacier ice flow changes inter-annually, and ice flow response to short-term events such as ice front or ice shelf changes, or summer melt/ surface lake drainage to bedrock.

Glacier Seismic Activity – Seismometer installations – 2 PASSCAL Seismometer installations, co-located with two of the cGPS bedrock rebound observation sites, for detecting interaction between the glacial bed and the glaciers at both the calving front and potentially upstream of the glacier. Additionally, short-term Seismometer installation at a site as close as possible to an active glacier front (possibly co-located with air navigation repeater) for as much of the cruise as possible to triangulate zones of activity. Larsen C Trough. Note as well that coring will be done at sites of mooring deployments. Kasten coring LGM grounding line zone at edge of shelf.

GPS and GPR surveys at glacier field camp sites – during installations of the AMIGOS and cGPS glacier systems, conduct 1 to 4 km-long cross-flow and along-flow surveys (to the extent that crevasse safety allows) using deep 2 – 5 Mhz, 25MHz radar, 250 Mhz radar and campaign GPS. Measure ice thickness, internal layering, and accumulation/melt layer variations, and detailed topography.

Oceanography

CTD/Rosette/LADCP

- Sections:

  Several sections of CTD/LADCP profiles are planned, all of which will be coordinated with the Marine Geology and Geophysics (MGG) and Biology (Bio) components. In some cases, locations will be determined after swath mapping the bathymetry. In general, station spacing along the continuous sections will be 10 km, perhaps less at the shelf-slope break, or greater over flatter areas of the continental shelf.

- Water sampling

  Requirements will be determined by the needs of the MGG and Bio programs, plus occasional sampling for salinity samples to be run on the vessel's Salinometer.

- LADCP

  We will mount a Lowered Acoustic Doppler Profiler (LADCP) system on the NBP 24-position CTD/Rosette frame. The mounting hardware and technique will be the same as those used on previous cruises (e.g. NBP09-1). The ADCP's, cabling, and battery will be provided by the grantees.

- Depth of Casts

  In general, casts will be to within 10 m of the bottom unless the cast is depth-limited by pressure limits of bio-optical sensors installed for a particular cast. Proximity to the bottom can be determined via bottom contact switch or altimeter. Altimeter is preferred, since the bottom contact switch lanyard and weight can interfere with LADCP operation.

- Station Locations and number

  At least one CTD/LADCP profile will be obtained at each ship's station, whether or not the station falls on one of the planned sections. Placement of the CTD profile within a station plan will be determined in part to make most efficient use of time.

- Opportunistic Sampling

  Profiles will be obtained while on station when the vessel is not otherwise engaged in other over the side work, and while field parties are ashore, consistent with requirements for ensuring the safety of shore parties. It is anticipated that during some field deployments, the ship will be on site for two or more days, during which we can carry out a time series of profiles, with repeated casts every 2 to 3 hours. The profiling schedule and water sampling during the time series will be coordinated with the Bio and MGG programs.

  Ship's Hull-mounted ADCP (SADCP)

- Velocity profiles from the hull-mounted ADCP will be acquired throughout the cruise, beginning as soon as possible after departure and continuing as long as possible prior to return to port.

- The SADCP data are critical to proper processing of the LADCP data.

- The OS75 SADCP, if operating properly, will be able to reach the bottom over much of the continental shelf. It will provide invaluable higher-resolution time series which will complement the profiles obtained by the CTD/LADCP system. We hope RPSC/USAP will make repair of the OS75 system a high priority during the next dry dock period

Moorings

- **Number and locations**
  11 potential sites have been tentatively identified. 8 to 11 mooring deployments are planned, depending on available resources and conditions found at the projected mooring sites.

- **Mooring Configurations**
  Most of the moorings will carry sediment traps (see the MG&G objectives) and be outfitted with a current meter, temperature-conductivity and temperature-pressure recorder.

  Two moorings, one at the shelf break and one on the slope, will carry additional instrumentation.

  There will be nominally three mooring types: shallow shelf, deep shelf, and slope.

  Shallow shelf and deep (> 1000 m) shelf moorings will differ primarily in the type of acoustic release and flotation used.

  The shallow and deep shelf moorings will carry two to three sediment traps, and must be deployed anchor first. These will carry recovery lines of length approximately 1.5 times the water depth. The recovery lines will be attached to acoustic releases, which upon release will allow the trap moorings to be recovered with the traps at all times vertical in the water column.

  The sediment traps are single sample, and must be kept vertical during recovery to prevent spilling of the sample.

  Shallow shelf and deep (> 1000 m) shelf moorings will differ primarily in the type of acoustic release and flotation used.

- **Deployment Considerations**
  The slope mooring can be deployed anchor first or anchor last. Anchor last is preferred.

  The shelf (sediment trap) moorings must be deployed anchor first

  None of the mooring components will require crane lifts for deployment. With the exception of the anchors and deep releases, all of the instruments and traps are lightweight, easily carried by one person.

- **Time Required**

  Setup for each mooring consists mainly of spooling the mooring line on the mooring winch drum. Each mooring will require about 1400 m of line. A comfortable winch speed for spooling is estimated to be 20 m/min, so preparation time is estimated to be 90 minutes (spooling plus set up). Spooling can be done any time before deployment, but spooled line should be covered to prevent subsequent icing.

  The time required to deploy each mooring is estimated to be two hours (70 minutes for line payout at 20 m /minute; 50 minutes for trap and instrument rigging on the mooring).

- **Whale Bone Landers**
  The Bio program plans to attach bags of whale bones to at least some of the moorings. Whale bones will be attached to two sediment-trap moorings via an aluminum frame that encloses the anchor-link ballast. No additional flotation is needed.

Table 4: Mooring Details

ID on map	Lat. S	Lon. W	Approx depth (m)	Comments
1.	65 30	61 30	820	Cold seep -Possibly do a short term deployment of 2 moorings: one with 2 traps at mid- and bottom, second with near surface trap and surface float for recovery (no release) then redeploy single 2-trap mooring for 2 year deployment
2.	65 30	60 00	500-700	Part of shelf flux trap array – positions to be determined to pick up outer shelf mooring
3.	66 00	58 00	500	Part of flux array - pos to be determined as above
4.	66 45	56 00	700	Outer shelf, Located at sill
5.	66 30	55 00	1200	mid slope, approx 1200 m isobaths
6.	68 00	60 00	? 500-1000	In front of Larsen C in trough
7.	65 30	57 00	700	Pending Multibeam survey and CTD section to determine possible outflow path from Larsen B
8.	65 10	61 30	800	Hektoria Basin
9.	65 26	62 03	800 - 1100	Crane Glacier , mid or outer basin
10.	65 45	61 30	700	SCAR inlet
11.	64 22	57 46	?	Swift Gl -Has established record – baseline measurements; as time allows

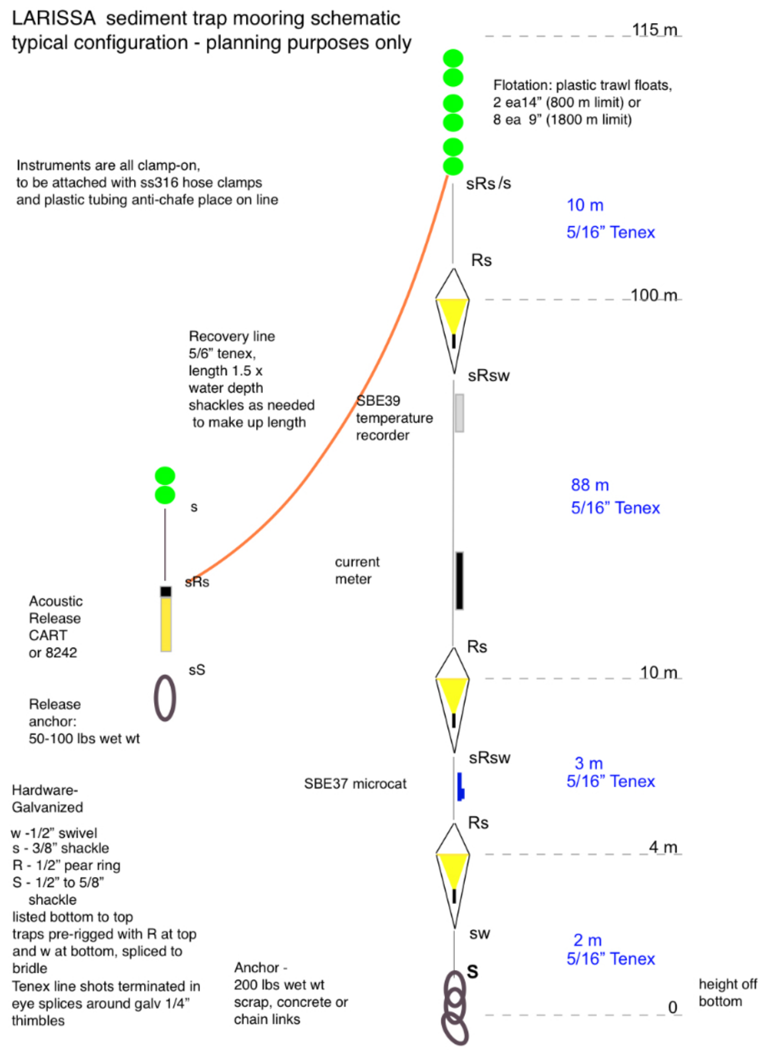

Figure 3: Example of LARISSA mooring types (three versions will be deployed)

Marine Ecosystems

Research Objectives

The Research Objectives for the Larissa Ecosystems group are focused on understanding the main processes that shape ecological communities in the western Weddell Sea before and after the recent retreat of ice shelves in the area. For that purpose we have planned extensive sampling in January and February 2010 in order to first, characterize the physical, sedimentological, geophysical and biological properties as well as location, composition and function of the first Antarctic seep community with emphasis on bacteria, macro and megafauna and sedimenting material; second, to evaluate the composition, biomass and productivity of the newly open waters in Larsen B; third, to estimate the contribution of sedimenting material from (phyto) plankton to benthic communities; and, fourth, to test timing and composition of invasion of benthic macro and megafauna in the newly open areas.

For this purpose we will:

1. Characterize at least one active seep community in the Larsen B embayment, similar to the clam community and Beggetoa mats discovered by Domack et al. in 2005 after the 2002 Larsen shelf breakup. Intensive water column, benthic fauna (surface and infauna), bacteria and sediment sampling is planned.
2. Characterize a past seep (clam) community location to document evolution of seep communities.
3. Estimate biodiversity of fauna in seep and non seep locations in the Larsen B coast and continental shelf.
4. Characterize evolution of surface fauna on the Larsen B continental shelf as function of ice shelf retreat during the last 50 years, with emphasis on the area opened after the 2002 ice shelf breakup, including composition and abundance of bone eating worms.
5. Evaluate present day benthic fauna distribution and composition and past diatom deposition in sediments as a function of phytoplankton distribution in surface waters (biomass, composition and primary production), carbon estimates in surface, mid– and bottom waters (including sea ice flora), sedimenting material and sediments.
6. Test functioning of chemoautotrophic community in active seep station, including extensive experiments under anoxic conditions; location, concentration and source of methane (CH4); molecular and genetic characterization of bacteria and seep fauna.
7. Collaborate with Physical Oceanography to sample for plankton communities from CTD rosette.
8. Collect plankton tows to collect phytoplankton and zooplankton for determining abundance and community structure

Collaboration with OPP ICEBERG Project (Dr. K. Smith, PI)

The Larsen B area and ice shelf break up is the source of large and small icebergs found months to years later in the Iceberg Alley in NW Weddell Sea. Icebergs are considered a source of iron to surface waters. Sampling water, ice shelf and glaciers from the Larsen B embayment during Larissa will provide source material to be compared with results obtained from icebergs sampled hundreds of miles away.

Field Season Overview

Sampling during the NBP10−01 to achieve the objectives outlined above will be done with a combination of water column and sediment collection during the cruise and mooring deployments. The sampling is to be conducted in collaboration with all groups within the Larissa project, in particular with Domack et al. for sampling sediments, ROV deployments, camera transects and sediment traps; with Bruce Huber et al. for CTD sampling and whale bone deployment with the physical oceanography moorings; with Scambos et al. for sampling loess in glaciers.

Specifically, we plan to conduct intensive data collection at:

1. Six benthic stations in a cross shelf transect and one station East of Scar Inlet in area opened up in 2006 (All PIs) − At each of our benthic sites, we will conduct three replicate yoyo camera/ROV transects, and collect seven megacores, at least two trawl samples (Blake or otter). In addition, at sites near the Larsen B margin, we hope to conduct replicate transects at depths of ~200 m, as well as in adjacent basins at ~800 m. Where possible (i.e., at 200, 500 and 800 m at sites 1−3), video transect lines will be those used on the Polarstern in 2006. Two other areas of interest, to be sampled if possible: Scar Inlet (65o 45" S, 61o 30" W) and Hektoria Inlet.

   Vernet − Water column sampling at the six cross shelf stations include 2 CTD casts from surface to bottom sampling at 12 depths (in collaboration with Huber); bottom water from ROV Niskin bottles (if available); vertical tows for phytoplankton (0−150 m) and zooplankton (0−300 m) with 1−M nets; surface water from seawater intake in Hydrolab; sub sampling from the megacores and Kasten cores for phytoplankton/pigments in collaboration with Domack et al.; sea ice algae from Zodiac (if sea ice is present).

   Approximate station locations (to be confirmed):

   Station 1, Crane Inlet, approx. 65o 26' S, 62o 03"W

   Station 2: Seep station approx. 65o 30" S, 61o 30" W

   Station 3: 97−02 Shelf, approx. 65o 30" S, 60o 30" W

   Station 4: 86−97 shelf, approx. 65o 30" S, 60o 00" W

   Station 5: outer shelf, approx 66o 00" S, 58o 00" W

   Station 6: shelf break, approx 65o 58" S, 55o 15' W

   Station 7, between Scar Inlet and Cape Framnes, area newly opened in 2008.

   Each station in the transect will require about 33 hours of wire/ship time.

2. At seeps station(s), Smith − Same sampling as in the transect stations (see above). In addition, sediments under microbial mats and in clam beds will be sampled with video (or at least transponder) guided Megacore or box core lowerings. If possible, ROV operated push cores (~10 cores at each habitat) will also be used to sample seep communities. Background community sediments will be sampled with megacores. We plan to collect at least 10 Megacore tubes from each habitat (microbial mat, clam bed, other seep habitats (e.g., ampharetid fields), background sediments).

   van Dover: We will conduct intensive data collection from cold seep clam beds and bacterial mats located near margins of the Larsen A, B, and C ice shelves (Eastern Antarctic Peninsula). We anticipate sampling up to three live clam beds, three dead clam beds, and three bacterial mats. Sampling at each clam bed will occur in the following order: (a) replicate video transects with the ROV in a 100 m x 100 m box around the seep center, (b) fine scale photo mapping of clam beds with the ROV. (c) opportunistic specimen collection with a scoop held by, or attached to, the ROV manipulator arm, (d) three video− or transponder guided box cores (seep center, periphery, and background), and (e) 1−2 Blake or otter trawls to collect background (ie, within 100 m of the seep center) megafauna. Sampling at each bacterial mat will consist of two Blake or otter trawls to collect benthic megafauna present on the mat.

   Vernet − see station sampling, same as for the transect stations (see above)

   Each seep station will require 66 hours of wire/ship time.

3. van Dover & Smith: One whale bone lander will be recovered (deployed in previous Smith cruise) near Vega Island @ Lat 63° 45.95'S, Long 56° 49.64'W, 644 m depth and two whale bone landers will be deployed for recovery on the 2012 cruise. In addition, bones will be deployed on two physical oceanography-sediment-trap moorings. Whale bone mooring location: Cold Seep station: Lat 65° 30' S, Long 61° 30' W (lander A and bones in PO mooring); Mid-Shelf station: Lat 66° 00' S, Long 58° 00' W (bones in PO mooring), Slope station: Lat 66° 20' S, Long 54° 30' W (approx.) (lander B) − See details on whale mooring deployment and parts in mooring section − Lander diagram available from Mr. David Honig.

4. McCormick − Primary work will involve recovery, sub sampling and analysis of sediments and pore water from megacores and Kasten cores. These activities will take place at seven stations (active cold seep, dead cold seep, and six benthic stations off-shore to on-shore.):

   Sub sampling megacores will occur in an anoxic glove bag in the aft cold room (little Antarctica).

   Sub sampling Kasten cores will occur in the dry lab (same as the Geo group).

   Chemical analyses will be conducted on subsamples as follows: − CH4 − using the

GC/FID in the main lab (support equipment = the water bath to thermally Equilibrate samples).

— Pore water extraction − Reeburgh presses will be set up in the main lab in coordination with the Geo group (Gene Domack and Stephanie Brachfeld).

— Pore water analyses − Fe (II), sulfide, sulfate will be performed in the aft cold room and in the main lab (support equipment = Ocean Optics spectrophotometer).

5. Vernet − Other CTD stations sampled in collaboration with Bruce Huber to characterize phytoplankton abundance, composition and production in the study area.

   COLLABORATION WITH OPP ICEBERG PROJECT: We will sample for surface iron concentration in Crane Inlet and Cape Framnes (samples to be analyzed by Dr. B.

   Twinning at Bigelow Labs) and will sample for rare earth elements from loess (samples to be analyzed by Dr. T. Shaw at South Carolina University).

LAB SPACE: as identified by Domack et al. after the 15−16 December 2008 meeting with RPSC and ECO in Punta Arenas.

We request the use of Little Antarctica (McCormick, all); Big Antarctica (van

Dover/Honig 4 ft linear counter and10 sq ft floor space; Smith 4 linear ft counter); Biolab (van Dover/Honig 9 ft counter space and access to hood; Smith 9 ft counter space and access to hood; McCormick 12 ft counter space and access to hood; Vernet access to hood); Hydrolab (Vernet 16 ft counter space, next to SWI, forward counter, STB side in middle counter); Aquarium (Smith, all); Wet Lab (Smith, 1/3 lab for Megacorer staging); Dry Lab (10 ft counter space in forward STB side). In addition to RPSC instrumentation, Biolab will house instruments brought from home institutions. Overflow from Biolab could be handled by Dry lab or placing some instruments (i.e. freeze drier) in the hold.

