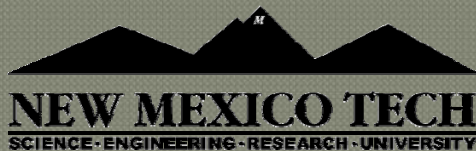
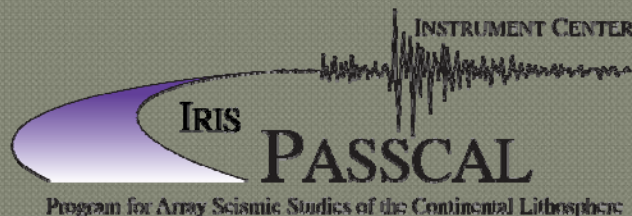


# Development, Testing, and Deployment of Xeos Iridium Communication Systems

B. Bonnett, K. Anderson  
B. Beaudoin, J. Fowler,  
T. Parker and G. Tytgat





# Development Background

- ❖ MRI – Development of a Power and Communications System for Remote Autonomous Polar Observations
  - ❖ Second year development deployed past season
  - ❖ Collaboration between IRIS PASSCAL & UNAVCO
- ❖ MRI – Acquisition of Broadband Seismic Stations for Polar Regions
  - ❖ Acquisition of 37 cold-hardened stations
  - ❖ Currently deployed at AGAP & POLENET



# Development Requirements

- ❖ Low Power
  - ❖ Minimal Power Draw During Standby
- ❖ Rugged
  - ❖ -55 C Operation
  - ❖ Durable Connectors and Enclosure
- ❖ Simple Operation
  - ❖ LED Status
  - ❖ Field Testable
  - ❖ Easily Deployed
- ❖ Adaptable for Other Systems
  - ❖ 2 Way Communication
  - ❖ Ethernet Connections
  - ❖ Serial Connections
  - ❖ Weather Station Compatible





# XI-100 Development

## ❖ XI-100 PHASE I

### ❖ A3LA Iridium Modem

❖ Configured for SBD Only

❖ ~2 Kb/s Data Rate

### ❖ SOH and 10s Data Samples Only

### ❖ Command and Control of Connected Devices and Reporting Schedules

### ❖ 5 AHr Annual Power Budget for Daily SOH

❖ 450  $\mu$ A Sleep Mode

❖ 150 mA During SBD

### ❖ Integration of Vaisala Weather Station

### ❖ Dimensions

❖ 10.75" x 4.25" x 3.5"



# XI-100 Development

## ❖ XI-100 PHASE II

- ❖ SBD & RUDICS (Router-based Unrestricted Digital Internetworking Connectivity Solution)
- ❖ -55 deg C to +60 deg C Operational Range
  - ❖ Heaters Used to Keep AL3A Within Operational Limits
- ❖ 700 mA Current Draw During Transmission with Active Heater
- ❖ 350 mA Current Draw During Transmission w/o Heaters
- ❖ Data Transmission During Antarctic Summer
- ❖ 5 Units Awaiting Testing @ PASSCAL



