IceGoat1
USNA Polar Science Program

3APR2012

LCDR John Woods

MIDN 1/C Ben Aspholm

MIDN 1/C Nathan Kren

MIDN 2/C Rhyan Lange

Mr. Dan Rhodes

Mr. Bob Bruninga

Primary Mission

- Record and relay weather data.
- Present virtual tracking data
- Send pictures
- Science Technology Engineering and Math (STEM)

The undergraduate college of the naval service, the United States Naval Academy strives to accomplish its mission to develop midshipmen "morally, mentally, and physically."

Core curriculum that includes courses in engineering, science, mathematics, humanities and social science.

World class laboratory facilities

All graduates serve minimum of 5 years in Navy and Marine Corps.

Graduate education opportunities are available.

Engineering & Weapons	*Mathematics & Science*	*Humanities & Social Sciences*
Aerospace Engineering	Chemistry	Arabic
Computer Engineering	Computer Science	Chinese
Electrical Engineering	General Science	Economics
General Engineering	Information Technology	English
Mechanical Engineering	Mathematics	History
Naval Architecture	Oceanography	Political Science
Ocean Engineering	Operations Research	
Systems Engineering	Physics	
	Quantitative Economics	



USNA Polar Science Program

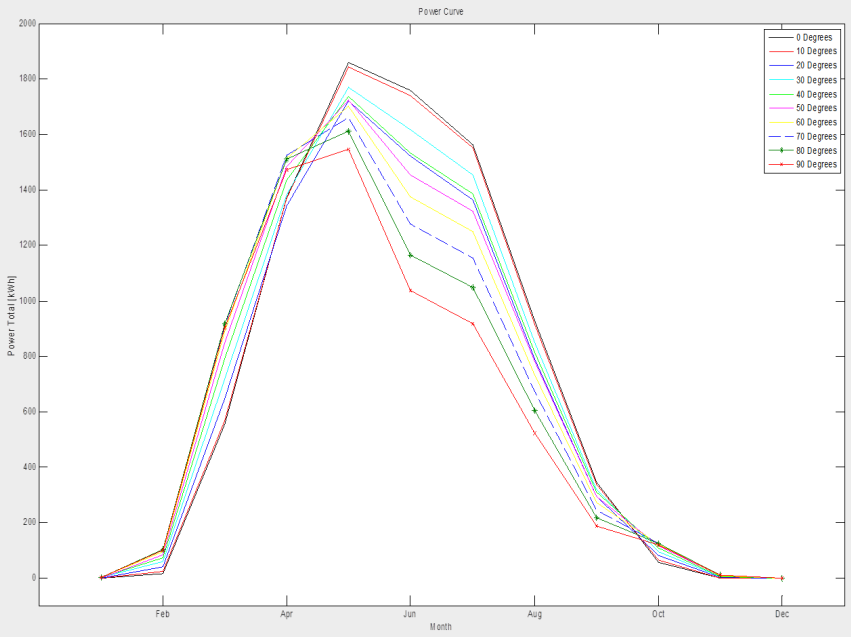
Arctic Buoy Project

IceGoat1