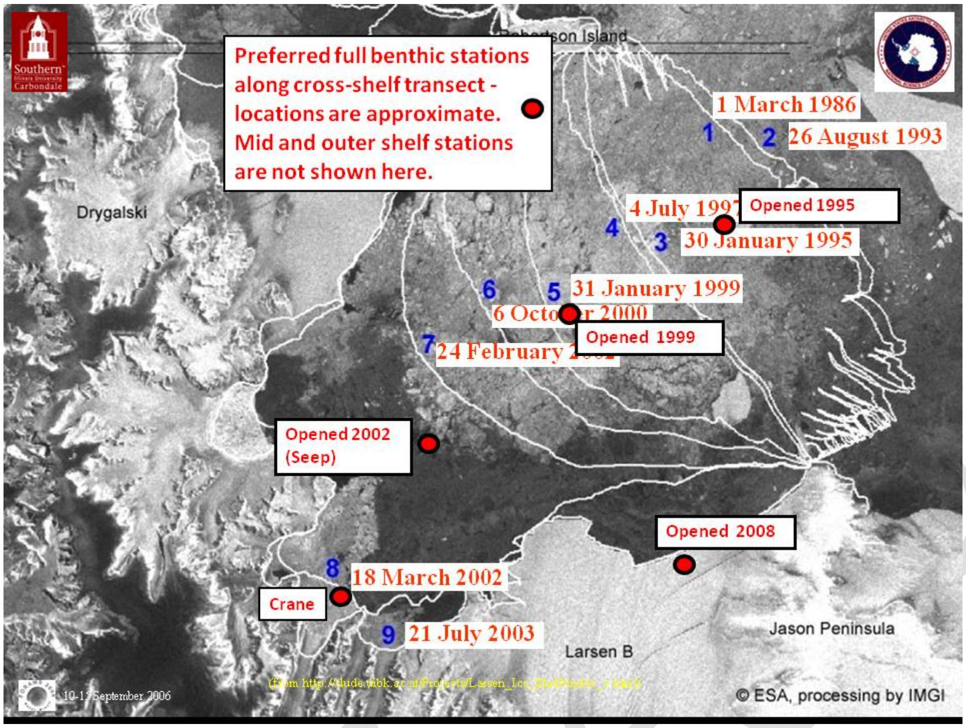

Figure 4: Preferred benthic stations for NBP10-01

Concept of Operations for Vessel-Based Helicopter Operations

Two Bell 206 Turbine helicopters will be contracted from PHI and deployed aboard the NBP for the duration of the 59-day cruise. The helicopters will be used for the support of field installations, passenger and equipment transport, and emergency response.

- The sole fuel supply for helo ops will be 6000 gallons held in two tanks aboard the NBP.
- This amount of fuel allows for approx. 120 hours of flight time for the two PHI helicopters and allow for 30% reserve
- On December 16, 2008 a formal inspection of the NBP helo hangar, flight deck and fueling system was conducted by representatives from PHI and AMD aboard the NBP in Punta Arenas Chile.

Table 5: List of LARISSA Field Equipment Deployments

	Lat S	Long W	Access	People	Priority
High Precision GPS sites					
Crane Glacier GPS	-65.4550	-62.8639	Helo	3	High
Flask Glacier GPS	-65.7568	-62.8340	Helo	3	High
Leppard Glacier GPS	-65.9544	-62.9800	Helo	3	High
GPS Rebound Stations (EAP), Seismic systems & Balco*					
Cape Framnes, Jason Peninsula*	-65.9500	-60.5500	Helo/Zod	3	High
Foyn Point, Nordenskold Coast*	-65.2500	-61.6300	Helo	3	High
Cape Marsh, Robertson Island*	-65.2390	-59.4680	Zodiac	3	High
Tentative AMIGOS Sites					
Bruce Plateau Drill Site AMIGOS	-66.0372	-64.0031	Helo	5	High
Scar Inlet Ice Shelf AMIGOS	-65.8501	-61.9420	Helo	5	High
Crane Glacier AMIGOS	-65.3734	-62.6383	Helo	5	High
Flask Glacier AMIGOS	-65.7789	-62.5500	Helo	5	High
Leppard Glacier AMIGOS	-65.9520	-62.6700	Helo	5	Moderate
AMIGOS Ridge Camera	-65.7505	-62.3296	Helo	4	Moderate
AP Outcrop Locations - Balco sites					
(Exposure-dating sites by helo)					
Drygalski lower glacier	-64.7750	-60.7500	Zodiac	2	High

	Lat S	Long W	Access	People	Priority
Drygalski lower glacier	-64.7750	-60.9010	Helo	2	High
Hektoria upper glacier	-64.9000	-61.7750	Helo	2	Moderate
Hektoria lower, S side	-65.0000	-61.8000	Helo	2	Moderate
Crane lower glacier	-65.3550	-62.2500	Zodiac	2	High
Crane upper glacier	-65.3250	-62.5500	Helo	2	High
Melville Glacier	-65.4790	-62.2320	Helo	2	Moderate
Starbuck Glacier	-65.6380	-62.4120	Helo	2	Moderate
Flask lower glacier	-65.8130	-62.4880	Helo	2	High
Leppard lower glacier	-65.9900	-62.6500	Helo	2	High
Leppard upper glacier	-65.8970	-62.8220	Helo	2	High
Exposure-dating sites by Zodiac					
Drygalski lower glacier	-64.7750	-60.7500	Poss zod	2	High
Hektoria Bluffs	-65.0250	-61.3750	Zodiac	2	High
Crane lower glacier	-65.3550	-62.2500	Zodiac	2	High
Cape Longing	-64.5560	-58.9000	Zodiac	2	N/A

Pre-Flight Aircraft Flight Schedules and Flight Documentation

24 hours prior to helo missions, a daily aircraft schedule will be sent via email to MAC Center, Rothera, and all others, as needed, to inform all stakeholders of the planned aircraft operations.

Daily Aircraft Schedule Details:

- Departure Date and Hour
- # of Missions for the day
- Mission objectives
- Estimated # of flight hours
- Flight waypoints
- On schedule or behind
- Expected cargo loads
- Expected PAX manifest

LARISSA Aircraft Flight Operations

Helicopters on flight commencement:

- The NBP Helitack calls MCM Center, Rothera Station and Marambio Flight Control to announce that aircraft are, or will shortly, begin flight ops
- MAC Center to confirm back to NBP Flight Ops that aircraft are visible on AFF
- Helos secured and flight operations terminate for the day
- NBP Helitack calls MAC Center to advise safe return to NBP and conclusion of flight ops for the day
- Operational Flight Following checks every 15 minutes with the NBP Bridge

For Twin Otter Operations

1. PIC or FO calls MAC Center (iridium) to notify they are departing Rothera and gives, destination, fuel onboard, PAX onboard and estimated mission duration
2. MAC Center to confirm aircraft are visible on AFF
3. Flight operations termination for the day, PIC or FO calls MAC Center to advise.

LARISSA Weather Forecasting and Automated Flight Following

- SPAWAR, MAC Center and Rothera Station will provide Weather Forecasting (contact information below)
- MAC Center will provide AFF and service (contact information below)

MAC Center, McMurdo
Weather Forecaster Direct dial: 720.568.1019
Weather Forecaster Email: mcm.weather.forecaster@usap.gov
Met Manager Email: mcm-soppmetmanager.mailbox@usap.gov
Weather Office Iridium: 8816-763-20030
Mac Center ATC Direct Dial: 720.568.1052
Mac Center ATC Email: macctr@usap.gov
Air Traffic Manager Email: mcmsoppatm@usap.gov
Mac Center Iridium: 8816-763-15197

SPAWAR, Charleston
ROF Weather Forecaster Direct Dial: 843.218.3927
ROF Weather Forecaster: chrl_fcstr@navy.mil
ROF Met Manager Phone: 843.218.4287
ROF Met Manager Email: ken.edele@navy.mil

ROF Weather Iridium: 8816-763-15168
ROF ATC Direct Dial: 843.218.7156
ROF ATC Email: chrl_rof@navy.mil
ROF Air Traffic Manager Phone: 843-218-3915
ROF Air Traffic Manager Email: jeremiah.a.clark1@navy.mil
ROF ATC Iridium: 8816-763-15168

LARISSA Daily Aircraft Operation Sit-Rep

A daily email will be sent out in the PM from the MPC to USAP, the NSF, PHI and identified individuals for the purpose of briefing off vessel parties of the status of the days flight operations and forwarding the daily Aircraft Usage Reports.

Debrief Sit-Rep Details

- Mission accomplishments
- Flight hours flown
- Status of overall flights % completed (estimated)
- On schedule or behind
- What was not completed for the planned day:

Helicopter Crew Duty Schedule

- LARISSA helicopter flight crews work a 14 hour duty day with a maximum 8 hours of flight time per duty day (based on lift off to final touch down).
- Every 7 days of duty time requires 1-day off, or two consecutive days of off time are required in a 14 day period.

Helicopter Operations – Field Camp Equipment

To be supplied by Special Projects (POC: Melissa Rider)

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Helo Ops Requirements
Climbing	axe, ice	1	2	ea	2
Climbing	carabiner, locking	0.1	0.3	ea	4
Climbing	daisy chain	0.04	1	ea	2
Climbing	harness, seat, Yates adjustable	0.3	2	ea	2
Climbing	rope, prussic size, 6 mm	0.01	0.01	ft	50
Fuel & Fuel Supplies	white gas (gallon)	1	8	gal	12
Safety Equipment	survival bag, helo	3	60	bag	9

Concept of Operations for Terrestrial Science Mission Plans and Protocols

High Precision GPS stations (Scambos)

Mission Protocol Summary

Mission Name: High Precision GPS and Geophysical Survey

-65.4550 -62.8639 = 65° 27.300' S 62° 51.834' W: GPS Upper Crane
-65.7568 -62.8340 = 65° 45.408' S 62° 50.040' W: GPS Upper Flask
-65.9544 -62.9800 = 65° 57.264' S 62° 58.800' W: GPS Upper Leppard

Mission Summary

The above three missions differ only in their locations. All other planning details are identical among the three sites. The following summarizes a single mission at a single location.

Objectives:

1. Radar Transects
2. Install UNAVCO dual frequency GPS station

Personnel: Ted Scambos, Martin Truffer, Erin Pettit
Minimum Time on Site: Two days, one night
Known Hazards: Glacier site, some crevasse risk, snow surface conditions variable.
Transportation Method: Helicopter:

- Four flights put–in, two of which are sling loads, maximum weight = 901 lbs.
- Three flights pull-out, one of which is sling load, maximum weight = 900 lbs.

Table 6: Description and Weights: Terrestrial Cargo

Description		Weight lbs
Weight per PAX x Total PAX = 250 x 3	(return)	750
Campaign GPS (topographic profile, flow velocity)	(return)	105
Deep RADAR System (glacier ice thickness)	(return)	80
Shallow RADAR Systems (layering)	(return)	290
UNAVCO Precision GPS Station	*must be slung*	1300
GPS Toolbox	(return)	80
Kovacs Firn Core Kit, 20 m	*must be slung* (return)	90
Essential Camping Gear (first flight)	(return)	240
30 6' Bamboo with flags	*must be slung* (some return)	20
Communication (first flight)	(return)	40
Essential Mountaineering Equipment (first flight)	(return)	60
Additional Mountaineering Equipment	*must be slung* (return)	75
2 Small Banana Sleds = 65 x 2	*must be slung* (return)	130
Emergency Bag (2 person) x Count = 60 x 2	(return)	120
Additional Camping Gear (later flight)	(return)	91
TOTAL		3471

- Radar Protocol:
  - Roped three-person team lays out and probes transects with handheld GPS and wands.
  - Set up Trimble GPS as local base station.
  - Set up Radar system on sled.
  - Set up Trimble GPS in backpack.
  - 1-2 person team hauls sled with Radar, GPS person leads, marking points along way to connect radar data with GPS data.
- UNAVCO GPS Protocol:
  - Drill 6 meter firn core and measure density.
  - Mount GPS antenna as "super pole" using 6 meter hole.
  - Assemble UNAVCO GPS with Iridium link.
  - Confirm data uplink, requires sat phone call to UNAVCO.

GPS Rebound Stations and Seismic Stations (Domack, Pettit)

Mission Protocols

Robertson Island, Cape Marsh, GPS Bedrock Station, NO Seismic

Zodiac deployment from Palmer. Duration: eight hours.

This station is due to be placed on bedrock exposed some 20 m above sea level on Cape Marsh (the SE end of Robertson Island)

- 65° 15'S
- 59° 28'W

Mission Summary

A prominent cape consisting of a rock cliff over 235 m high, marking the SE extremity of Roberson Island on the edge of former Larsen Ice Shelf. The site may be accessed by small boat (Zodiac) but care should be taken of tide, high tide being difficult. Site should be located on bedrock flat, some 20 m above sea level near a small hut (Argentina). The gear is easily deployed via Zodiac and landings should be attempted at low tide and the following gear needs to be transported to the site. Three individuals (E. Domack, RPS staff will attend). Others could be used to help heft cargo to the site. A brief site reconnaissance will be required (about 45 mins.) prior to lifting gear to the top of the bench. Approximately 6-8 hours are required for installation; in the meantime Dr. Gregg Balco can walk the exposure in search for suitable moraine debris for cosmogenic sampling. Two Zodiacs would be the best, total trips will be four to shore (one way).

Five personnel to deploy:

- E. Domack
- field assistant (TBA)
- G. Balco
- field assistant (TBA)

Total Cargo to offload includes:

1) 800 lbs. batteries in single packs for easy transport
2) 190 lb remote GPS station in components for transport

3) 136 lbs. cradle frame, in sections for transport
4) 64 lbs. antenna mounts, in sections
5) 27 lbs. strengthening tubes
6) 180 lbs. of solar panels
7) 20 lbs. bolts and fasteners

Cape Framnes, Jason Peninsula, GPS Bedrock Station and Seismic Station

Zodiac or Airlift with helos. Duration: eight hours.

-65° 57' S

-60° 33' W

Mission Summary

Cape which forms the NE end of Jason Peninsula, on the E coast of Graham Land. Site may be accessible by small boat based upon visual sightings during NBP06-03 and LMG05-02 but a large rocky flat is available some 20 m above sea level for helo. landing and deployment. Landing site will have to be confirmed by pass-by near Cape from Palmer. The target is the second more southerly, of two rocky flats that lay along the southeastern side of the Cape. If the site is inaccessible by shore landing helos will be needed to deploy gear and personnel. If flown by helo five flights in will be needed, two with personnel the other three with cargo and personnel. The seismic and GPS systems will be set up immediately adjacent to each other (if possible). At this site Dr. Gregg Balco will also walk about the exposure to examine the suitability of and sample boulders for cosmogenic dating.

Seven personnel to deploy:

- E. Domack
- field assistant (TBA)
- G. Balco
- field assistant (TBA)
- E. Pettit
- M. Truffer.

Total Cargo to offload includes:

1) 800 lbs. batteries in single packs for easy transport
2) 190 lb remote GPS station in components for transport
3) 136 lbs. cradle frame, in sections for transport
4) 64 lbs. antenna mounts, in sections
5) 27 lbs. strengthening tubes
6) 180 lbs. of solar panels
7) 20 lbs. bolts and fasteners
8) 40lbs. PASSCAL seismometer and mini vault (including hardig box for transport)
9) 150lbs. Seismic enclosure
10) 50lb digitizer (including hardig box for transport)

11) 575lbs. Batteries (8 batteries)
12) 100lbs. solar panels and tower and anchor material.
13) 180lbs. Emergency bags (2 person 60lb. each)

Seismic Protocol (additional details on PASSCAL website)

- Locate site for seismometer and site for digitizer/power system
- Build and secure vault for seismometer
- Setup power system and digitizer box
- Connect cables, check communications, stomp test.

Foyn Point, Oscar II Coast, GPS Bedrock Station and Seismic Station

Mission Summary

This station can only be accessed by airlift from helos. Duration 8 hours.

-65 15'S

-61 38' W

Elevated point, backed by a peak 525 m high, marking the N side of the entrance to Exasperation Inlet, on the Oscar II Coast. Site is inaccessible from small boat but includes several sizable rock benches or flats where helos can land. Five helo flights in will be needed, two with personnel the other three with cargo and personnel. The seismic and GPS systems will be set up immediately adjacent to each other (if possible). Dr. Gregg Balco will also conduct reconnaissance of outcrop for potential sampling of erratic boulders for cosmogenic dating.

Seven personnel to deploy:

- E. Domack
- field assistant (TBA)
- G. Balco
- field assistant (TBA)
- E. Pettit
- M. Truffer.

Total cargo to offload includes:

1) 800 lbs. batteries in single packs for easy transport
2) 190 lb remote GPS station in components for transport
3) 136 lbs. cradle frame, in sections for transport
4) 64 lbs. antenna mounts, in sections
5) 27 lbs. strengthening tubes
6) 180 lbs. of solar panels
7) 20 lbs. bolts and fasteners
8) 40lbs. PASSCAL seismometer and mini vault (including hardig box for transport)
9) 150lbs. Seismic enclosure
10) 50lb digitizer (including hardig box for transport)
11) 575lbs. Batteries (8 batteries)

12) 100lbs. solar panels and tower and anchor material.
13) 180lbs. Emergency bags (2 person 60lb. each)

Seismic Protocol (additional details on PASSCAL website)

- Locate site for seismometer and site for digitizer/power system
- Build and secure vault for seismometer
- Setup power system and digitizer box
- Connect cables, check communications, stomp test.

AMIGOS Stations (Scambos, Pettit)

Mission Protocol Summary

Mission Protocols: AMIGOS and Geophysical Survey

-65.8501 -61.9420 = 65° 51.006' S 61° 56.520' W: AMIGOS Scar Inlet
-65.3734 -62.6383 = 65° 22.404' S 62° 38.298' W: AMIGOS Lower Crane
-65.7789 -62.5500 = 65° 46.734' S 62° 33.000' W: AMIGOS Lower Flask
-65.9520 -62.6700 = 65° 57.120' S 62° 40.200' W: AMIGOS Lower Leppard

Mission Summary

The above four missions differ only in their locations. All other planning details are identical among the four sites. The following summarizes a single mission at a single location.

Objectives:

1. Radar Transects
2. Install AMIGOS Station

Personnel: Ted Scambos, Martin Truffer, Erin Pettit, Ronald Ross, Terry Haran
Min. Time on Site: Two days, one night
Known Hazards: Glacier site, some crevasse risk, snow surface conditions variable.
Transportation Method: Helicopter:

- Four flights put–in, one of which is sling load, maximum weight = 951 lbs.
- Three flights pull-out, one of which is sling load, maximum weight = 975 lbs.