# XI-101 Development

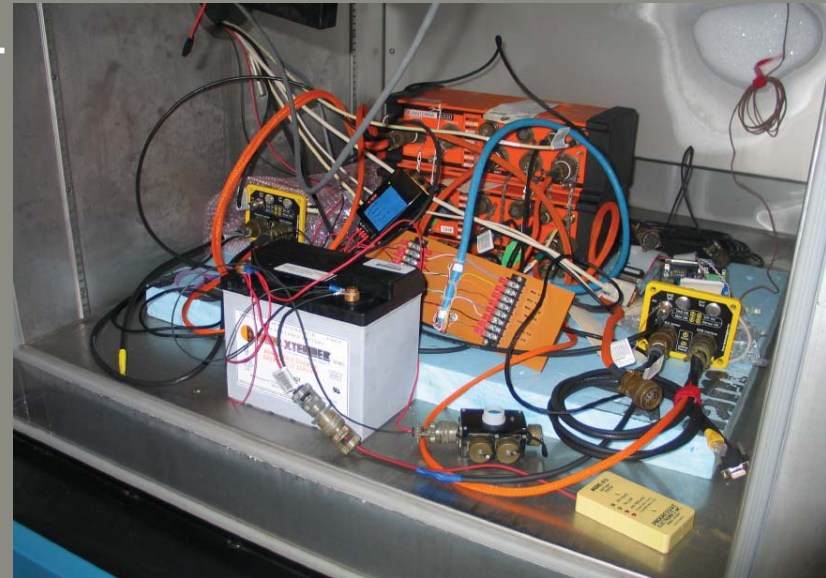
## ❖ XI-101

- ❖ Similar to XI-100
- ❖ 9601 Iridium Modem
  - ❖ SBD only
  - ❖ ~2 Kb/s Data Rate
  - ❖ Lower Operation Cost
  - ❖ Lower Initial Cost
- ❖ SOH and 10s Data Samples Only
  - ❖ Command and Control of Connected Devices and Reporting Schedules
  - ❖ 5 AHr Annual Power Budget for Daily SOH
  - ❖ Integration of Vaisala Weather Station



# XI-100 Testing

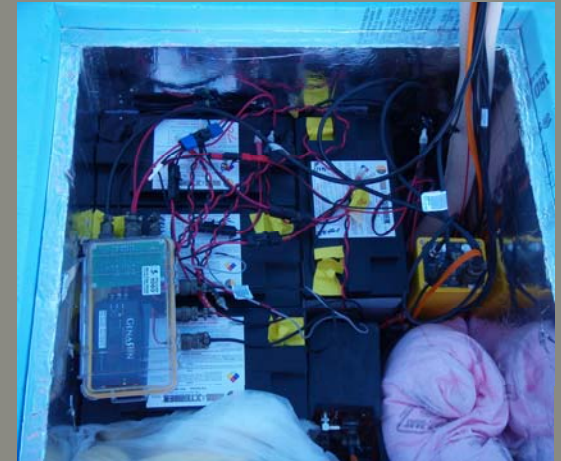
- ❖ Environmental Testing
  - ❖ Hard Frozen to -60 C
  - ❖ Operated @ -50 C
  - ❖ Cycled -50 to 20 C
- ❖ Power Requirement Testing
- ❖ Data Transmission Testing