Determining Ideal Solar Panel Configuration

Original Solar Panel Configuration

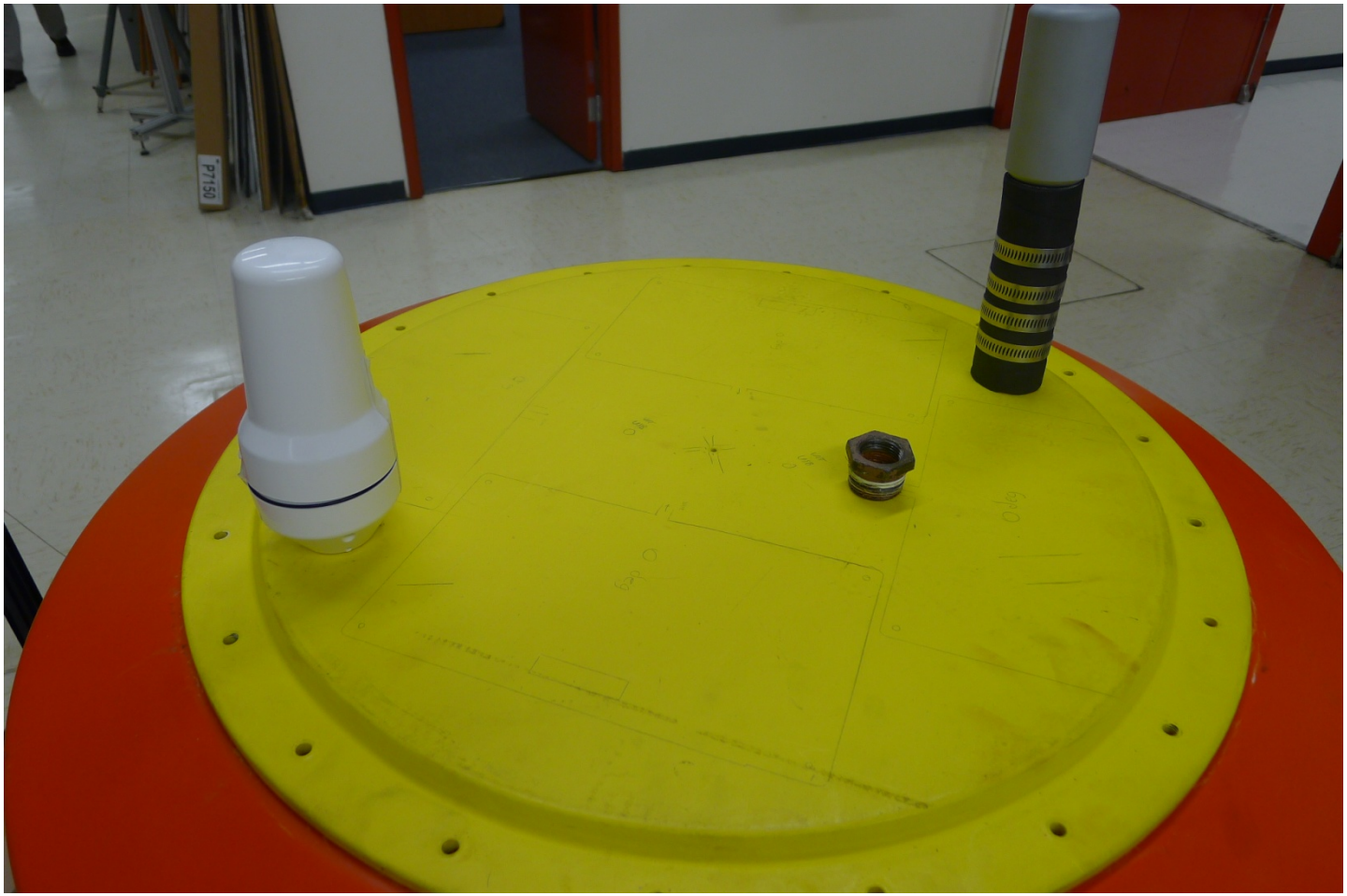
- PV Watts
- Summing and Plotting



Modified Solar Power Configuration

- Power budget displayed a shortage of available power

Build



Build

Build

IceGoat 1 Power System

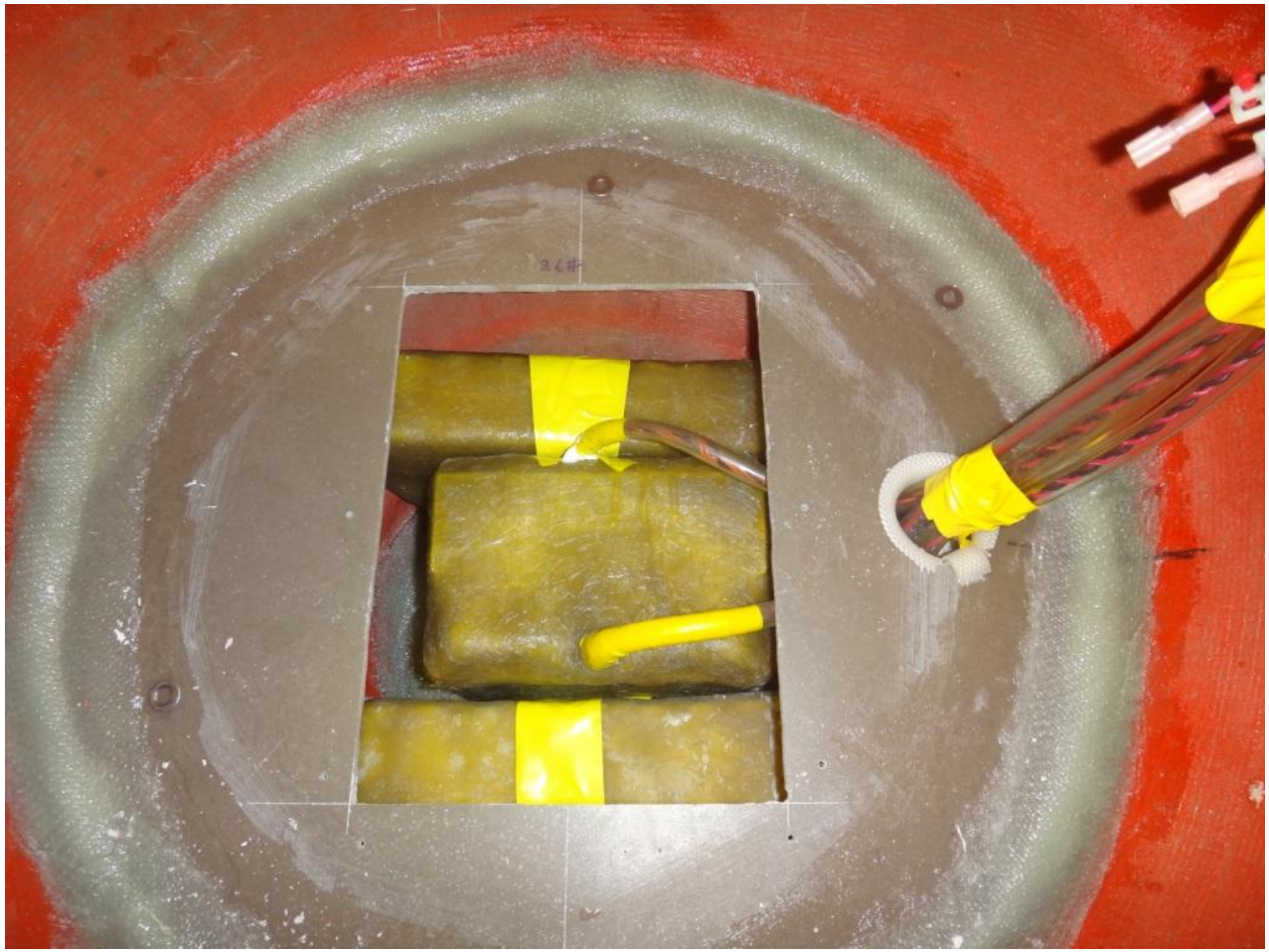
Lithium Ion Batteries

- Argos

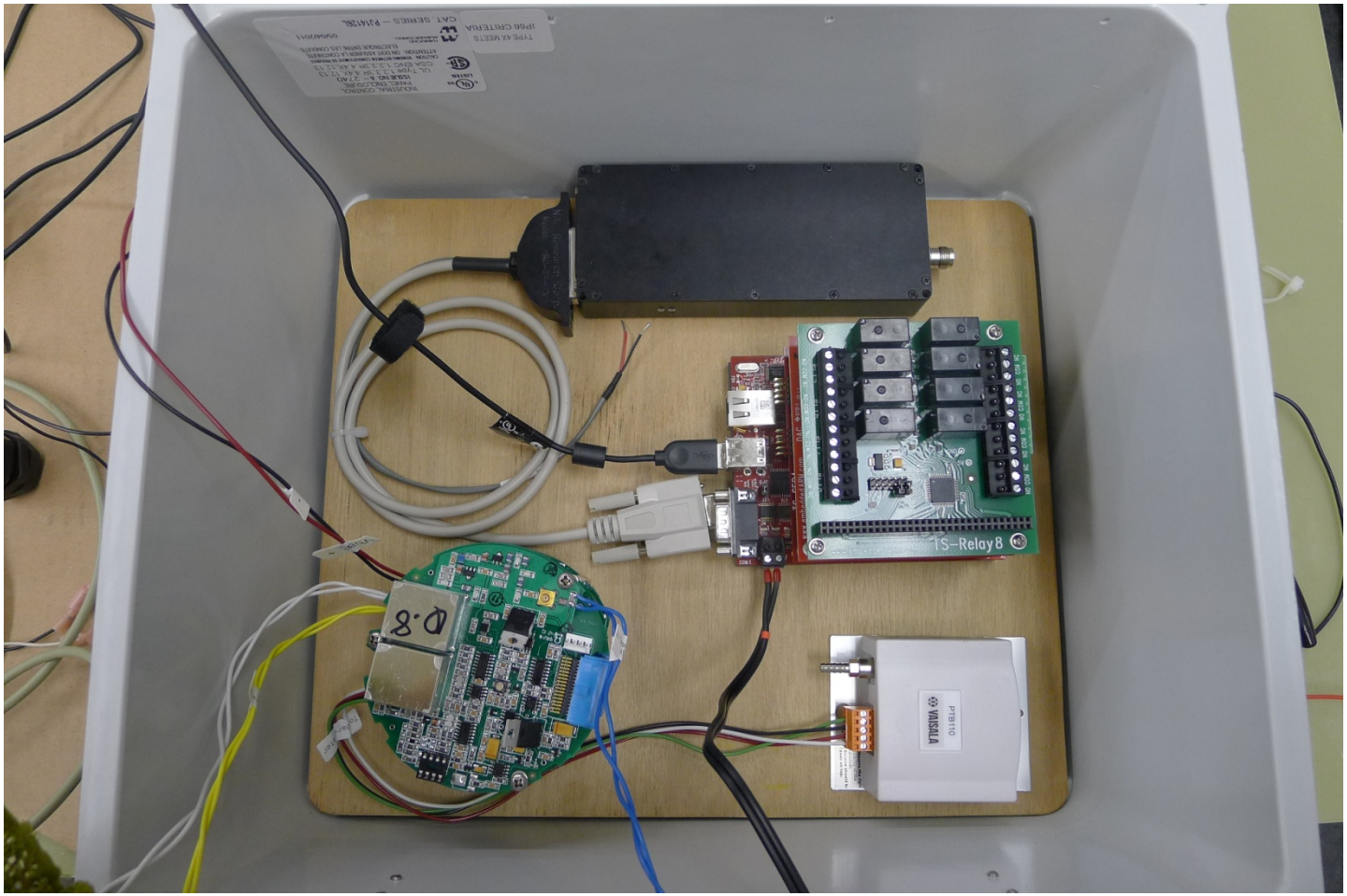
Lead Acid Battery

- Charged by Solar Panels