Table 7: Description and Weights: AMIGOS Cargo

Description		Weight lbs.
Weight per PAX x Total PAX = 250 x 5	(return)	1250
Campaign GPS (topographic profile, flow velocity)	(return)	105
Deep RADAR System (glacier ice thickness)	(return)	80
Shallow RADAR Systems (layering)	(return)	290

AMIGOS Station	*must be slung*	536
AMIGOS Toolbox spares and toolkit, laptop	(return)	100
Wire mesh for filtering snow backfill	(return)	10
Kovacs Firn Core Kit, 20 m	*must be slung* (return)	90
Essential Camping Gear (first flight)	(return)	240
30 6' Bamboo with flags	*must be slung* (some return)	20
Communication (first flight)	(return)	40
Essential Mountaineering Equipment (first flight)	(return)	60
Additional Mountaineering Equipment	*must be slung* (return)	75
2 Small Banana Sleds = 65 x 2	*must be slung* (return)	130
Emergency Bag (2 person) x Count = 60 x 3	(return)	180
Additional Camping Gear (later flight)	(return)	180
TOTAL		**3386**

- Radar Protocol:
  - Roped 3-person team lays out and probes transects with handheld GPS and wands.
  - Set up Trimble GPS as local base station.
  - Set up Radar system on sled.
  - Set up Trimble GPS in backpack.
  - 1-2 person team hauls sled with Radar, GPS person leads, marking points along way to connect radar data with GPS data.
- AMIGOS Protocol:
  - Assemble Tower
    - attach solar panels, camera enclosure, cables, and guy wires.
  - Assemble Electronics and battery case.
  - Raise Tower and guy out.
  - Test and initialize system.
  - Drill 12 meter firn core for density and thermistor string.
  - Install thermistor string and backfill hole.

Ice Core Bruce Plateau AMIGOS installation

-66.0372 -64.0031 = 66° 2.232' S 64° 0.186' W : AMIGOS Bruce Plateau

Mission Summary

Objectives:

1. Resurvey specific GPS stations from Drill Site RADAR Survey
2. Install AMIGOS Station #1

Personnel:

Ted Scambos, Terry Haran, Ronald Ross

Minimum Time on Site:

Two days, one night

Known Hazards:

Snow dome site, low crevasse risk, snow surface conditions variable

Transportation Method:
Helicopter:
Two flights put–in, no sling loads, max weight = 900 lbs.
2 flights pull-out, no sling loads, max weight = 900 lbs.

Table 8: AMIGOS Installation—Description and Weights

Description	Weight lbs
Weight per PAX x Total PAX = 250 x 3 (return)	750
Campaign GPS (topographic profile, flow velocity) (return)	105
AMIGOS Station	270
AMIGOS Toolbox spares and toolkit, laptop (return)	100
Wire mesh for filtering snow backfill (return)	10
Essential Camping Gear (first flight) (return)	240
Communication Equipment (first flight) (return)	40
Essential Mountaineering Equipment (first flight) (return)	60
Emergency Bag (2 person) x Count = 60 x 2 (return)	120
TOTAL	1725

- GPS Resurvey Protocol:
    - Set up Trimble GPS as a local base station
    - Set up Trimble GPS in backpack or on a sled from ice camp
    - Using snow machine from ice camp, revisit GPS stations created during original GPS-Radar survey for Drill Site to check for possible ice motion during previous 2+ months
- AMIGOS Protocol:
    - Assemble Tower
        - attach solar panels, cables, guy wires
    - Assemble Electronics and battery case
    - Raise Tower and guy out
    - Test and initialize system
    - Set up thermistor string
    - Back fill thermistor string hole

Ridge Camera AMIGOS Installation

-65.7505 -62.3296 = 65° 45.030' S 62° 19.776' W : AMIGOS Ridge Camera

Mission Summary

Objectives:
Install AMIGOS Station #5

Personnel:
Ted Scambos, Ronald Ross, Terry Haran, and Martin Truffer or Erin Petit

Minimum Time on Site:

One long day, **excellent weather required**

Known Hazards:

Mountain ridge site (near helo-accessible snowfield area).

Transportation Method:

Helicopter:

Three flights put–in, one of which is sling load, max weight = 900 lbs.

Three flights pull-out, one of which is sling load, max weight = 900 lbs.

Table 9: Ridge Camera AMIGOS Installation

Description	**Weight lbs**
Weight per PAX x Total PAX = 250 x 4 (return)	1000
AMIGOS Station *must be slung*	516
AMIGOS Toolbox spares and toolkit, laptop (return)	100
Essential Camping Gear (first flight) (return)	240
Communication (first flight) (return)	40
Essential Mountaineering Equipment (first flight) (return)	60
2 Small Banana Sleds = 65 x 2 *must be slung* (return)	130
Additional Camping Gear (return)	156
Emergency Bag (2 person) x Count = 60 x 2 (return)	120
TOTAL	2362

- AMIGOS Protocol:
  - Assemble Tower
  - attach solar panels, camera enclosure, cables, guy wires.
  - Assemble Electronics and battery case.
  - Raise Tower and guy out.
  - Test and initialize system.

Terrestrial glacial geology and surface exposure dating

Logistics plan

1. Overall science objective.
   1.1. Visit nunataks and rock outcrops adjacent to major glaciers in the Larsen Embayment field area. Look for geologic evidence of past glacier expansion and retreat. When such evidence is located, collect rock samples from a range of elevations on a given nunatak.

In laboratory work following cruise, determine the age of these samples to develop a picture of glacier advance and retreat over the past several thousand years.

2. Detailed logistical objectives.
   2.1. Number of sites. Here and below, I'll use 'site' to describe a single nunatak or large ice-free area, or a group of closely spaced (within 1 km) nunataks or ice-free areas. Each listing in the attached table of GPS coordinates is a 'site.' An 'elevation transect' refers to a group of rock samples collected at a particular site that span a range of elevations, typically from near the present glacier margin to the summit of a nunatak that could be several hundred meters above the glacier surface. Typically this would involve collecting 10-20 samples over an elevation range of 200-300 meters. To accomplish the scientific objective, I'll need to collect detailed elevation transects at least four sites. However, there is no way to know in advance whether it will be possible to collect acceptable samples at a given site – often one arrives at a site and fails to find any geologic deposits that can be sampled. Past experience in other parts of Antarctica suggests that about half of site visits will be successful. Thus, reaching the goal of four elevation transects will most likely require visiting at least eight sites.
   2.2. What are the characteristics of sample sites? All the sites visited in this part of the project are ice free areas or nunataks. I've used two criteria to select target sites, as follows. First, the sites must be adjacent to major glaciers. This is necessary for science reasons – we are trying to learn about the history of these large glaciers, so the sample sites must be as close to them as possible. Second, the sites should not be extremely steep or rugged. This is also important for science reasons – steep rock faces don't preserve geologic deposits very well, because they fall off. In addition, it's necessary for practical reasons so that i) helicopter landing sites are available, and ii) one can travel around the site safely and efficiently on foot without technical equipment. The existing list of target sites is based on examining air photos of the field area to locate sites that meet these requirements. The majority of target sites require helicopter access; a minority of sites are coastal and we believe that it will be possible to access them by small boat.
   2.3. What is required in a visit to a sample site to accomplish the objectives? A visit to a site will consist of two geologists traveling around the site on foot for approximately an eight-hour workday. We will try to look in detail at as much ice-free area as we can. Thus, the amount of time required to visit a site depends on how large the ice-free area is. In addition, it depends on whether or not we find acceptable sample material during ground reconnaissance of the site. For example, a small nunatak – less than one square km in size and 50-100 m in height – would require approx. 1 hour for reconnaissance. If we found acceptable sample material, it would require another 1-2 hours to collect the samples. On the other hand, a large site – many square km of ice-free area with rugged terrain and large elevation changes – could require 6-8 hours for initial reconnaissance, followed by an additional 4-6 hours or more for sample collection. As this amount of time may not be available in a single day, a large site with abundant sample material may require more than one visit. To summarize, the amount of time required to accomplish our objectives at a particular site depends on the size of the site (which can be predicted in advance) and the geologic deposits that are present (which cannot be predicted in advance).

2.4. Planning uncertainties. As described above, we cannot predict in advance whether or not useful geologic deposits will be found at a particular site. This means that we cannot predict in advance the exact length of time that it will take to accomplish the scientific objectives at each site. Thus, efficiently accomplishing these objectives will most likely require adjusting flight schedules often to reflect new information about field conditions.

3. Description of typical daily field work and transport requirements.

3.1. Personnel and cargo weights. A minimum of two personnel are necessary for each day's field work. They will consist of Balco and at least one other member of the shipboard science party, most likely drawn from the marine geology group. Each person will carry a day pack (max. 40 lbs. each) containing personal gear, communications equipment, and geologic field equipment (e.g., compass, hammers and chisels, etc.). One campaign GPS system (30 lb. Pelican case) is also required. The total cargo for each put-in will include personal day packs, GPS, empty rock boxes, and survival bags appropriate to the number of personnel. The cargo for each pull-out will be the same, except that the rock boxes will, we hope, contain rock samples. The maximum possible weight of rock to be collected in a single day is approx. 100 lbs.

3.2. Helicopter access – single put-in/single pull-out. We expect that the majority of sites will require at least one full day's work. Thus, the field party can be dropped off at the site, and the helicopter can return to the ship or work with other field parties before returning to pick up the field party at the end of the day. The helicopter hour requirement for this schedule includes: i) flying to the site area, ii) overflying the site and the immediate area for approx. 10-15 minutes to identify the best work area and landing zone, iii) landing and unloading the field party and cargo, and iv) returning to the same landing site at the end of the day to pick up the field party and cargo. This approach will probably be most efficient for sites that are close to the ship. It is possible that the field party will find that there are no acceptable sampling targets at the site, in which case they would be stuck until the helicopter was available again. Thus, this approach is probably most desirable for large sites that are geologically promising.

3.3. Helicopter access – put-in/close support/pull-out. Instead of just a single put-in and pull-out at the beginning and end of the day, some sites will require close support from a helicopter throughout the day. This would occur for two reasons: first, the site may be far from the ship, so returning to the ship during the day would waste fuel unnecessarily. Second, the site may consist of a group of small nunataks separated by glaciated areas that cannot be crossed on foot. In this case, the helicopter would be necessary to move the field party between small ice-free areas. As in the above case, this approach would involve flying the field party to the site and a brief over flight to identify work areas and landing sites. However, the helicopter would land the field party, remain at the landing zone until they completed work, take off and fly to another landing zone, etc., and return the field party to the ship at the end of the day.

3.4. Helicopter access – joint operations with glaciology fieldwork on glacier sites. Many of the geological target areas are located near sites where glaciology field parties will be installing equipment on glaciers. This is particularly true in the Crane Glacier and Flask Glacier areas, where the glaciology group is planning several installations and I have identified several geological target sites nearby. This gives the potential to combine helicopter flights for both purposes. One potential problem with this, however, is that most of the glaciology sites are located on glaciers, whereas for the geological sites we must visit ice-free rock areas. Glacier margins are likely to be crevassed, so it will not be possible to travel on foot between the glaciology equipment-installation site and our geological sites. Thus, separate landing zones will be required for the geological field party and the glaciology field party.

3.5. Helicopter access - joint operations with glaciology fieldwork on rock sites. The glaciology group proposes to visit several ice-free sites to install cameras. These are near lower Crane Glacier and Flask Glacier. These sites are in geologically promising areas, so the geological field party should also go to these sites. In this case, however, the geology and glaciology field parties can be landed at the same landing zone. An additional consideration for this situation is that the glaciology field party will already be present, so the geologic field party can include only Balco – no field assistant is needed.

3.6. Small boat access – individual put-in/pull-out. Several of the target sites are coastal areas where bedrock outcrops are adjacent to open water. Thus, we anticipate that it will be possible to access these sites by Zodiac. The highest-priority coastal site is the southern bank of Crane Fjord, which was recently exposed by ice-shelf retreat; photos from previous NBP cruises show that it may be possible to directly access a large area of rock outcrop directly from the water. Other high-priority boat-access sites are located near the calving margins of the Hektoria and Drygalski glaciers. The personnel, cargo, and scheduling requirements described above for helicopter logistics also apply for small-boat access.

3.7. Joint operations with bedrock GPS installations. Several coastal bedrock sites (Cape Framnes, Foyn Point, and Cape Marsh) are targeted for GPS installations to measure postglacial rebound rates. Some of these sites will be accessible by small boat, but others will require helicopter access. The primary importance of these sites is their suitability for the GPS study, but as these sites are on bedrock it is also possible that useful geological deposits will be present. Thus, the geologic field party should visit these sites. Personnel will already be on site installing the GPS system, so the geologic field party can consist only of Balco and an additional field assistant is not needed.

3.8. Mission planning template. A sample mission planning template for helicopter access following the single put-in/single pull-out model (see above) is attached.

4. Contingency planning.

4.1. Maximum and minimum success objectives. No one has ever carried out an exposure-dating study in this region of Antarctica, so if we learn anything at all it will be a success. Thus, there is no minimum number of site visits below which this project would not still be valuable. Even in the worst-case scenario where field conditions make it only possible to visit a couple of sites, it is still worth visiting the sites and these visits will yield important scientific results. Similarly, there is no maximum number of site visits for this part of the project beyond which the scientific value of the additional site visits would stop increasing. The more time that the geologic field party can spend on the ground, the greater the likelihood of accomplishing the scientific objectives. Thus, in the event that unexpected helicopter time becomes available, this part of the project will be able to use it for scientifically valuable purposes.

4.2. Backup plans in case helicopter logistics are impossible. This part of the project depends primarily on helicopter logistics to put the geologic field party on the ground. Only a small minority of the identified target sites can be accessed directly by small boat. Thus, if no helicopter logistics were available, we would be limited to the very few boat-accessible sites. There would most likely be no other way to access inland sites.

4.3. Backup plans in case sea ice prevents the ship from operating in the primary field area. This possibility would prevent access to all of the small-boat accessible sites, but would not prevent access to helicopter-accessible sites. If the ship were forced to operate on the west side of the Peninsula, it would become necessary to fly over the Bruce Plateau to access the target field sites, but the distance to most of the target sites would not be significantly increased. If the ship could operate on the east side of the Peninsula but could not proceed south into the Larsen B embayment, the distance to the target field sites in the Crane and Flask Glacier areas would increase, requiring additional helicopter time. However, I have identified a number of backup sites in the Larsen A region. These sites are less relevant to the primary focus of the overall project, but would most likely also yield important scientific results while minimizing helicopter hours in this scenario.

NBP10-01 On-the-Ice Support

The On-the-ice support for cruise NBP10-01 is listed below:

C-515-N Balco - Field Camp Equipment

To be supplied by Special Projects (POC: Melissa Rider)

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Balco NBP
Camping Gear	packs, internal frame	2	5	ea	2
Instruments	GPS unit, Garmin GPS76	0.3	0.8	ea	2
Instruments	GPS download cable for Garmin GPS76	0.1	0.01	ea	2
Instruments	kestrel, hand held weather monitor*	0.1	0.5	ea	0
Kitchen	thermos	0.3	3	ea	3
Medical	first aid kit, personal style	0.3	2	ea	1

*per Dr. Balco, Kestrel hand held weather monitors will be supplied by the field team.

Field Food: Field food for day trips will be supplied by the NBP galley stocks (ex: sandwiches, crackers, cookies, etc.).

C-515-N National Geographic - Field Camp Equipment

To be supplied by Special Projects (POC: Melissa Rider)

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Nat Geo Team NBP
Camping Gear	bag, dry XL	2	5	ea	3
Camping Gear	sleeping bag liner, pile	0.7	2	ea	3
Camping Gear	sleeping bag, standard length	3	9	ea	3
Camping Gear	sleeping pad, ensolite	1	4	ea	3
Camping Gear	sleeping pad, thermarest	1	3	ea	3
Kitchen	fork	0.1	0.1	ea	3
Kitchen	mug, insulated	0.2	0.5	ea	3
Kitchen	plate	0.1	0.4	ea	3
Kitchen	pot, 6-8 qt.	0.3	1	ea	3
Kitchen	spoon, tablespoon	0.01	0.2	ea	3
Tents & Structures	tent, mountain	1.7	21	ea	2
Toilet Equipment	urine bottle	0.3	0.3	ea	3

Field Food: Field food for day trips will be supplied by the NBP galley stocks (ex: sandwiches, crackers, cookies, etc.). Field food for the overnight stay with Scambos, C-515-N, will be provided by the Scambos field team.