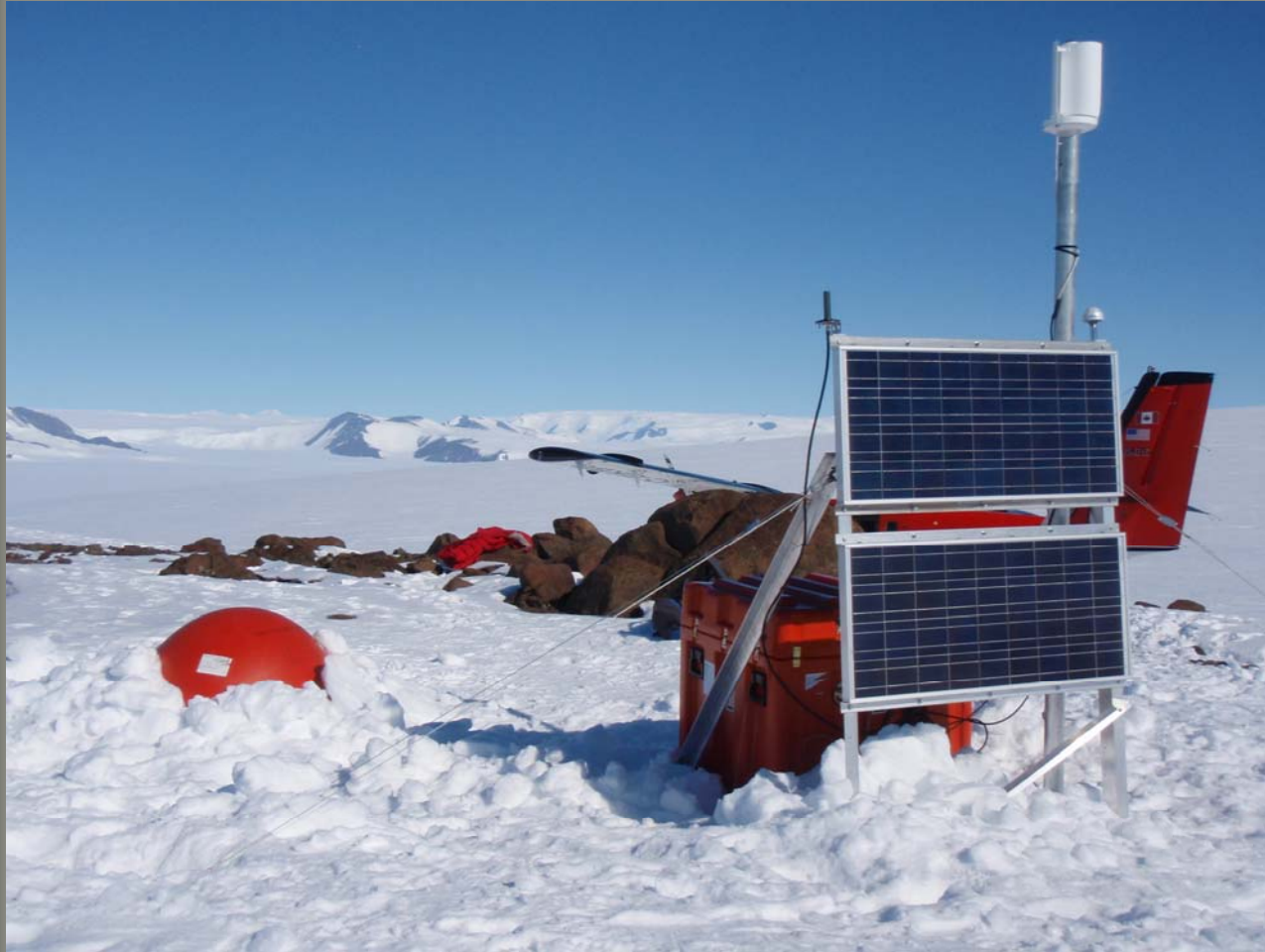
# Deployment

- ❖ 22 XI-100 (Phase I) Modules Deployed
  - ❖ 14 for POLENET
    - ❖ Currently Operating @ -23 C
  - ❖ 8 for AGAP
    - ❖ Currently Operating @ -49 C
- ❖ 5 XI-100 Phase II Delivered to PASSCAL
  - ❖ Awaiting Validation Test Results
- ❖ 5 XI-101 Delivered to PASSCAL
  - ❖ 1 Awaiting Deployment Near Yakutat, Alaska
  - ❖ 2 Awaiting Deployment on Yahtse Glacier





# Deployment



- ❖ Sat Test
- ❖ Das Test
- ❖ Antenna
  - ❖ SAF5350-C
- ❖ Coax Cable
  - ❖ LMR 400

# Interface and Control

- ❖ Web Console Developed by IRIS PASSCAL

  - ❖ [www.xeos.passcal.nmt.edu](http://www.xeos.passcal.nmt.edu)

- ❖ SOH Display

  - ❖ Iridium Message Statistics and Time Series Data

  - ❖ Weather Data from Vaisala Met Station

  - ❖ 10 Second Data Snippets

  - ❖ Q330 SOH Statistics and Time Series Data

- ❖ Command and Control

  - ❖ Device Configurations and Programming

  - ❖ Reporting Intervals

  - ❖ Sensor Control (i.e. Centering and Locking)

- ❖ Phase II Control

  - ❖ Switching between SBD & RUDICS

  - ❖ Request Download of Specific Data Sets



# Interface and Control

## Screen Shot From Iridium Console Device Summary

Iridium Web Console : Device Summary

http://xeos.passcal.nmt.edu/cgi-bin/devsummary.cgi

Iridium Web Console : Device S...