C-514-N Scambos - Field Camp Equipment from NBP

To be supplied and distributed from NBP

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Scambos NBP - Needs supplied by NBP MT/ET/MST	Request Supplies from:
Power & Power Accessories	cord, extension (25')	0.5	12	ea	1	Electronics Technician
Power & Power Accessories	power strip (3 prong outlet)	0.2	3	ea	2	Electronics Technician
Stoves & Heaters	stove board, 18 x12" (approx) thin sheet of metal for stove base	0.01	1	ea	2	Marine Technician
Sleds & Vehicles	sled, banana	4	36	ea	2	Marine Technician
Kitchen	paper towels	0.3	0.5	roll	15	ECO Staff
Kitchen	garbage bags	0.001	0.1	ea	20	ECO Staff
Toilet Equipment	toilet paper	0.1	0.8	roll	30	ECO Staff
Communications & IT	VHF handheld radios		3	ea	4	Marine Project Coordinator
Communications & IT	VHF radio chargers (120 v)	0.2	2	ea	4	Marine Project Coordinator
Communications & IT	iridium phone + accessories	0.75	10	kit	2	Marine Project Coordinator
Communications & IT	air to ground radio, Motorola	0.2	3	ea	2	Marine Project Coordinator
Safety Equipment	survival bag, helo - 2 person	3	60	bag	3	Marine Project Coordinator

C-514-N Scambos - Field Camp Equipment Special Projects

To be supplied and distributed by Special Projects (POC: Melissa Rider)

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Scambos NBP Needs supplied by SPECIAL PROJECTS
Camping Gear	bag, dry XL	2	5	ea	5
Camping Gear	bamboo poles, 2-4'	0.05	1	ea	50
Camping Gear	bamboo poles, 8-12', ~1" diameter green flags	0.1	2	ea	120
Camping Gear	chair, thermarest collapsible	1	1	ea	5
Camping Gear	sleeping bag liner, nylon	0.5	2	ea	5
Camping Gear	sleeping bag, long length	3	10	ea	1
Camping Gear	sleeping bag, standard length	3	9	ea	4
Camping Gear	sleeping pad, ensolite	1	4	ea	5
Camping Gear	sleeping pad, thermarest	1	4	ea	5

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Scambos NBP Needs supplied by SPECIAL PROJECTS
Climbing	ascenders	0.1	1.5	pr	4
Climbing	axe, ice	1	2	ea	5
Climbing	carabiner, locking	0.1	0.3	ea	6
Climbing	carabiner, non-locking	0.1	0.1	ea	10
Climbing	crevasse rescue bag	3	55	kit	1
Climbing	harness, seat, Yates adjustable	0.3	2	ea	5
Climbing	picket, 36"	2	2	ea	3
Climbing	pulley	0.5	0.4	ea	5
Climbing	rope, 50 M climbing, dynamic	1.5	10	ea	2
Climbing	rope, prussic size, 6 mm	0.01	0.01	ft	200
Climbing	webbing, 1"	0.001	0.2	ft	60
Communications & IT	iridium phone + accessories	1	10	kit	2
Food & Beverage	dehydrated meals, breakfast (2 svgs/package)	0.2	0.7	ea	20
Food & Beverage	dehydrated meals, dinner (2 svgs/package)	0.2	0.7	ea	80
Food & Beverage	field camp dry foods	12	250	set	1
Fuel & Fuel Supplies	gasoline cans, 18 L. - flight safe	1.5	8	ea	2
Fuel & Fuel Supplies	white gas (gallon)	1	8	gal	12
Kitchen	bag, ziplock 1 gallon	0.001	0.1	ea	50
Kitchen	bag, ziplock 1 quart	0.001	0.1	ea	100
Kitchen	bowl, cereal type	0.1	0.3	ea	6
Kitchen	bowl, plastic tupperware w/ lid	0.3	1	ea	2
Kitchen	can opener	0.1	0.3	ea	2
Kitchen	clothespin	0.005	0.01	ea	20
Kitchen	coffee cone (plus filters)	0.001	0.1	ea	2
Kitchen	corkscrew	0.01	0.3	ea	2
Kitchen	cutting boards, asst. sizes	0.1	1.5	ea	2
Kitchen	fork	0.1	0.1	ea	6
Kitchen	grater	0.2	0.1	ea	2
Kitchen	hotpad	0.01	0.3	ea	2
Kitchen	knife sharpener	0.1	0.1	ea	1
Kitchen	knife, 10" cooks	0.1	0.3	ea	2
Kitchen	knife, butter	0.1	0.1	ea	6
Kitchen	knife, paring	0.1	0.1	ea	2
Kitchen	ladle (10 oz.)	0.1	0.5	ea	2
Kitchen	matches (250/box)	0.1	0.2	ea	2
Kitchen	measuring cup	0.01	0.1	ea	2
Kitchen	mug, insulated	0.2	0.5	ea	6
Kitchen	plate	0.1	0.4	ea	8
Kitchen	pot grip spondonagles	0.1	0.3	ea	2

CATEGORY	DESCRIPTION	Cube (ft)	Weight (lbs)	Unit of Issue	Scambos NBP Needs supplied by SPECIAL PROJECTS
Kitchen	pot, MSR set of 3 @ 1,2 & 3 qt.	0.7	2	set	2
Kitchen	pot, stock 8 qt. +	1	3	ea	2
Kitchen	scrubbies	0.01	0.2	ea	6
Kitchen	soap, dish	0.2	2	bot	2
Kitchen	soap, hand, liquid, 8 oz	0.2	0.5	ea	2
Kitchen	spatula, plastic	0.1	0.9	ea	2
Kitchen	sponges	0.01	0.2	ea	6
Kitchen	spoon, tablespoon	0.01	0.2	ea	6
Kitchen	thermos	0.3	3	ea	4
Kitchen	towel, baby wipe	0.001	1.5	ea	200
Kitchen	towel, dish	0.1	0.1	ea	4
Kitchen	wash basin	0.5	1	ea	2
Kitchen	water bottle, 1 qt	0.3	0.3	ea	2
Kitchen	water jug, 10 gallon insulated w/ spigot	1.7	5	ea	1
Medical	first aid kit, backcountry or comprehensive style	0.5	2.5	ea	1
Power & Power Accessories	generator (1 kw)	1.5	30	ea	2
Safety Equipment	fire extinguishers, 2-5 lb	1	5	ea	2
Stoves & Heaters	stove, backpacking style, multi liquid fuel	0.3	0.5	ea	2
Stoves & Heaters	stove, Coleman 2 burner, white gas	1	12	ea	2
Tents & Structures	tent poles, spare VE-25	0.4	2	set	1
Tents & Structures	tent, mountain	1.7	21	ea	4
Toilet Equipment	bag, 1 gal. biodegradable personal size	0.003	0.01	ea	200
Toilet Equipment	bag, 20 gal. biodegradable storage size	0.003	0.01	ea	15
Toilet Equipment	hand sanitizer, Purell 8 oz.	0.2	1	bot	2
Toilet Equipment	toilet, collapsible frame	1	2	ea	1
Toilet Equipment	urine bottle	0.3	0.3	ea	5
Tools	tool kit (see content list on next tab)	1.5	18	kit	1
Waste Mgmt.	fuel spill kit	1	4	kit	1
Waste Mgmt.	instaberm, 3" sides (collapsible fuel berm)	1.5	2.2	ea	1

Field Food: Dry field food stocks will be supplied by the Special Projects group. This will include both dehydrated meals and more typical dry stocks (ex: pastas, grains, rices, prepared mixes). Fresh and frozen foods will be supplied by the NBP galley staff (ex: cheese, milk, meat, bread).

STANDARD TOOL KIT CONTENTS	QTY	UOI	STANDARD TOOL KIT CONTENTS	QTY	UOI
allen keys, metric	1	set	pencil	3	ea
allen keys, standard 5/64-1/4	1	set	pliers, diagonal cut	1	ea
bungee cords, mini	4	ea	pliers, needlenose	1	ea
cable ties, asst	40	ea	pliers, robogrip	1	ea
channel locks	1	ea	pliers, slip joint	1	ea
crescent wrench, ~10"	1	ea	pliers, vise grips	1	ea
crescent wrench,~ 4"	1	ea	razor knife + spare blades	1	ea
crescent wrench, ~6"	1	ea	scissors	1	ea
earplugs	4	pr	screwdriver, flat head	2	ea
emery paper	1	roll	screwdriver, jeweler's	1	set
file, flat	1	ea	screwdriver, phillips	3	ea
file, one in hand or bastard	1	ea	screws, nuts,& bolts, asst	1	set
file, round	1	ea	tape measure	1	ea
glasses, safety	1	pr	tape, electric	1	roll
hacksaw	1	ea	tape, teflon	1	ea
hacksaw replacement blades	3	ea	wire, 16 gauge	1	roll
hammer, claw	1	ea	wonder bar	1	ea
marker, sharpie	1	ea	wrench, pipe 14"	1	ea
nails, asst	1	set	wrench, spark plug	1	ea

Concept of Operations for Ice Core Drill Camp and IPR survey

Overall science objective

Two main scientific operations will be conducted in the Bruce Plateau region via USAP-chartered Twin Otter to be based at BAS Rothera Station (-67.5667S -68.1333W) – the Radar Survey and the Ice Core Drilling Camp. The Radar Survey and Ice Core Drilling Camp are intended to be able to operate independently from the LARISSA cruise on the NBP. The Radar Survey will consist of three personnel who will spend approximately 2-3 days at the selected ice core drilling site where they will perform a ground-based ice-penetrating radar survey to determine the most optimal location for the ice core samples to be retrieved. Directly following the Radar Survey, the Ice Core Drilling Camp will commence with six personnel occupying the selected drilling site for approximately 45 days where they will retrieve ~500 meters of ice core for shipment back to The Ohio State University. The text and timeline which follows describes the general field plan for both scientific operations.

Ice Penetrating Radar (IPR) Survey:

Survey Participants are:

Ted Scambos
Rob Bauer
Erin Pettit

Ted Scambos will be the field team leader for this portion of the operations and will be accompanied by two other researchers. Scambos and his team will arrive to Rothera via BAS air resources to be closely coordinated with the arrival of the LARISSA field equipment (to be delivered to Rothera Station via the NBP in early December 2009) and the arrival of the USAP-chartered Twin Otter to Rothera also in early December 2009. The team will spend one to two days preparing their cargo for the Twin Otter transport; then, weather permitting; they will fly into the field site with their radar equipment, one Super Wide Track Scandic snow machine, camping and survival equipment, AMIGOS installation equipment, and GPS equipment. The cargo will be pre-arranged to ensure that survival equipment and critical scientific equipment will arrive on site first so that the radar survey can begin even in the event flight operations must be stopped before all the cargo can be delivered.

The Radar Survey team will establish a temporary Scott Tent camp at the designated location then begin the field work. Three Twin Otter flights will be needed to shift the approximate cargo load of 5,500 lbs. to the field site which can be completed in one day if weather conditions allow. However, per the suggestion of Mike Dinn, BAS Operations Manager, 3-4 weather days should be planned to complete this work given the notoriously poor weather conditions in the area.

The primary field work will focus on an ice penetrating radar survey which will radiate 5 km or less from the intended drilling location. The radar team will work in real time to precisely locate the most optimal drilling site for the Ice Core Drilling Camp to recover a core from surface to bedrock. The Radar field team anticipates spending approximately two to three days surveying.

Equipment for the installation of AMIGO and GPS station will be on site; however, full installation of these two systems will not occur until later in the field season (passenger transport via helo from the NBP).

At the completion of the Radar Survey, it is expected that the precise location of drilling operation will be selected. The Radar group will depart the area on the same day that of the Ice Core Drilling team arrives, to ensure optimal Twin Otter use. The Radar Survey group will have a minimal amount of cargo which will have to be returned to Rothera as the camping and survival equipment will be used by the Ice Core Drilling team, and the AMIGOS and GPS equipment will be staged on site for later installation. A lengthy debrief between the Radar Survey group and the Ice Core Drilling Camp team is not expected.

The three field team members of the Radar Survey group will return to Rothera Station and carry on to Punta Arenas via BAS fixed-wing aircraft at the earliest opportunity. Two of the three Radar Survey team members hope to sail on the LARISSA cruise NBP10-01 which intends to depart Punta Arenas in the final days of December 2009.

Ice Core Drilling Camp:

LARISSA Ice Camp Participants are:

* Lonnie Thompson
Ellen Mosley-Thompson
Victor Zagorodnov
Roberto Filippi
Vladimir Mikhalenko
Thai Verzone (RPSC Camp Manager)

* Felix Benjamin Vicencio Maguina is an alternate PQing for the Ice Camp

The Ice Core Drilling Camp will be led by Drs. Ellen Mosley-Thompson and Lonnie Thompson. Drilling operations will begin directly after the conclusion of the Radar Survey operation. The Ice Core Drilling Camp will be set up in the precise location determined by the Radar Survey team in hopes of retrieving a high resolution core series to bedrock to develop histories of glacial flow on the Larsen ice shelf. Approximately 500 meters of core will be retrieved in 1 meter sections. The approximate duration of the Ice Core Drilling Camp will be 45 days.

The Ice Core Drilling Team will arrive to Rothera Station via Rothera air resources approximately four days in advance of their anticipated deployment to the field site. This time will be needed to pre-stage cargo for Twin Otter operations.

Just under 30,000 lbs. of cargo is needed to support the Ice Core Drilling Camp. All equipment and supplies will be delivered to the field site via USAP-chartered Twin Otter, based at BAS's Rothera Station. Scientific equipment for the camp will consist of a lightweight ice core drilling system, generators, ice core storage tubes and insulated boxes, food grade ethanol, and fuel. Field camp equipment will include all tents, food, camping gear, first aid equipment, kitchen goods, and additional fuel for camp operational use. Propane will be the cooking fuel source, while diesel fuel will power generators.

Approximately five days of Twin Otter support will be needed to stage the camp equipment presuming three flights per day. Per the suggestion of Mike Dinn, BAS Operations Manager, 10 days should be planned to complete this work given the notoriously poor weather conditions in the area.

Ice core drilling camp cargo will be staged for transport to the field site in the following priority:

1. Life safety equipment
2. Field structures
3. Scientific equipment

The first priority at the site will be to establish the camp's soft-sided work and sleeping tents which will take approximately two to three days. Once the camp is established, the science drilling will commence. It is anticipated that drilling activities will continue throughout the field season until three to four days prior to the camp close out period (ie: three days camp set up; 38 days drilling; four days camp close out). Approximately 500 meters of core will be retrieved in 1 meter sections which will be processed and stored on site in a "freezer cave" dug into the plateau. The early drilling period will produce ice core more rapidly than the later drilling period because the distance each core must travel increases as the core becomes deeper. Three to four days prior to camp close out, scientific operations will cease and attention will turn to camp deconstruction. It is anticipated that five days of Twin Otter support will be needed to pull out the camp. Again, additional days will be anticipated in the field planning to account for the generally poor weather conditions in this region.

At an interval yet to be identified, four separate days of Twin Otter support are requested at the camp for re-supply of incoming ice-core storage boxes and fuel, and for sending recovered ice cores and waste to Rothera. The field team would prefer to have a weekly flight planned; however, dependent on other commitments for the Twin Otter, the team can be very flexible as to the arrival of these flights to allow maximum efficient usage of the Twin Otter on other projects.

In addition to the field and science equipment which will be delivered to Rothera Station via the NBP in early December 2009, two freezers shipping containers will also be delivered. These freezer containers will house the frozen core as it is transported from the field site to Rothera. Rothera technicians will be asked to monitor the core samples to ensure that they maintain temperature until they can be shipped to Punta Arenas for transport.

Near the end of the drilling campaign, one helo flight from the NBP will bring two to three members of the Scambos science team to the Ice Core Drilling Camp where they will spend two to three days on site installing the AMIGOS and GPS systems. Camping provisions will be available on site for the Scambos team as to reduce their helo flight load from the NBP to the Ice Core Drilling Camp.

At the completion of the field season, all personnel and material will be flown to Rothera Station for return to Punta Arenas, Chile, via Twin Otter. The only material left on site will be the AMIGOS and GPS stations as per the scientific proposal. All field equipment, science equipment, scientific samples, and waste will be packaged and prepared for pick by the NBP in late April (as a part of another science cruise which will work in the vicinity of Rothera Station). Of particular importance, the ice core samples will be transferred to the NBP for continued frozen storage. All equipment and samples will be returned to Punta Arenas and prepared for either on-site storage or further shipping as needed. Ice core samples will be shipped back to The

Ohio State University, again, as frozen cargo, via the USAP cargo system, Port Hueneme, California.

Due to another field commitment, Dr. Lonnie Thompson has requested that a small percentage of the total science drilling equipment (1308 lbs/100 cube) be returned to The Ohio State University by 1 April 2009. The may require shipment via commercial air from Punta Arenas to Port Hueneme.

Ice Camp Site Selection

Preliminary Ice Drill Camp Locations:

Jorum 1: -65.126 S, -62.560 W >900 m ice thickness
Crane 1: -65.411 S, -63.256 W ~450 m ice thickness
Crane 2: -65.602 S, -63.406 W ~410 m ice thickness
Bruce 1: -66.040 S, -64.000 W (thickness uncertain)

First Bruce Plateau Twin Otter Recce

November 17th, 2008, a USAP Twin Otter flight crew took landed a several potential landing sites on and around the Bruce Glacier. There was a very brief weather window so not all of the potential sites were landed at.

Second Bruce Plateau Recce via USAP Aircraft

A second successful recce to the Bruce Plateau was conducted by BAS Twin Otter flight crews on February 4th 2009. A SITREP and photos provided by the BAS flight crew are posted on the LARISSA website:

http://www.hamilton.edu/news/exp/LARISSA/reportandABimages.html

The two LARISSA landing sites visit on the recce include:

Alpha	(approx 4 km x 4 km square)
Center	65.717892 S 63.480540 W
UL	65.695731 S 63.462567 W
UR	65.725111 S 63.426552 W
LL	65.710357 S 63.533777 W
LR	65.739698 S 63.498259 W

Beta	(approx 8 km x 8 km square)
Center	66.037205 S 64.003112 W
UL	66.990314 S 63.963476 W
UR	66.053486 S 63.887130 W
LL	66.021068 S 64.118648 W
LR	66.084270 S 64.043059 W

For images of both Alpha and Beta sites see
ftp://sidads.colorado.edu/pub/incoming/tharan/larissa_landing/

LARISSA Site Selection position

Based on a thorough review of all the data the position of the LARISSA Ice Coring Drill Camp will be located: 66.037205 S 64.003112 W (Beta Center)

An IPR survey will provide the exact location for the camp once survey is completed in early December 2009, just prior to the camp put in from Rothera Station (BAS).

LARISSA Twin Otter Schedule (including potential work with POLENET)

The LARISSA USAP-contracted Twin Otter will arrive at Rothera on 02 December 2009 and be based at Rothera until 20 February 2010 in support of LARISSA Ice Camp and POLNET.

Given the needs of the LARISSA field team, planning dictates that the LARISSA team cannot commit to releasing the Otter until 15 January 2010 at the latest for work in Patriot Hills. The LARISSA team will endeavour to release the Otter before the 15^{th}. If this can be done, Liz Kauffman has stated that, depending on the weather, the Fixed Wing group can likely adjust the schedule to optimize this potentially early release.

Thai Verzone will discuss new information on the Patriot Hills closure with Ellen Mosley-Thompson to seek any additional efficiencies; however, for planning purposes the January 15^{th} date will remain as the release date for the Otter to perform any work at Patriot Hills. ALE support for scientific personnel at Patriot Hills will cease on 23 January 2010.

Note: Richard Cameron is the USAP Twin Otter Captain his email is: cameron.rich@gmail.com

Vessel Based Communications

All participants will be provided with an individual e-mail account. The address will be of the form **firstname.lastname.Guest@nbp.usap.gov**. For example, Ernest Shackleton's address would be Ernest.Shackleton.guest@nbp.usap.gov and Robert Scott's address would be Robert.Scott.guest@nbp.usap.gov. E-mail and network access will be made available 24 hours before departure and will end no later than 24 hours after arrival in port following the cruise so that workstation and network maintenance can begin. The E-mail system used on the USAP vessels is Eudora.