### Iridium Web Console V0.85

Current Time: 2009-04-14, 23:14:21 UTC  
Last Update: 2009-04-14, 23:11:17 UTC  
Refresh Interval: 5m

Display devices for project:

Click column headers to sort the listing. Hover over headers and list items for details.

s#	Station	Project	Status				Last Message	Last Status Code	Last Message Type	Messages Received					°C	V	mA	Mass		
			S	D	W	X				S	D	W	X	T				1	2	3
101	Deverall Island	POLENET	■	■	■	■	1h 45.5m	Success, Weak Signal	Q330 Data	1583	1442	2	140	5933	■	■	■	■	■	■
104	ICEZ	MRI	■	■	■	■	44d 10h 10.6m	Success, Good Signal	Q330 Status	2268	3239	16722	169	28253	■	■	■	■	■	■
105	WAIS	POLENET	■	■	■	■	35.0m	Success, Good Signal	Q330 Status	2089	1448	8	17	4726	■	■	■	■	■	■
106	Mt. Paterson	POLENET	■	■	■	■	11h 27.6m	Success, Weak Signal	Empty Msg	366	992	1	24	1855	■	■	■	■	■	■
107	P80	AGAP	■	■	■	■	1d 12h 22.1m	Success, Weak Signal	Empty Msg	1767	317	-	19	2335	■	■	■	■	■	■
108	Thwaites	POLENET	■	■	■	■	1h 34.1m	Success, Good Signal	Empty Msg	241	217	-	115	800	■	■	■	■	■	■
109	N140	AGAP	■	■	■	■	4h 10.5m	Success, Weak Signal	Q330 Status	2379	1036	-	25	3871	■	■	■	■	■	■
110	GM02	AGAP	■	■	■	■	4h 16.5m	Success, Good Signal	Q330 Data	4194	1712	137	144	9949	■	■	■	■	■	■
111	N206	AGAP	■	■	■	■	4h 13.1m	Success, Good Signal	Q330 Status	2055	825	-	19	3194	■	■	■	■	■	■
113	Pecora Escarp.	POLENET	■	■	■	■	215d 6h 28.2m	Success, Weak Signal	Q330 Status	181	115	-	4	988	■	■	■	■	■	■
114	Dufek Massif	POLENET	■	■	■	■	15d 16h 19.6m	Success, Good Signal	Empty Msg	1198	1168	-	8	4524	■	■	■	■	■	■
115	Siple Dome	POLENET	■	■	■	■	11h 39.3m	Success, Weak Signal	Empty Msg	602	351	-	20	1742	■	■	■	■	■	■
116	Cape Surprise	POLENET	■	■	■	■	3h 44.9m	Success, Weak Signal	Q330 Status	4491	1946	6	204	10067	■	■	■	■	■	■
117	P061	AGAP	■	■	■	■	5h 11.4m	Success, Good Signal	Empty Msg	2159	299	558	30	3484	■	■	■	■	■	■
118	Herrick Mtns.	POLENET	■	■	■	■	320d 3h 27.1m	Error, Incomplete	Empty Msg	80	77	-	1	250	■	■	■	■	■	■
119	Lonewolf	POLENET	■	■	■	■	3h 48.4m	Success, Good Signal	Q330 Status	3232	990	344	192	9682	■	■	■	■	■	■
120	Fishtail Point	POLENET	■	■	■	■	9h 4.6m	Success, Good Signal	Empty Msg	203	239	-	21	959	■	■	■	■	■	■
121	N124	AGAP	■	■	■	■	3h 48.4m	Success, Good Signal	Q330 Status	2126	609	-	12	3143	■	■	■	■	■	■
122	Wilson	POLENET	■	■	■	■	236d 16h 6.3m	Success, Good Signal	Empty Msg	144	142	-	3	477	■	■	■	■	■	■
123	Howard Nunatak	POLENET	■	■	■	■	4h 24.9m	Success, Good Signal	Empty Msg	6087	232	-	2	9728	■	■	■	■	■	■
124	Miller Range	POLENET	■	■	■	■	3h 30.4m	Success, Weak Signal	Q330 Status	2142	938	-	12	3550	■	■	■	■	■	■
125	N182	AGAP	■	■	■	■	1d 4h 1.5m	Success, Good Signal	Q330 Data	2096	481	-	13	2976	■	■	■	■	■	■