The current vessel E-mail policy gives each user an allotment based on the cruise length 59 days (plus four days for port call time) multiplied by a daily quota of 25kB. This allows each cruise participant 1.6Mb for the cruise.

A per-message size filter of 100kB outbound and 75kB inbound will be in effect. Users who have exceeded their allotment will be responsible for paying the additional transmission cost. Please see the attached 'Vessel Cruise participant E-mail Policy' for details.

The NBP does *not* maintain an active Internet connection. Outbound E-mail is collected on the ship's mail server, while mail bound for the NBP is stored on a server at RPSC headquarters in Denver. E-mail is generally exchanged with Denver three times per day. The E-mail transmission times will be posted in the Electronics Laboratory (E-Lab). It is not recommended that files/messages of over 5 megabytes be transferred, as the chances of maintaining a connection long enough to transfer this volume of data are very low.

NBP10-01 Meta Data collection

E-log is an electronic log used to keep information online in a chronological order. The grantees will use this software package on NBP10-01 to keep a shared event logbook. E-log lives on a single computer, but can be accessed through a web page from other computers. If desired, access can be controlled with user name and password. A configuration file is used to customize data entry fields and the look and feel of the log. Entries are time stamped. If desired, variables can be extracted from the RVDAS shared memory to automatically populate fields (such as latitude, longitude, TSG sea surface temperature, etc). The entries can be sorted, updated and deleted as required. The data can be exported to several formats including a CSV file for easy importation to Excel.

Excess Data Communications

The APPROVED supportable amount of traffic for excess data transmissions is 30MB a week

Estimated Excess Data Transmission requested for NBP10-01, LARISSA by group and totaled.

Outreach Programs

SEN and Institutions	MB/Week
C-515-N (Domack)	
Hamilton College	200 kB/day = 1.4 MBytes
Montclair State Univ.	500 kB/week = 0.500 MBytes
Southern Illinois University	1400 kB/week = 1.4 MBytes
C-246-N (Vernet)	
SCRIPPS Inst. Oceanography	1000 kB/week = 1.0 MBytes
University Hawaii	2500 kB/week = 2.5 MBytes
Univ. Ghent Belgian News	573 kB/week= 0.560 MBytes
Duke University	2500 kB/week = 2 MBytes
C-514-N (Scambos)	
Univ. Alaska Fairbanks	573 kB/week = 0.560 MBytes
U of Colorado/NSIDC	2000 kB/week = 2 MBytes
Univ. Ghent Belgian News	573 kB/week= 0.560 MBytes
National Geographic (Stenzel)	80 kB/ ~3days = 2.4 MBytes
Totals	**14.88 MBytes/week**

Remote Sensing Data Incoming

C-514-N for AMSR passive microwave, MODIS, and other high-resolution sensors = 2 MB per week

C-246-N MODIS ocean color, ice, sea surface temperature (calculated at 150 KB per day) for Vernet group =1-2 MB per week

Estimated Totals Incoming = 4 MB per week

Field Communications

Communication Equipment

The standard method for communications for LARISSA will be Iridium satellite phones and VHF radios. Communication resources and numbers are in the LARISSA Communications Plan

LARISSA Communications Inventory

Ice camp

- Two Iridium phones + accessories + voicemail on primary line
- Two SIM cards
- One laptop, one data kit (for Iridium email)
- Eight handheld VHF radios with chargers

AMIGOS and GPS installations via Helo

- Two Iridium phones + accessories + voicemail on primary line
- Two SIM cards
- Four handheld VHF radios with chargers

Zodiac Ops

- One Iridium phone + accessories + voicemail on primary line
- One SIM card
- Three handheld VHF radios with chargers

Spares

- Four handheld VHF radios with chargers

Marine Band Repeater

A marine band repeater borrowed from McMurdo Station will be installed at (Determine Lat and Long) the repeater works on frequencies 146MHZ to 174MHZ. The installation of this equipment will be one of the first missions for the NBP based helicopters. A team of two RPSC vessel staff including an ET and MT and Dr. Greg Balco and the repeater equipment will fly to a pre determined installation site. This may require two round trip flights for this deployment.

Concept for LARISSA Communication

This project has three field components:

1. Ship-based science operations off the *RV/IB Nathaniel B. Palmer* (NBP)
2. Field equipment installations supported by two contracted USAP helicopters and Zodiacs based off the NBP.
3. A light-weight ice core drilling field camp on the Bruce Plateau.

Each component of this multidisciplinary project requires communication between all other components. For the most part, LARISSA project communications will be coordinated from the NBP. Communications occurring at the LARISSA Ice Drilling Camp will be coordinated and managed locally by the RPSC Camp Manager, Melissa Rider, who will communicate with the NBP, Rothera and Palmer Stations on a regular communication schedule.

Communication Schedules

RV/IB Nathaniel B Palmer and the LARISSA Ice Drilling Camp

- The NBP and the LARISSA Ice Drilling Camp will make contact twice a day via Iridium telephone or VHF FM radio with a morning and evening schedule at 0800 (local time) and 2000 (local time)

Helicopter operations off the RV/IB Nathaniel B Palmer

- Upon departure from the ship, radio communications are passed from the RPSC Helicopter manager to the ships bridge. The pilot will state the persons on board (POB) and duration of fuel. The pilot is required to check in every 15 minutes and state latitude, longitude and fuel duration.
- Before landing on the ice or at the Ice Camp, the pilot must establish communication and state location and intentions. Once landed, no further check-ins are required until takeoff.
- Before departure from ice, the pilot will re-establish radio communications with the NBP and any individuals left at location prior to final departure. The pilot states POB (persons on board) and duration of fuel. The pilot is required to check in every 15 minutes and state latitude, longitude and fuel duration.
- There are three forms of communication for flight operations. One is the VHF FM radio. The second is the VHF AM radio and the third is the satellite Iridium phone which is equipped with speed dial. In addition, the deployed aircraft AFF will be monitored by McMurdo Flight Control where every two minutes the flight data of the underway aircraft will be recorded.

NBP Fast Boat SAR tender or Zodiac deployments

- Upon departure from the ship, the shore boat coxswain is required to establish radio communications via VHF radio with the bridge. If the shore boat is with in line of sight with the vessel or secured ashore contact between the vessel and the shore boat should be made every 30 minutes.
- If the shore boat is out of sight of the *RV/IB Nathaniel B Palmer* the shore boat coxswain is required to check in every 15 minutes and state latitude, longitude and fuel duration.

Project Resources with Communication Information

RV/IB Nathaniel B. Palmer

Bridge Iridium +00-8816-763-15077,
MPC Office Iridium +00-8816-763-15076
Inmarsat +00-698-874-764-716-772 (from Iridium via AOR-W Inmarsat)
VHF Channel 09 and 16
Email:MPC@nbp.usap.gov
Airband: VHF-FM 157.175 TX/RX, (Handheld radios for Helitacks Jenkins/Hein)
Air to ground: VHF-FM 170.00 TX/RX
Science frequency: VHF FM (TBD)
Traffic Control Air VHF: 118.1 MHz

Aircraft aboard RVIB Nathaniel B. Palmer for LARISSA Support

N215PH, Bell 206L helicopter

Iridium +00-8816-514-67519
Airband: VHF-FM 157.175 TX/RX,
Air to ground: VHF-FM 170.00 TX/RX
Science frequency: VHF FM (TBD)
Traffic Control Air VHF: 118.1 MHz
Emergency locator beacon hex code: ADC64999743B651 S/N 02853

N219PH, Bell 206L helicopter

Iridium +00-8816-514-67521
Airband: VHF-FM 157.175 TX/RX,
Air to ground: VHF-FM 170.00 TX/RX
Science frequency: VHF FM (TBD)
Traffic Control Air VHF: 118.1 MHz
Emergency locator beacon hex code: ADC64999741B651 S/N 03115

NBP Fast Boat SAR tender

Primary Phone Number:8816-763-27170 Direct dial: (808) 659-7170
ICCID: 89-88-169-312-002-999-229 NSF023410
Airband: VHF-FM 157.175 TX/RX,
Air to ground: VHF-FM 170.00 TX/RX
Science frequency: VHF FM (TBD)
Two handheld VHF Channels 09 and 16

On Ice Field Communications

Primary Phone Number: +8816-763-27171 Direct Dial: (808) 659-7171
ICCID: 89-88-169-312-002-999-245 NSF (not assigned yet)
Alt. Phone Number: +8816-763-27167 Direct Dial: (808) 659-7167
ICCID: 89-88-169-312-002-999-237 NSF (not assigned yet)

Rothera Station

Air Ops: +44 1223 221670, Air –ground ops: +88 1631 831219,
Station: + 0870 32301614, Out of hrs emergency number, +0044 221696
Base Commander out of hrs, +0044 221 688
Inmarsat: +870 323201611
FAX: +870 323 201614
E-mail: Rfom@bas.ac.uk, rcomms@bas.ac.uk
HF: 5080 USB, 7775 USB, 9106 USB: with primary freq in bold HF
(Capabilities – 2 to 30 MHz)
Traffic Control Air VHF: 118.1 MHz

Marambio Station:

Tel/Fax +29 744 72583
Fax: +0810 333 0660
E-mail: Marambio@satlink.com.air
Air VHF: 118.1 MHz

Palmer Station:

Iridium: +00-8816-763-15071, Inmarsat: +00-697-720-568-2775,
HF radio: 4125.0 MHZ
E-mail: palmer.manager@usap.gov

LARISSA Ice Drilling Field Camp

Primary Phone Number: 8816-763-17871 Direct Dial Number: (808) 659-7871
ICCID: 89-88-169-312-002-999-203
NSF Handset # 024021
Secondary Phone Number: 8816-763-17876 Direct Dial Number: (808) 659-7876
ICCID: 89-88-169-312-002-999-211
NSF Handset # 024018
Airband: VHF-FM 157.175 TX/RX,
Air to ground: VHF-FM 170.00 TX/RX
Science frequency: VHF-FM (TBD)
VHF Channel 09 and 16
Email: larissafieldcamp@gmail.com

Chilean Rescue Coordination Centre (RCC)

Captain Ricardo Bendel: Head of MRCC Punta Arenas - SAR Operations.

PH: +56 61 201161

Email: rbendel@directemar.cl

MAC Center, McMurdo

Weather Forecaster Direct dial: 720.568.1019

Weather Forecaster Email: mcm.weather.forecaster@usap.gov

Met Manager Email: mcm-soppmetmanager.mailbox@usap.gov

Weather Office Iridium: 8816-763-20030

Mac Center ATC Direct Dial: 720.568.1052

Mac Center ATC Email: macctr@usap.gov

Air Traffic Manager Email: mcmsoppatm@usap.gov

Mac Center Iridium: 8816-763-15197

SPAWAR, Charleston

ROF Weather Forecaster Direct Dial: 843.218.3927

ROF Weather Forecaster: chrl_fcstr@navy.mil

ROF Met Manager Phone: 843.218.4287

ROF Met Manager Email: ken.edele@navy.mil

ROF Weather Iridium: 8816-763-15168

ROF ATC Direct Dial: 843.218.7156

ROF ATC Email: chrl_rof@navy.mil

ROF Air Traffic Manager Phone: 843-218-3915

ROF Air Traffic Manager Email: jeremiah.a.clark1@navy.mil

ROF ATC Iridium: 8816-763-15168

Field Data Transmission

NBP10-01 SIM Cards

The LARISSA project will require 22 SIM cards. 2 -Seismic units will be using SIM-Less cards. (See below spreadsheet)

*SIM-Less modem used

Table 10: LARISSA SIM Cards for Field Equipment

Card #	Geographic Position	Activation date	Deactivation date
1	AMIGOS-1 Lower Leppard	Aug 1st 2008	Approx. Dec 1st 2012
2	AMIGOS-3 Lower Flask	Aug 1st 2008	Approx. Dec 1st 2012
3	AMIGOS-4 Scar Inlet	Aug 1st 2008	Approx. Dec 1st 2012
4	cGPS Duthiers Point	Feb 1st 2009	Approx Dec 1st 2013
5	cGPS Vernadsky	Feb 1st 2009	Approx Dec 1st 2013
6	cGPS Hugo Island	Feb 1st 2009	Approx Dec 1st 2013
7	cGPS Cape Marsh	Dec 1st 2009	Approx. Dec 1st 2012
8	cGPS Cape Frammes	Dec 1st 2009	Approx. Dec 1st 2012
9	cGPS Foyn Point	Dec 1st 2009	Approx. Dec 1st 2012
10	AMIGOS-2 Lower Crane	Jun 1st 2009	Approx. Dec 1st 2012
11	AMIGOS Communications	Jun 1st 2009	Approx. Dec 1st 2012
12	AMIGOS-5 Bruce Plateau	Nov 1st 2009	Approx. Dec 1st 2012
13	AMIGOS-6 Ridge Camera	Nov 1st 2009	Approx. Dec 1st 2012
14	Glacier Precision GPS(Crane)	Dec 1st 2009	Approx. Dec 1st 2012
15	Glacier Precision GPS (Flask)	Dec 1st 2009	Approx. Dec 1st 2012
16	Glacier Precision GPS (Leppard)	Dec 1st 2009	Approx. Dec 1st 2012
17	Seismic Cape Framnes **(SIM-Less)**	Dec 1st 2009	Approx. Dec 1st 2012
18	Seismic Foyn Point **(SIM-Less)**	Dec 1st 2009	Approx. Dec 1st 2012
19	cGPS Unit Comms at Boulder	Dec 1st 2009	Approx. Dec 1st 2013
20	LARISSA Field Camp	Nov 1st 2009	Approx. May 1st 2010
21	LARISSA Field Camp	Nov 1st 2009	Approx. May 1st 2010
22	LARISSA Zodiac Ops	Dec 1st 2009	Approx. Mar 1st 2010
23	LARISSA Helo Ops	Dec 1st 2010	Approx. Mar 1st 2011
24	LARISSA Helo Ops	Dec 1st 2011	Approx. Mar 1st 2012

LARISSA Emergency Plan SAR and Medevac

Concept for Emergency Response

This project has three field components:

4. Ship based science operations off the *RV/IB Nathaniel B. Palmer* (NBP),
5. Field equipment installations supported by two contracted USAP helicopters and Zodiacs based off the *RV/IB Nathaniel B. Palmer*,
6. A light-weight ice core drilling field camp on the Bruce Plateau.

Each component of this multidiscipline project requires SAR planning. On the whole SAR and medivac incidents that occur during the LARISSA project will be coordinated from the *RV/IB Nathaniel B Palmer*. Emergency incidents occurring at the LARISSA Ice Drilling Camp will be coordinated and managed locally by the RPSC Camp Manager, Melissa Rider, who will communicate with the Rothera Station medical facilities and flight control, and with the *RV/IB Nathaniel B Palmer.*

Project Locations

RVIB Nathaniel B. Palmer:

The NBP will conduct LARISSA Operations in the Larsen B Embayment and surrounding waters. The vessel will carry two Bell 206L turbine helicopters (Tail numbers are **N215PH** and **N219PH**) for the duration of the NBP10-01 cruise. These helicopters will support field equipment installations and be on call for Emergency Response.

NBP10-01 Cruise dates: Depart PUQ Jan 2, returns to PUQ Mar 2, 2010 (59 Sea days)

Field Equipment Installation Sites:

	Lat S	Long W	Access	People	Priority
High Precision GPS sites					
Crane Glacier GPS	-65.4550	-62.8639	Helo	3	High
Flask Glacier GPS	-65.7568	-62.8340	Helo	3	High
Leppard Glacier GPS	-65.9544	-62.9800	Helo	3	High
GPS Rebound Stations (EAP), Seismic systems & Balco*					
Cape Framnes, Jason Peninsula*	-65.9500	-60.5500	Helo/Zod	3	High
Foyn Point, Nordenskold Coast*	-65.2500	-61.6300	Helo	3	High
Cape Marsh, Robertson Island*	-65.2390	-59.4680	Zodiac	3	High
Tentative AMIGOS Sites					
Bruce Plateau Drill Site AMIGOS	-66.0372	-64.0031	Helo	5	High

	Lat S	Long W	Access	People	Priority
Scar Inlet Ice Shelf AMIGOS	-65.8501	-61.9420	Helo	5	High
Crane Glacier AMIGOS	-65.3734	-62.6383	Helo	5	High
Flask Glacier AMIGOS	-65.7789	-62.5500	Helo	5	High
Leppard Glacier AMIGOS	-65.9520	-62.6700	Helo	5	Moderate
AMIGOS Ridge Camera	-65.7505	-62.3296	Helo	4	Moderate
AP Outcrop Locations - Balco sites					
(Exposure-dating sites by helo)					
Drygalski lower glacier	-64.7750	-60.7500	Zodiac	2	High
Drygalski lower glacier	-64.7750	-60.9010	Helo	2	High
Hektoria upper glacier	-64.9000	-61.7750	Helo	2	Moderate
Hektoria lower, S side	-65.0000	-61.8000	Helo	2	Moderate
Crane lower glacier	-65.3550	-62.2500	Zodiac	2	High
Crane upper glacier	-65.3250	-62.5500	Helo	2	High
Melville Glacier	-65.4790	-62.2320	Helo	2	Moderate
Starbuck Glacier	-65.6380	-62.4120	Helo	2	Moderate
Flask lower glacier	-65.8130	-62.4880	Helo	2	High
Leppard lower glacier	-65.9900	-62.6500	Helo	2	High
Leppard upper glacier	-65.8970	-62.8220	Helo	2	High
Exposure-dating sites by Zodiac					
Drygalski lower glacier	-64.7750	-60.7500	Poss zod	2	High
Hektoria Bluffs	-65.0250	-61.3750	Zodiac	2	High
Crane lower glacier	-65.3550	-62.2500	Zodiac	2	High
Cape Longing	-64.5560	-58.9000	Zodiac	2	N/A

Ice Core Drilling Camp:

Bruce Plateau: **66.037205 S 64.003112 W (Beta Center)**
Supported by USAP Twin Otter based at Rothera Station (BAS)
Six camp participants (Five grantees and one RPSC camp manager)
Field camp dates: Jan 1-Feb 15, 2010 (45 days)

Emergency Coordination

Coordination of any emergency or SAR event will begin locally at the scene. The field team leader at the scene will communicate with the Master of the *RV/IB Nathaniel B. Palmer*, the Marine Projects Coordinator (MPC) and Chief Scientist, providing a current Situation Report (SITREP) of the emergency incident on the ground or at sea.