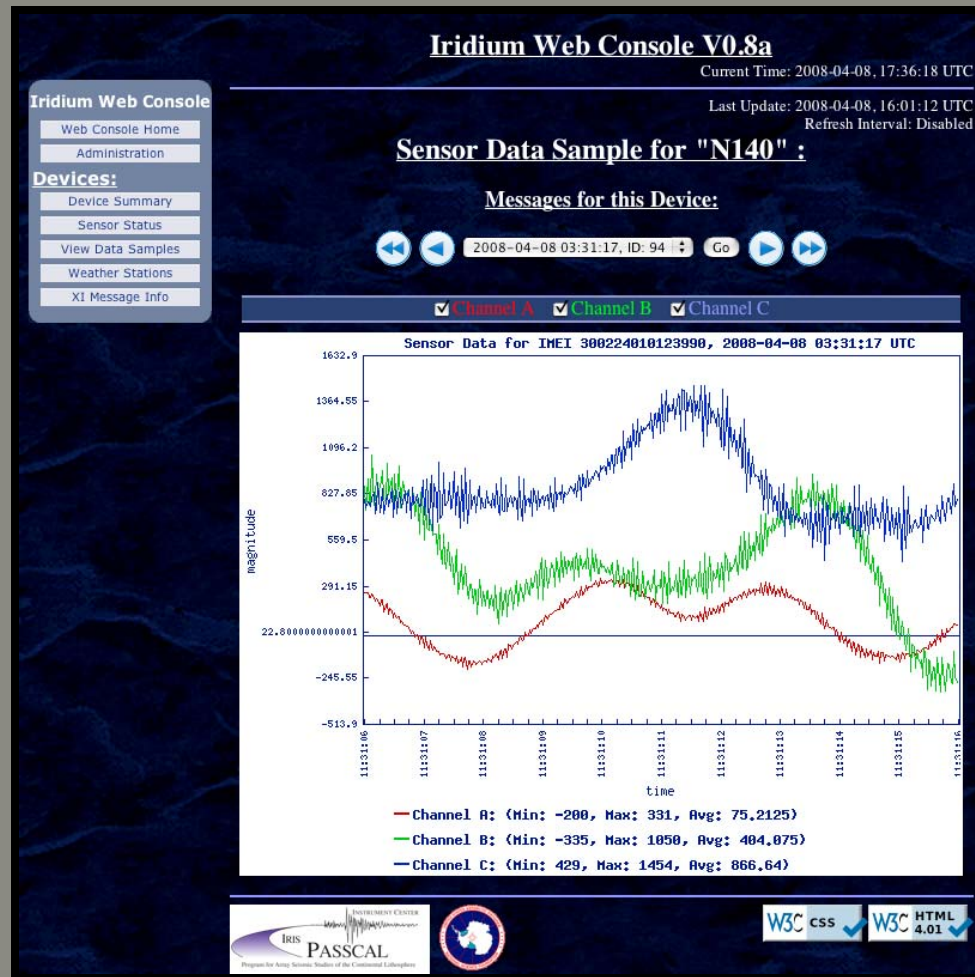
IRIS PASSCAL INDEPENDENT CENTER

W3C CSS W3C HTML 4.01



# Interface and Control

## Data Snippet Sample from AGAP Station N140



# More Information & Design Docs

<http://www.passcal.nmt.edu/Polar>

<http://www.xeos.passcal.nmt.edu>

<http://www.xeostech.com>



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