In the event of any emergency or SAR event at the ice drilling field camp, the camp manager is responsible for establishing communications with both the *RV/IB Nathaniel B. Palmer* and Rothera Station, and for providing a SITREP of the emergency situation to both.

RV/IB Nathaniel B. Palmer

In field

Response to an emergency situation

Aboard the *RV/IB Nathaniel B. Palmer*
Involving a deployed field party
Involving aircraft deployed off the ship
Each of these will be coordinated, in the first instance, by the Master of the *RV/IB Nathaniel B Palmer* or the RPSC MPC, Adam Jenkins. Once contact between the ship's Master and the field team leader on the emergency scene has been established, protocols for incident management and resource allocation will follow, based on the emergency SITREP.

A routine communication schedule will be followed when any field team is deployed off the *RV/IB Nathaniel B. Palmer*.

NBP based Helicopter missions: Flight crew will make contact with ship's communication command via VHF/SSB or Iridium every 15 minutes while underway until the Helicopter has either successfully landed on site, or is back aboard the ship. If aircraft is overdue by 15 min (has not responded to radio calls) a second SAR aircraft will begin deployment, while calls to mission aircraft continue, At the same time a phone call will be made from the *RV/IB Nathaniel B Palmer* to McMurdo (MCM) flight command to determine flight status of the overdue aircraft based on their flight-following (AFF) data. McMurdo flight command should be notified of pending SAR call out and confirmed that MCM has both aircraft on AFF. This does not preclude the launching of the NBP's Zodiac (As the incident warrants). The second aircraft will be deployed in a SAR mode with a medical recovery person. If mission aircraft is known or highly suspect to be in water the SAR aircraft will have the Billy Pugh attached. The SAR aircraft will carry internally a four person raft that could be dropped to the survivors and then inflated in the water if the aircraft has ditched in the sea.

Shore Boat missions (Zodiac mark V): Zodiac field team will make contact with ship's communication command via VHF or Iridium every 30 minutes while underway in the field. If after 45 minutes no communication is established with the deployed Zodiac, a second shore boat will be prepared for an emergency response. In addition an aircraft will be rolled out of the hanger and prepared for an emergency response in the event it is warranted for proper emergency response.

Initial medical response: Initial medical response involving LARISSA is limited by medical resources. Any requests for critical patient aeromedical evacuation from LARISSA project sites in the vicinity of the *RV/IB Nathaniel B. Palmer* will be coordinated through the Master of the *RV/IB Nathaniel B. Palmer*. Non-critical patient evacuation may originate from the *RV/IB*

Nathaniel B. Palmer, using the Bell 206L helicopters, and supplemental oxygen and stretcher provided as part of the *RV/IB Nathaniel B. Palmer* medical kit.

Out of field

Notification will be sent to the Punta Arenas, Chile-based NSF Representative as outlined in the NSF emergency response protocols.

Ice core drilling camp

In field

For emergency incident response stemming from the LARISSA ice drill camp and the resources based in this vicinity, the RPSC camp manager will take the role as on-site incident commander. The RPSC camp manager will coordinate between the incident personnel, the *RVIB Nathaniel B. Palmer* and Rothera Station to determine which resource would provide the proper respond to the emergency SITREP.

Communications and consultation between RPSC camp manager and *RV/IB Nathaniel B. Palmer* emergency medical technicians (EMT's) and Rothera Station medical doctor will be initiated immediately to assist with medical treatment protocols.

Out of field

Notification will be sent to the Punta Arenas, Chile-based NSF Representative as outlined in the NSF emergency response protocols.

Field equipment Installations

In field

Emergency incident response to situations based at or near LARISSA field equipment sites will be coordinated through the field team leader (TBD). The field team leader will then follow the same procedures outlined above for incidents at the LARISSA ice drill camp.

In the event that communications cannot be made between the field party and the *RV/IB Nathaniel B. Palmer*, the field team leader will attempt to establish communication directly with Rothera Station or McMurdo Station respectively. Rothera or McMurdo Station emergency operations center (EOC) will follow the established protocols for incident command system and resource allocations.

Broader Crisis Management and Recovery

Broader crisis management and recovery (CMR), and international coordination will be conducted by the Search and Rescue Service (SAR) of Chile. Under international search and rescue arrangements, the LARISSA project activities fall within the Chilean Search and Rescue Region. Therefore, the Chilean Rescue Coordination Centre (RCC) would be the lead RCC for International Maritime Organization and International Civil Aviation Organization (IMO/ICAO) purposes.

Chilean Rescue Coordination Centre (RCC)

Captain Ricardo Bendel: Head of MRCC Punta Arenas - SAR Operations.

PH: +56 61 201161

Email: rbendel@directemar.cl

Resources Available

RV/IB Nathaniel B. Palmer

Bridge Iridium +00-8816-763-15077,

MPC Office Iridium +00-8816-763-15076

Inmarsat +00-698-874-764-716-772 (from Iridium via AOR-W Inmarsat)

Email:MPC@nbp.usap.gov

Airband: VHF-FM 157.175 TX/RX,

Air to ground: VHF-FM 170.00 TX/RX

Science frequency: VHF FM (TBD)

HF Radio

VHF Channels 09 and 16

SAR range: 240 nm in 24 hours @ 10 knots

From approx 1 Jan –28 Feb.

- Certified emergency medical technician (EMT)
- A full remote area first aid kit, medical oxygen, a stretcher.
- Personnel trained in remote-area first aid.
- Telemedicine support MCM 24/7.

NBP Fast Boat SAR tender

Primary Phone Number: 8816-763-27170 Direct dial: (808) 659-7170

ICCID: 89-88-169-312-002-999-229 NSF023410

Airband VHF Channel 09 and 16

SAR range: 20nm (weather dependent)

From approx: 1 Jan –28 Feb.

Aircraft aboard RVIB Nathaniel B. Palmer for LARISSA Support

- **N215PH** , Bell 206L turbine helicopter
  Designated call sign: **5PH**
  Iridium +00-8816-514-67519
  Airband: VHF-FM 157.175 TX/RX
  Air to ground: VHF-FM 170.00 TX/RX
  Science frequency: VHF FM (TBD)
  Emergency locator beacon hex code: ADC64999743B651 S/N 02853
  SAR range: 270 nm, carrying 1 patient litter and SAR team (3)
  From approx 1 Jan –28 Feb.

- **N219PH**, Bell 206L turbine helicopter
  Designated call sign: **9PH**
  Iridium +00-8816-514-67521
  Airband: VHF-FM 157.175 TX/RX,
  Air to ground: VHF-FM 170.00 TX/RX
  Science frequency: VHF FM (TBD)
  Emergency locator beacon hex code: ADC64999741B651 S/N 03115
  SAR range: 270 nm, carrying 1 patient.litter
  From approx 1 Jan –28 Feb.

On Ice Field Communications for AMIGOS and cGPS Teams

Primary Phone Number: +8816-763-27171 Direct Dial: (808) 659-7171
ICCID: 89-88-169-312-002-999-245 NSF (not assigned yet)
Alt. Phone Number: +8816-763-27167 Direct Dial: (808) 659-7167
ICCID: 89-88-169-312-002-999-237 NSF (not assigned yet)

Rothera Station

Air Ops: +44 1223 221670, Air –ground ops: +88 1631 831219 ,
Station: +44 1223 221673, FAX: +870 323 201614
Inmarsat: +870 323201611
Station: + 0870 32301614, Out of hrs emergency number, +0044 221696
Base Commander out of hrs, +0044 221 688
Inmarsat: +870 323201611
E-mail: Rfom@bas.ac.uk, or rcomms@bas.ac.uk
Air VHF: 118.1 MHz

- BAS Twin Otter fixed-wing support
- SAR range: 300nm
- Medical facility and doctor
- Full aero-medical retrieval kit (allows aero-medical critical care support)

- Telemedicine support from 24/7.

Marambio Station:

Tel/Fax +29 744 72583
Fax: +0810 333 0660
E-mail: Marambio@satlink.com.air
Air VHF: 118.1 MHz

- Fixed-wing air support
- Helicopter support
- Medical facility and doctor
- Full aero-medical retrieval kit (allows aero-medical critical care support)
- Telemedicine support from 24/7.

Palmer Station:

Iridium: +00-8816-763-15071, Inmarsat: +00-697-720-568-2775,
E-mail: palmer.manager@usap.gov
HF radio: 4125.0 MHz

- Medical facility and M.D

LARISSA Ice Drilling Field Camp

Primary Phone Number: 8816-763-17871 Direct Dial Number: (808) 659-7871
ICCID: 89-88-169-312-002-999-203
NSF Handset # 024021
Secondary Phone Number: 8816-763-17876 Direct Dial Number: (808) 659-7876
ICCID: 89-88-169-312-002-999-211
NSF Handset # 024018
Email: larissafieldcamp@gmail.com
Airband VHF-FM 157.175 TX/RX,
SAR range: local response
From approx: 1 Jan –15 Feb.

- Certified EMT and PA, Thai Verzone
- A full remote-area first aid kit, medical oxygen, and backboard.
- Personnel trained in remote-area first aid.

LARISSA Twin Otter Based at Rothera Station

Primary Phone Number: 8816-514-67634
Email: cameron.rich@gmail.com
Captain Richard Cameron, KBA

Medical Evacuation via Aircraft

RVIB Nathaniel B. Palmer

Primary route

- The most desired medical evacuation route for life-threatening injuries from the *RV/IB Nathaniel B Palmer* is to fly the patient directly to Marambio Station using one of the Bell 206 helicopters carried aboard the vessel, if the vessel is within the aircraft's SAR range of 270 nm. If the vessel is outside the aircraft's SAR range, the vessel will steam full speed toward Marambio until the distance is within 270 nm and conditions allow the aircraft to be deployed safely

Secondary route

- If weather does not allow for a safe helicopter flight, the *RV/IB Nathaniel B Palmer* will steam full speed to Marambio Station and transfer the patient and the medevac team to shore via shore boat or helicopter.

Field equipment installation party

Primary route

- The most desired medical evacuation route for life threatening injuries will be recovery directly from the incident site to the *RV/IB Nathaniel B. Palmer* via USAP helicopter, then on to Marambio Station via USAP helicopter with the RPSC Medevac team.

Secondary route

- A *RV/IB Nathaniel B. Palmer*-based USAP helicopter flies the patient and medevac team directly from the incident site to the LARISSA Ice Camp to be met by a USAP Twin Otter flown from Rothera Station, if weather conditions will allow for fixed-wing landings at the camp. The Twin Otter will then transport the patient to Rothera Station.

LARISSA Ice Drilling Field Camp

Primary route

- The most desired medical evacuation route for life-threatening injuries will be directly from the ice camp or incident site to Rothera Station via USAP or BAS Twin Otter deployed from Rothera Station with a Medevac team from Rothera Station.

Secondary route

- A *RV/IB Nathaniel B. Palmer*-based USAP helicopter flies patient and medical team directly from the incident site to the *RVIB Nathaniel B. Palmer*, then on to Marambio Station via USAP helicopter.

Fuel available to support evacuation

- Rothera Station: for USAP and BAS Twin Otter support
- Marambio Station: helicopter fuel for USAP Bell 206l helicopters
- Ice Drill Camp: (small cached supply in drums for NBP-based helicopters)

Communication

See LARISSA communications plan.

NOTES:

- A designated SAR and medivac person (RPSC EMT) will be established aboard the *RV/IB Nathaniel B. Palmer* and he/she should fly in the backseat in order to drop raft if necessary.
- The proper SAR and medivac equipment will be available and ready aboard the ship to deploy aboard the aircraft in the event there is a need for emergency response. Items include: Deep Field medical kit, medical oxygen and backboard, a Billy Pugh net, extra 8-man life raft and life-sling system for removing individuals from the water.
- If overdue aircraft is down in the water the second helicopter deployed in SAR mode should take off with the Billy Pugh net attached to the belly hook
- If rescue is accomplished via the Billy Pugh net the aircraft will proceed to the nearest safe landing location and land and the aircrew member will assist in the transfer of the victim inside the aircraft if the rescue is for only one victim, if multiple victims are you be extracted then they shall be all be lifted to a safe landing spot and then transferred inside the aircraft once all have been removed from the water.
- For ship operations where the NB Palmer is adjacent to open water, which would require the mission helicopter to fly beyond gliding distance from shore or back to the flight deck, these flights will be considered "over water" flights. For all over water flights the mission aircraft will conduct the required flight ops, and the second helicopter will be on "standby alert" for SAR. The SAR aircraft will be piloted by the PHI pilot that has the mission approvals for external loads vertical reference (VR). When the Palmer is positioned such that no flight beyond power off gliding distance to shore is an issue (Palmer is and will remain in close proximity to a shore, where power off gliding distance to a shore is attainable) then both helicopters can conduct science missions simultaneously. Shore is defined as a location that will support the helicopter should an emergency landing be required, this can be pack ice, sea ice or land.
- If aircraft is overdue by 15 min (has not responded to radio calls) SAR aircraft will begin deployment, while calls to mission aircraft continue, MCM should be notified of pending SAR call out and confirmed that MCM has both aircraft on AFF. This does not preclude the launching of the NBP's Zodiac. (As the incident warrants)

- (If the mission aircraft is ditched, the SAR aircraft will respond with the VR pilot and one, with the air crewmember in the aft passenger compartment, so that the extra raft can be delivered) This means that the air crewmember will be flying while the Billy Pugh rescue net is attached.

LARISSA Air Support Fuel Requirements and Fuel Delivery

The two aviation fuel tanks aboard the NBP will be the sole source of fuel for the two PHI helicopters; the total amount of available fuel is 7400 gallons of AN8 aviation fuel.

2010 Helo fuel requirements and costs:

$3.00/gal X 6000 gallons = $18,000 USD for NBP-based helo ops fuel

$3.00/gal X 9000 gallons = $27,000 USD for Rothera Based USAP Twin Otter fuel

2012 Helo fuel requirements and costs:

$3.00/gal X 6000 gallons = $18,000 USD for NBP-based helo ops fuel

Rothera based USAP Twin Otter fuel requirements and costs:

Estimated fuel:

- Estimate 80 hours of flight time @100gal/hr = 9000 gallons X $3.00 per gallon =$27,000
- The delivery of the Aviation fuel (AN-8 or JP-8) to Rothera Station for the USAP Twin Otter support will be done aboard the BAS vessel *HMS James Clark Ross* on January 9 2009

USAP Fuel Caches available for LARISSA

The BAS fuel cache on the Larsen is at a site designated J108.

*J108 *

S67 06.466   W061 17.186

This cache contains:

Jet A1 drums x 4

Mogas drum x 1

Kerosine x 1 jerry

Man food box x 4

It is marked with a drum marker so it should be visible on radar. Please note that the contents of the depot may change depending on timings. However this will not affect the Jet A1.

Timelines

LARISSA Project Timeline

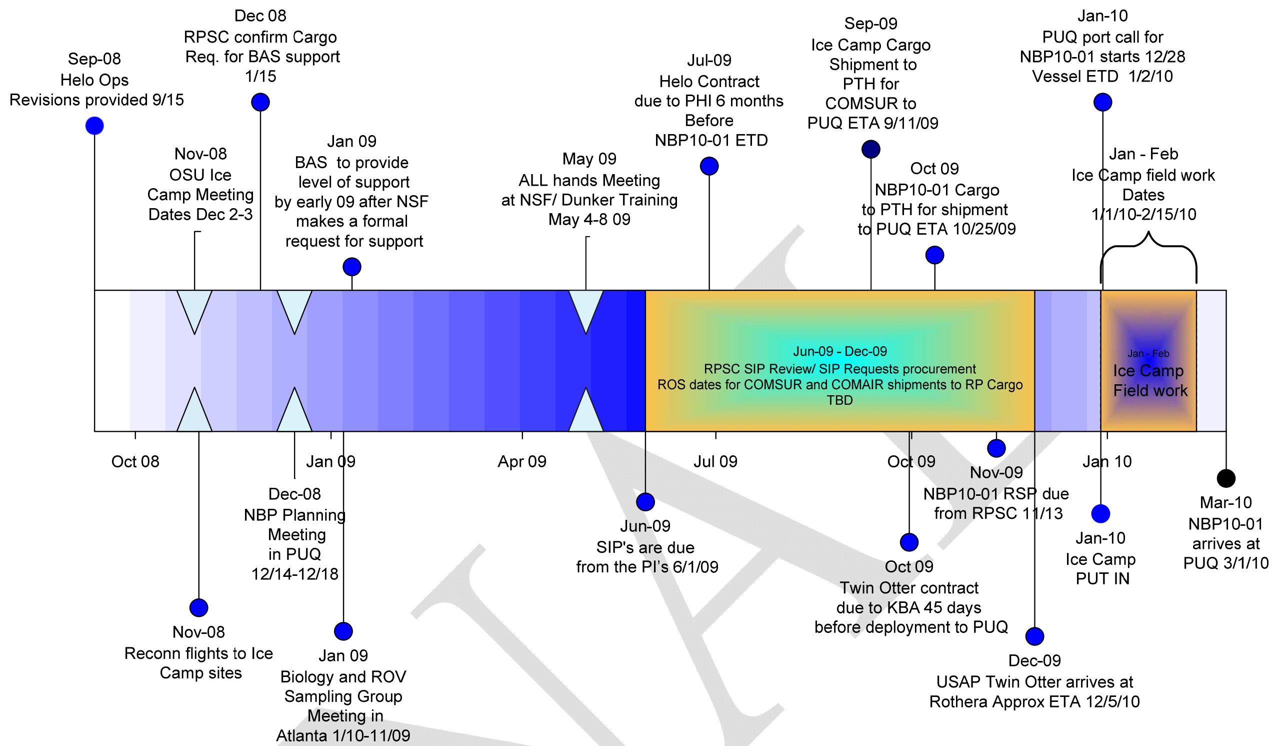

Figure 5: LARISSA Project Timeline

LARISSA Ice Drilling Camp Timeline

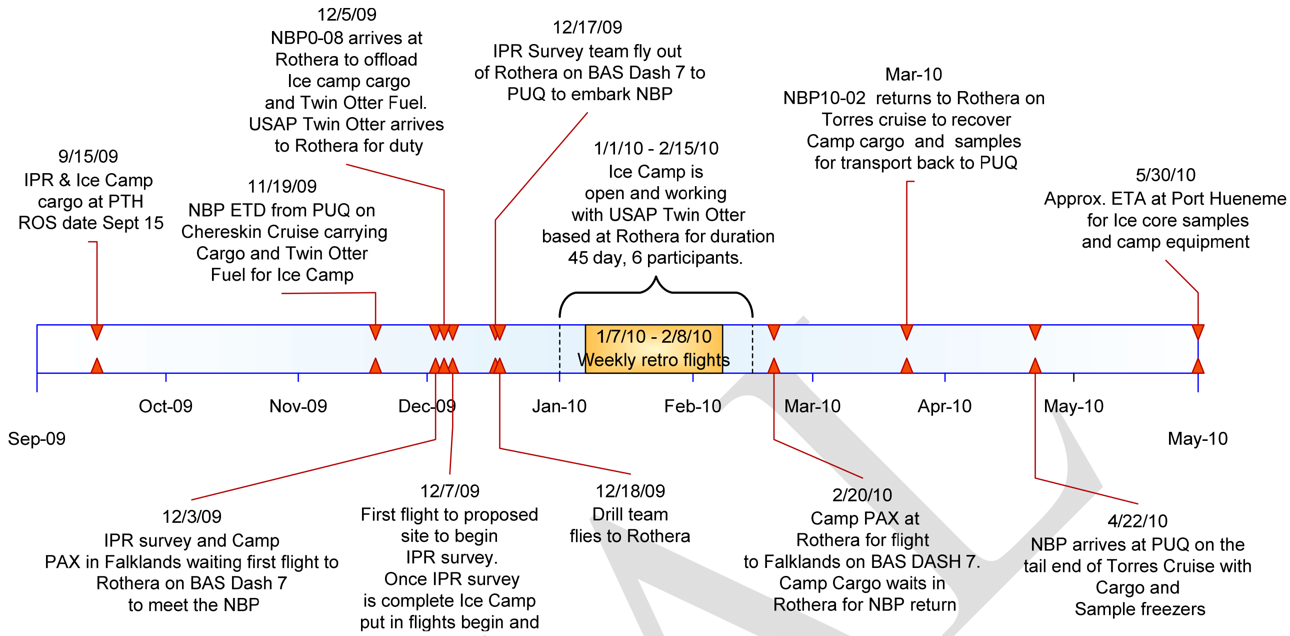

Figure 6: LARISSA Ice Drilling Camp Timeline

LARISSA Aircraft Mobilization Timeline

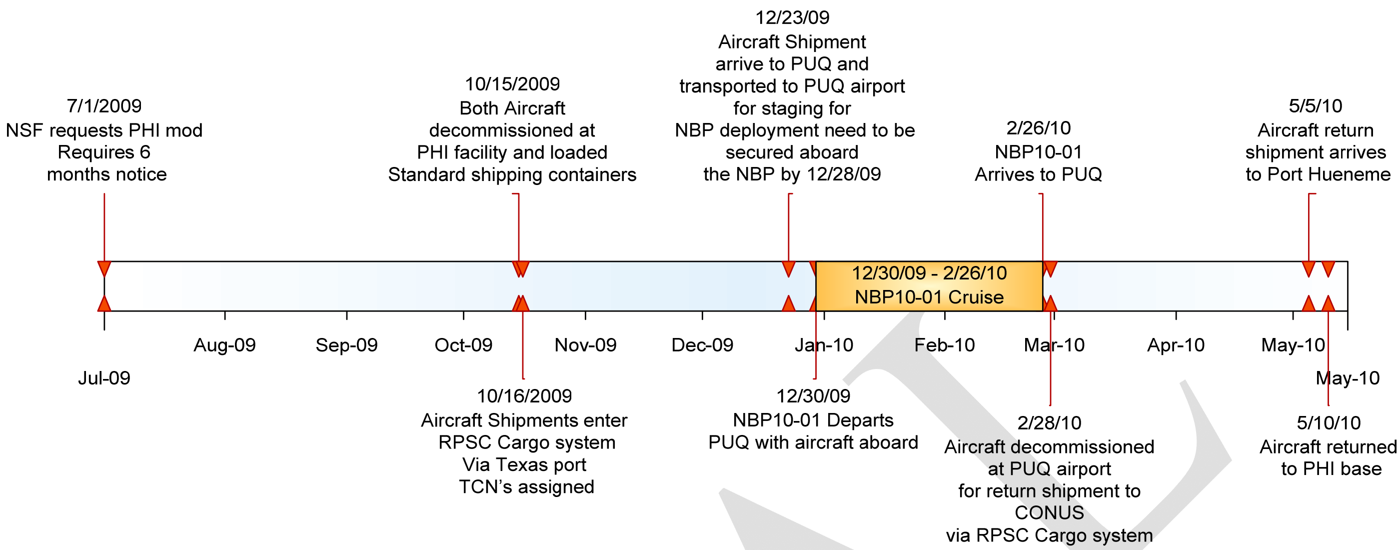

Figure 7: LARISSA Aircraft Mobilization Timeline

Meetings

LARISSA Proposal Review Meeting

Raytheon Polar Services Company, Centennial, CO
August 01, 2007

Attendees

Dan Herlihy, Raytheon Polar Services Company (RPSC)
Alice Doyle, Raytheon Polar Services Company (RPSC)
John Evans, Raytheon Polar Services Company (RPSC)
Jesse Doren, Raytheon Polar Services Company (RPSC)
Maria Vernet, Scripps Institute of Oceanography
Ted Scambos, University Colorado
Amy Leventer, Colgate
Ellen Mosley-Thompson, Ohio State University

LARISSA Planning Meeting

Friday, 22nd February 2008, 12th Floor Board Room
Offices of the U.S. National Science Foundation
4201 Wilson Blvd
Arlington, VA.

Attendees

NSF Office Polar Programs, Antarctic:

Tom Wagner, Geology and Marine Geology/Geophysics
Roberta Marinelli, Biology and Medicine
Julie Palais, Glaciology
Kelly Falkner, Antarctic Interdisciplinary Science
Scott Borg, Antarctic Science Director
Alexandra Isern, Antarctic Infrastructure and Logistics Division

Raytheon Polar Services:

Karl Newyear, Marine Operations and Support
Mike McClanahan, Aircraft support

Principle Investigators:

Eugene Domack, Hamilton College
Amy Leventer, Colgate University
Gregg Balco, University of Washington

Cindy Lee van Dover, Duke University
Mike McCormick, Hamilton College
Erin Pettit, Oregon State University
Ted Scambos, Univ. Colorado, National Snow and Ice Data Center
Martin Truffer, Univ. Alaska
Ellen Mosley-Thompson, Ohio State University, Byrd Polar Research Center
Lonnie Thompson, Ohio State University, Byrd Polar Research Center
Stefanie Brachfeld, Montclair State University
Scott Ishman, Southern Illinois University
Maria Vernet, Scripps Institute of Oceanography, Univ. California San Diego
Arnold Gordon, Columbia University, Lamont-Doherty Earth Observatory
Bruce Huber, Columbia University, Lamont-Doherty Earth Observatory
Julia Wellner, University of Houston
(Absent: Craig Smith, University of Hawaii)

International collaborators (absent but informed of meeting):

Jean-Pierre Henriet (Univ. Ghent, Belgium) logistics coordination
Marc Debatist (Univ. Ghent, Belgium) field team member ROV support
Julian Gutt (Alfered Wegener Polar Institute, Germany) informal
Sergio Marenssi (Argentine Antarctic Institute) logistics coordination
Rudy DeValle (Argentine Antarctic Institute) field team member in mid cruise fly in
Robert Gilbert (Kingston University, Canada) 210Pb analyses
Jeff Evans (University of Loughborough, UK) sedimentology
Matt King (University of Newcastle, UK) GPS data processing and modeling
Miquel Canals (Univ. Barcelona, Spain) informal swath data

LARISSA Moorings Planning Meeting

May 6 2008
Lamont-Doherty Earth Observatory of Columbia University
Attendees:
Eugene. Domack, Hamilton College
Arnold Gordon, Columbia University, Lamont-Doherty Earth Observatory
Bruce Huber, Columbia University, Lamont-Doherty Earth Observatory
Amy Leventer, Colgate University
Maria Vernet, Scripps Institute of Oceanography, Univ. California San Diego

LARISSA Ice Core Drilling Camp Meeting

December, 2-3 2008, OSU, Columbus Ohio

Meeting will be in Room 136 Scott Hall, 1090 Carmack Road, Columbus OH 43210

Attendees

Eugene Domack, Hamilton College, Hamilton, NY
Kelly Falkner, NSF-OPP, Washington, DC
Paolo Gabrielli, Ohio State University, Columbus, OH
Terry Haran, National Snow and Ice Data Center, Boulder
Adam Jenkins, Raytheon Polar Services Company (RPSC)
Ellen Mosley-Thompson, Ohio State University, Columbus, OH
Erin Pettit, University of Alaska Fairbanks
Melissa Rider, Raytheon Polar Services Company (RPSC)
Mike Scheuermann, NSF-OPP, Washington, DC
Lonnie Thompson, Ohio State University, Columbus, OH
Victor Zagorodnov, Ohio State University, Columbus, OH

LARISSA Vessel Planning Meeting

December 16-17 2008, Punta Arenas, Chile

Meetings were held aboard the R/V Nathaniel B. Palmer on deck and in the 03 deck Conference Room.

Attendees:

Eugene Domack, LARISSA Project PI
Maria Vernet, LARISSA Project PI
Erin Pettit, LARISSA Project PI
Wim Versteeg, Engineer, Belgian ROV group
Alex Isern, NSF-OPP
Dale Johnson, Operations Manager, PHI
Mark Reese, Aircraft Specialist, AMD
Captain Joe Borkowski, ECO
Johnny Pierce, Chief Engineer, ECO
Adam Jenkins, Project Manager, RPSC
Ross Hein, MT Vessel Supervisor, RPSC
Andy Nunn, Vessel ET Supervisor, RPSC
Bob Kluckhohn, Marine Superintendent, RPSC

LARISSA Biology Meeting

10-11 January 2009

Atlanta, GA

Attendees:

Cindy van Dover, Duke University
David Honig, Duke University
Bruce Huber, Columbia University, Lamont-Doherty Earth Observatory
Scott Ishman, Southern Illinois University
Amy Leventer, Colgate University
Mike McCormick, Hamilton College
Craig Smith, University of Hawaii
Maria Vernet, Scripps Institute of Oceanography,

NBP10-01 Cruise Biology Participants:

David Honig,
Mike McCormick,
Craig Smith (+ post-doc)
Maria Vernet
Mattias Cape, graduate student (Vernet)

LARISSA All-hands Meeting at NSF

Schedule: May 4-8 2009

May 4- Travel to NSF
May 5- Planning Meeting at NSF
May 6- Planning Meeting at NSF
May 7 – Dunk Training at Westin Hotel pool facility
May 8 – Dunk Training at Westin Hotel pool facility

Location Details:

Meetings will be held at NSF in Stafford Place II, Room II 595 on Tuesday May 5 and on Wednesday May 6. This building is next door (to the east) of the main NSF building at 4201 Wilson Boulevard, between North Stuart and Randolph Streets. There is a secure entry procedure for this building (see below).

Attendees:

1. Alex Isern, NSF-OPP
2. Kelly Falkner, NSF-OPP

3. Jessie Crain, NSF-OPP
4. Mike Scheuermann, NSF-OPP
5. Eugene Domack, Hamilton College
6. Maria Vernet, Scripps Institute of Oceanography
7. Ted Scambos, Univ. Colorado
8. Bruce Huber, Columbia University
9. Greg Balco, Berkeley Geochronology Center
10. Cindy Lee van Dover, Duke University
11. Mattias Cape, Scripps Institute of Oceanography
12. David Honig, Duke University
13. Mike McCormick, Hamilton College
14. Erin Pettit, University of Alaska Fairbanks
15. Ellen Mosley-Thompson, Ohio State University
16. Lonnie Thompson, Ohio State University
17. Caroline Lavoie, Hamilton College
18. Stefanie Brachfeld, Montclair State University
19. Scott Ishman, Southern Illinois University
20. Craig Smith, University of Hawaii
21. Laura Grange, University of Hawaii
22. Arnold Gordon, Columbia University
23. Julia Wellner, University of Houston
24. Marc Debatist, Univ. Ghent Belgium
25. Terry Haran, National Snow and Ice Data Center
26. Mark Parsons, National Snow and Ice Data Center
27. Amy Leventer, Colgate
28. Martin Truffer, University of Alaska Fairbanks
29. Bjorn Johns, UNAVCO
30. Adam Jenkins, Project Manager, RPSC
31. Melissa Rider, Field Camp Manager, RPSC
32. Ross Hein, Vessel MT Supervisor, RPSC
33. Andy Nunn, Vessel ET Supervisor, RPSC (via telephone)
34. Mark Reese, Flight Ops specialist, AMD
35. Gail Fisher, National Geographic
36. Doug Fox, National Geographic
37. Maria Stenzel, National Geographic
38. Hans Weise, National Geographic
39. Jamie Shreeve, National Geographic

Dunk Training for Helo Operations

All LARISSA participants involved in the helicopter-based operations and missions will be required to attend and participate in dunk training. This training will be held at the spring All-Hands meeting at NSF in Washington, DC, and will be coordinated and arranged by Adam Jenkins (RPSC) and Mark Reese (AMD).

Training Location Details:

The dunk training will be held at the Westin Hotel in Private Dining Room 1 on the 7th May and the pool area of the hotel on the 8th May. Please wear swimming attire of your choosing. The training instructors are Meg Gallagher and Woody Kessler of AMD.

Attendees:

1. Maria Vernet, Scripps Institute of Oceanography
2. Ted Scambos, University of Colorado
3. Bruce Huber, Columbia University
4. Greg Balco, Berkeley Geochronology Center
5. Mattias Cape, Scripps Institute of Oceanography
6. David Honig, Duke University
7. Mike McCormick, Hamilton College
8. Craig Smith, University of Hawaii
9. Laura Grange, University of Hawaii
10. Julia Wellner, University of Houston
11. Terry Haran, National Snow and Ice Data Center
12. Adam Jenkins, Project Manager, RPSC
13. Ross Hein, Vessel MT Supervisor, RPSC
14. Doug Fox, National Geographic
15. Maria Stenzel, National Geographic
16. Hans Weise, National Geographic

Dunk training schedule:

May 7th
0800-1100 Class at the Westin Hotel

1100-1200 Lunch

1300-1500 Hands on with Billy Pugh rescue net and helicopter safety briefing with a US Park Police's helicopter

Note: This last section with the helicopter is dependent upon the US Park Police's availability. If they have missions that day, we may become a non-priority, but they should have two crews on then and hopefully can accommodate our request. Transport of people to the location will be provided.

May 8th

Training at the Westin Hotel Swimming Pool (where grantees, RPSC and AMD instructors will stay).

1000-1030 Group Brief, Breathing Exercise

1030-1100 PFD Use and Deployment

1100-1130 Water Survival Exercises (drown proofing, group survival)

1130-1200 Life Raft Use and Deployment

1200-1230 Lunch (sack lunch)

1300-Until finished Live Dunks: 2/person SWET (shallow water egress trainer) 2/person water dunker

1900 - Cocktails in the Westin bar celebrating our survival...

Helitack S-271 Training:

May 26-29, 2009

Price Valley Idaho,

Attendees:

1. Adam Jenkins - RPSC
2. Ross Hein - RPSC

Environmental Impact Documentation

(See Con Ops Addendum for documentation)

Media

A National Geographic media team (four persons) will meet the R/V Nathaniel B. Palmer in Punta Arenas, Chile on 01 January 2010. The media team will sail the NBP10-01 cruise for the duration.

LARISSA Media Participants

Maria Stenzel, photojournalist,
Douglas Fox, writer and videographer,
Sarah Park, videographer/producer

Travel

The media team would like to travel with the ship for the entire cruise rather than flying in on 12 January 2010. Our fear is that bad weather could delay us from joining the cruise while it is underway, and that we will miss important work on Crane Glacier. We anticipate that Crane may be the most visually impressive of the glaciers (steep and crevassed) and also recognize its importance from a story point of view (glaciers speed up when the ice shelves that buttress them break up).

Robertson Island GPS Rebound Station

If possible we would like to participate.

Installation of the Repeater Station above Crane Glacier

If possible, we would like to participate in this outing, for good views of the region and shots of people working in a dramatic landscape.

Glacial Dynamics – Time-Lapse Camera

Dr. Martin Truffer is willing to help install a time-lapse camera system (supplied by NGM) at this spot, which would be removed at the end of the expedition when the repeater is removed. The time-lapse camera would shoot high quality RAW files to show the movement of Crane Glacier. The images would be available to Martin for scientific use and to NGM for publication on the website/television as a Quick Time file.

Cosmogenic Exposure Dating

Greg Balco has given us permission to join him collecting rocks on the Nunatuks above Crane Glacier. This will afford us fantastic views of Crane Glacier and the surrounding landscape. If our schedules allow, he welcomes us on other outings too. Doug has generously volunteered to be a “field assistant” on outings, helping to carry rocks in his backpack. Maria and Sarah will be carrying photographic/video equipment and will not be able to carry rocks.

(Off-ship support: helo flights, possibly strap-on crampons.)

Cryosphere

Dr. Ted Scambos prefers that we not deploy on Crane Glacier since that will be the first of five AMIGO and GPS stations. Crane is likely to be the most dangerous of the glaciers, and he also wants to make his first installation without the pressure of an audience. Perhaps we could try to get an aerial photograph/video from the helicopter of the AMIGO tower going up, or a shot of the team roped up and pulling the GPR (ground penetrating radar) across the glacier? Dr. Scambos is willing to have the NGM team join him at two other locations – Scar Inlet (on Larsen C ice shelf), and Flask Glacier. On Flask, he will allow us to camp with him. All three NGM team members feel this is critically important to our coverage. It will necessitate requesting additional gear from RPSC Science Support.

Proper shelter and meals to accommodate the media team for one to two days will be supported should adverse weather hinder their return to the R/V Nathaniel B. Palmer.

Aerial Wish List of the Cryosphere

Dr. Ted Scambos showed us stunning photos of the Larsen area that he shot. Based on those images, here is a wish list of images that would greatly enhance the magazine article, web and television show:

- Melt ponds on the surface of Larsen Ice shelf
- The cliff-like front of Larsen ice shelf
- Waterfalls pouring off the front of the ice shelf (better shot from the air than at sea level)
- Icebergs that have calved off from the Larsen Ice Shelf
- Crane Glacier with crevasses
- Another glacier still buttressed by the ice shelf to contrast with Crane – maybe Flask?
- The new 15 km fjord in front of Crane (this would work particularly well in video, showing the retreat of the grounding line as you fly up the brand new fjord towards Crane)
- Aerials of scientists working in a huge landscape i.e. Ted's team with the GPR or an Amigo tower, or Greg Balco on a nunatak with glacier below
- The ship seen from the air, perhaps as it sails along the front of Larsen C, or as a zodiac departs for shore
- Front view of Larsen C, looking inland over the top of the ice shelf.
- Aerial of the Bruce Plateau where the ice core camp is located, with the tents in the shot

Paleoclimate - The Ice Core Camp on Bruce Plateau

Since we would like to journey to the Weddell Sea with the ship, may we visit the ice core camp as a day trip via helicopter. The climate history that the ice core provides is a very important element of the story, but not particularly visual. In addition to photographing the drilling operations inside the tent, it might also be a good idea to dig a backlit snow pit nearby. I once took a picture of a glaciologist in a backlit snow pit at Byrd Research station for a prior Antarctica story. The snow pit vividly and beautifully illustrates the idea of annual snow accumulation. It also might be a more visual spot for Sarah to interview Lonnie Thompson and Ellen Mosley Thompson than beside a drilling rig inside a tent.

CTDs, Moorings, and Jumbo cores

These operations are important for the science of understanding past and future behavior of Larsen B. NGM coverage of these operations will probably emphasize story text and video more than photography. They are difficult to make visually interesting for still photography. As visuals, they are somewhat dependent on luck such as – an interesting landscape in the background, dramatic light, stormy skies, or icebergs nearby. If it's possible to photograph these activities from the zodiac looking back on the ship -- that could help tremendously. Another option is to look down at the view on deck from the top of the science mast.

Marine Ecosystems – Bottom trawls, Box cores and Mega-cores

The biological component of the science expedition will add a brilliant, living dimension to the story. We're thrilled to have an opportunity to photograph/video giant clams, red corals, huge worms, ice fish, starfish, and whatever samples are dredged up. Our approach will be to make "portraits" of the specimens with good studio lighting against a white or a black backdrop. Maria Vernet and Craig Smith are willing to make some space for us in the aquarium room, and Craig will order 3 different sized aquariums for us. We will also photograph specimens retrieved in the sediment cores (in the microscope), and possibly a sample from the box corer.

ROV Operations

Video editor Hans Weise of National Geographic is working to help supply an HD camera to the ROV so that we can get high quality footage in situ of methane vents as they are discovered. While the ROV is underway, there should be good opportunities for Sarah to get video of the ROV pilots and scientists in the control van, reacting to what they see.

Marine Geology

The swath mapping is probably going to be the most visual way to show the ocean floor and prior grounding lines of Crane Glacier. The NGM cartographer could incorporate this into a map. There'll be good field opportunities here for Doug and Sarah, less so for still photography. (One possibility for still photography might be an aerial photo of the ship as it is mapping the newly created Crane fjord).

Cargo Shipping Dates for the LARISSA Project

All shipping costs for processing and transport between point of origin and Port Hueneme, CA, will be borne by the Principal Investigator's grant. The USAP contractor pays for cargo-shipping costs between Antarctica and the Continental United States (CONUS). If cargo weight allowances approved in the Support Information Packet (SIP) must be exceeded, advance authorization is required from the National Science Foundation (NSF). The methods of shipping cargo to Antarctica, in order of increasing cost, are the re-supply vessel (New Zealand, McMurdo and South Pole based sites only), Commercial Surface, and Commercial Air.

Southbound Cargo for NBP09-08 (Ice Camp cargo and Ice Core freezers)

If you are planning on sending any cargo south via the RPSC cargo system for **NBP09-08**, please contact your POC with the date of shipment and the number of pieces sent, so the shipment can be tracked through the cargo system.

- The deadline to receive cargo for **COMSUR** surface shipment in Port Hueneme for **NBP09-08** is **September 11, 2009**
- The deadline to receive cargo for **COMAIR** shipment in Port Hueneme for **NBP10-01** is **October 25, 2009**

Note COMAIR is for emergencies or late items only and requires approval from NSF for the extra costs.

Southbound Cargo for NBP10-01 (Main LARISSA Cruise)

If you have sent or are planning on sending any cargo south via the RPSC cargo system for **NBP10-01**, please contact your POC with the date of shipment and the number of pieces sent, so the shipment can be tracked through the cargo system.

- The deadline to receive cargo for **COMSUR** surface shipment in Port Hueneme for **NBP10-01** is **October 25, 2009**
- The deadline to receive cargo for **COMAIR** shipment in Port Hueneme for **NBP10-01** is **December 01, 2009**

Note COMAIR this is for emergencies or late items only and requires approval from NSF for the extra costs.

Note Shipments to Punta Arenas (PUQ) coordinated by grantees themselves through an outside cargo forwarder must arrive 7 days before the cruise departure date.

- **NBP09-08 departs PUQ November 19 2009**
- **NBP10-01 departs PUQ January 2 2010**

Address for Cargo Shipments

It is recommended that all USAP participants use the NSF's Port Hueneme facility for all cargo shipments as it is the most reliable method for tracking shipments destined for Antarctic research sites. Cargo which is entered into the USAP cargo stream via the Port Hueneme facility will be assigned a Transportation Control Number (TCN) at the inception of its journey to Antarctica and will be shipped with all due priority given to a researcher's science season. For all cargo shipments to Port Hueneme, the following forwarding address and information should be stenciled on all boxes (alternately, the address may be typed onto 3"x5" white cards and the cards secured to each box or item with glue and/or staples):

NATIONAL SCIENCE FOUNDATION
C/O RAYTHEON POLAR SERVICES COMPANY, PORT HUENEME OPERATIONS
BLDG 471 – NORTH END
NAVAL BASE VENTURA COUNTY – PORT HUENEME
PORT HUENEME, CALIFORNIA 93043
Telephone: **805-985-6851**
Toll Free: **800-688-8606, x33608 / 33619 / 33601**
Fax: **805-984-5432**
E-mail address: **PH-CargoOps@usap.gov**

ATTN: USAP
<Cruise Number>
<Grantee name>
<Event number>

McMurdo Support for LARISSA

Equipment List

- Eight Motorola HT-1000 handheld radios. Model number H01KDC9AA3DN. Serial numbers: 402TAN1631 Z, 402TCS1567 Z, 402TEN2355 Z, 402TCS1569 Z, 402TAW2224 Z, 402TEN2384 Z, 355ABQ0270, 355AZU1240Z. No NSF tags.
- Eight single chargers for Motorola HT-1000 (including "wall wart" type transformers.
- 12 NiCd batteries for Motorola HT-1000
- One Orange Box Marine Band repeater unit. Containing two Motorola Radius GM300 base station radios with NSF tags of 012595 and 012594.
- One approximately 3'x4' solar panel with supporting A frame.
- Two aluminum "folded dipole" VHF antennas.
- One tripod antenna mount.
- 14 survival bags for NBP10-01 and the Ice camp

Preliminary NBP10-01 NBP Port Call Plan

26 December - 2 January 2009 Punta Arenas, Chile

December 26

AM Grantees preassembling field equipment in PA warehouse

Begin laboratory layout and setup of equipment

Cargo loading begins

December 27

AM Helos are flown aboard the NBP

Helo flight crew setup the helo hanger work shop

Begin Belgian ROV Van integration in to power service on aft deck

Continue laboratory layout and setup of equipment

PM Cargo onload

December 28

AM Cargo onload

Continue integration of ROV in to NBP system

Bring grantee lab supplies and chemicals

PM Load JPC equipment and supplies

Cargo onload continues

Laboratory setup

December 29

AM Cargo onload continues

Laboratory setup

Test ROV systems and deploy off NBP stern

Deploy the GAP systems pole at the pier

PM Cargo onload continues as necessary

Lab setup continues

December 30

AM Cargo Onload continues as necessary
Load flat rack with mooring supplies and break bulk in to hold
Load Chiller Van in to hold
Load Coring Van in to hold
Decommission ROV and Van for SB transit

PM Lab setup continues
Helo flight crew setup the helo hanger work shop
Equipment setup and staging continues
Bring grantee lab supplies and chemical

December 31

AM Lab setup continues
Deck Equipment setup and staging continues
Bring coring equipment: Megacorer, Kasten corer, Smith Mac secure on Helo deck for SB transit

PM
Lab setup continues
Deck Equipment setup and staging continues
ROV van transferred to Helo Deck for SB transit

January 1

AM Vessel Fuel is taken on?
Equipment setup and staging continues
Grantees coming aboard vessel (Cabins ready) Ask for Passports

PM Lab setup continues
Equipment setup and staging continues
Secure all labs work spaces and cabins for departure

January 2

AM Secure all labs work spaces and cabins for departure

PM Proposed departure TBD
Cruise Orientation meeting
Helo Ops Orientation

NBP10-01 Deck Lay Outs

Main Deck and After deck

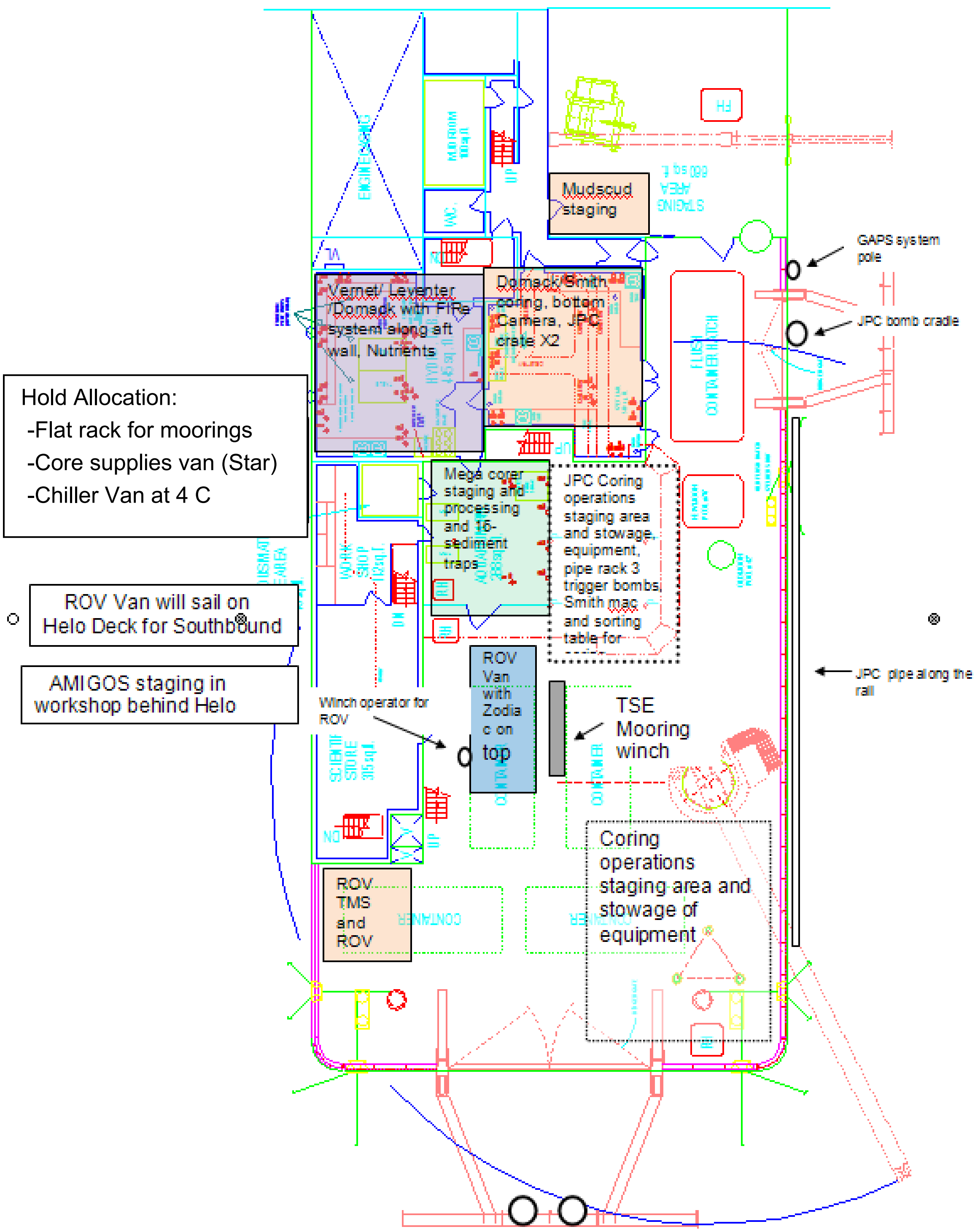

Figure 8: NBP Aft Deck Allocations

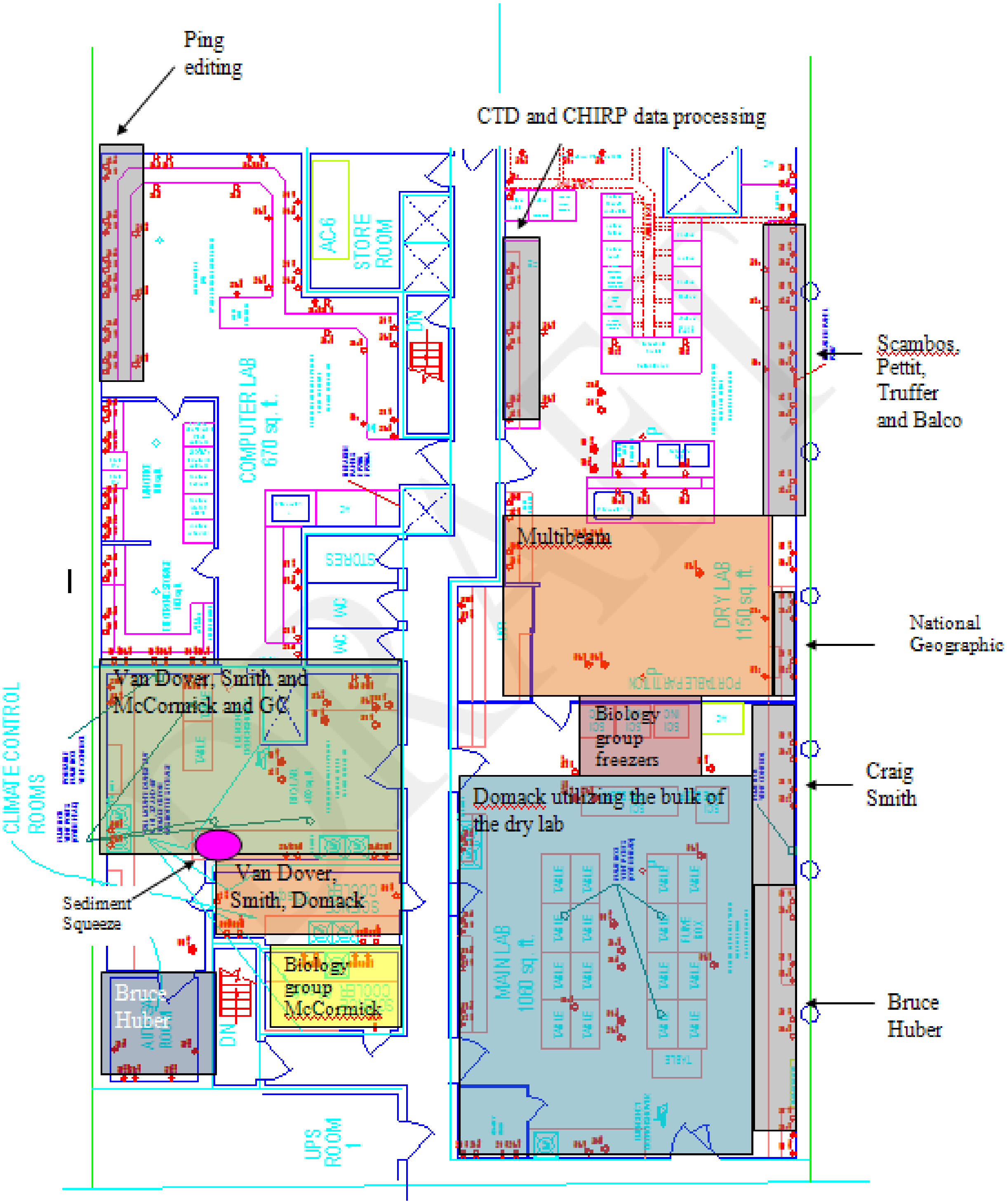

Figure 9: NBP Lab Space Allocations

NBP10-01 Berthing Plan

Cabin		Phone
109	Adam Jenkins	241
311	Eugene Domack (Chief Scientist)	212
113	Mike Lewis	248
113	Dan Powers	248
114	Ross Hein	240
115	Andy Nunn	249
115	Sheldon Blackmon	249
116	Scott Ishman	242
116	Mike McCormick	242
117	Lindsey Ekern	250
117	Maria Vernet	250
118	Terry Haran	243
118	Ted Scambos	243
119	Paul Huckins	251
119	Dimitry Tizon	251

120	Erin Petit	244
120	Stefanie Brachfeld	244
121	Ronald Ross	252
121	Martin Truffer	252
122	Craig Smith	245
122	David Honig	245
123	Chris Dean, PHI Pilot	253
123	Cindy Dean	253
124	Debra Tillinger	246
124	Kathleen Gavahan	246
125	Barry James, PHI Pilot	254
125	Cooper Guest	254
126	Jeremy Lucke	247
126	Buzz Scott	247
127	Ku-Chul Yu	255
127	Mattias Cape	255
129	Sarah Park	256
129	Maria Stenzel	256

131	Katrien Heirman	258
131	Caroline Lavoie	258
133	Dries Boone	257
133	Lieven Naudts	257
217	Kimberly Roe	232
217	Yuribia Munoz	232
217	Sun Mi Jeong	232
217	Laura Grange	232
209	Jay Cox, PHI Mechanic	203
209	Randy Perrodin, PHI Mechanic	203
210	Greg Balco	227
210	Douglas Fox	227
211	Bruce Huber (Co chief)	231
310	Amy Leventer	215