- Powers
  - SBC
  - APRS
  - Camera
  - Iridium

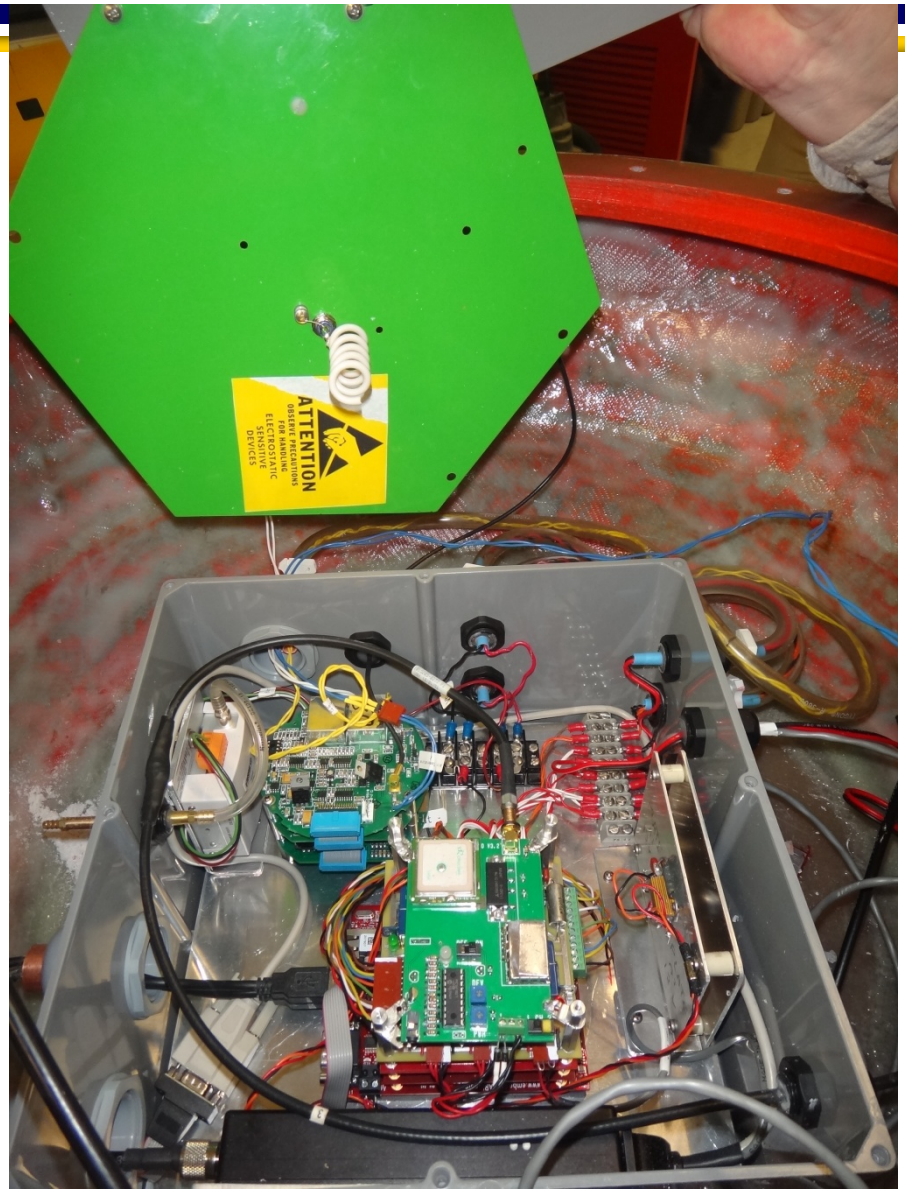
Build



Build



Build


ATTENTION
OBSERVE PRECAUTIONS
FOR HANDLING
ELECTROSTATIC
SENSITIVE
DEVICES

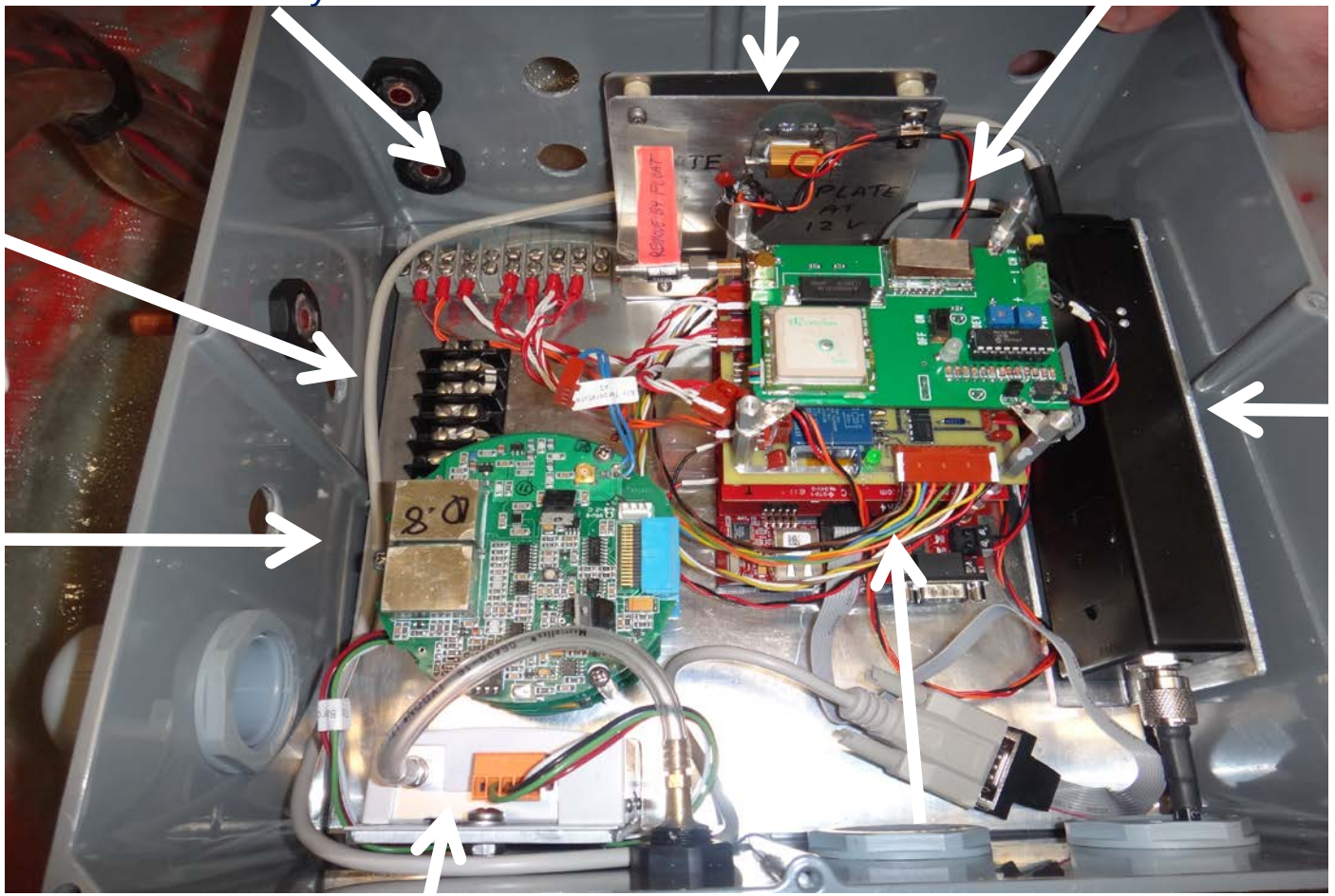
Build

Build

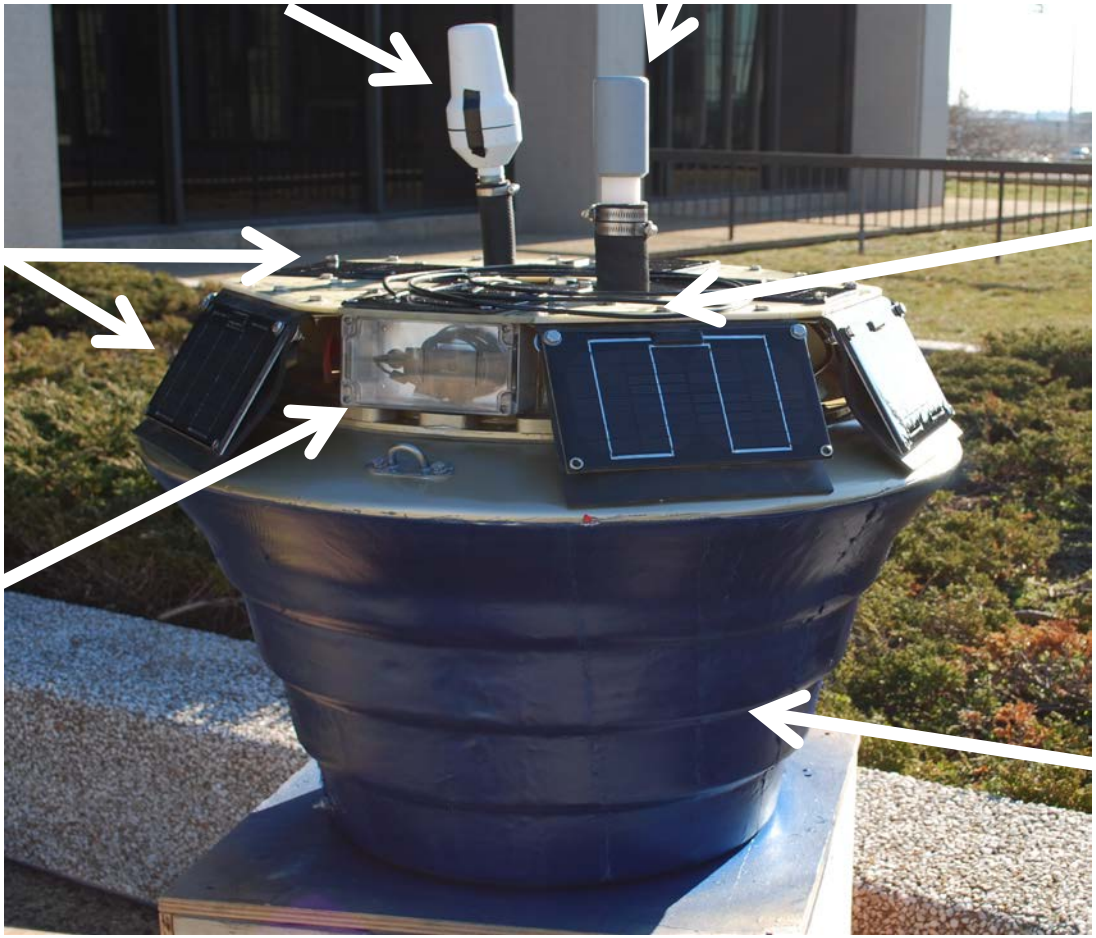
Build

Build

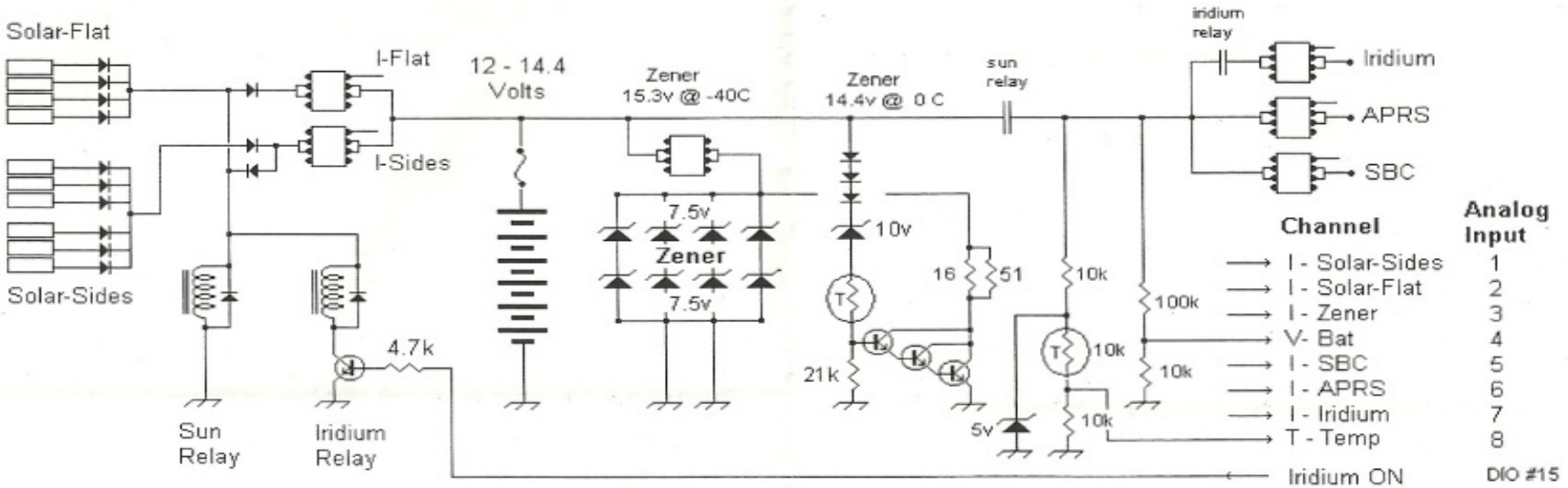
IceGoat1


Lead Acid Battery
Power Relay
Zener
APRS
Lithium Ion
Battery Power
Relay
Iridium
Modem
ARGOS
Barometer
SBC Stack

IceGoat1

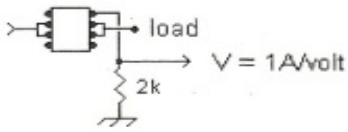

Iridium Antenna
Barometer
Solar Panels
Coiled APRS Antenna Cable
Logitech Web Camera
Watertight Hull

EPS Diagram



Zener Design: Max of 7 solar panels illuminated. At 2 Watts each (due to direct energy transfer) times .7 due to max 40 degree Sun - needs 10W dissipation. These 8W are epoxied to Aluminum for maximum dissipation.

MAX471 Current Sensor (1 of 6)



Project:	Arctic Buoy	**Title:**	Schematic
Engineer:	Bruninga	**Date:**	3 Feb 2012
USNA Satellite Lab		**Dwg No:**	

SBC

Managing Computer

- Compiles Data and controls all of the functions for the Cameras and Iridium modem
- Also monitors, compiles and controls data to two top boards (Power Distribution Board and APRS)
- Pins connecting SBC and Power Distribution Board allow for data compiling and transmission

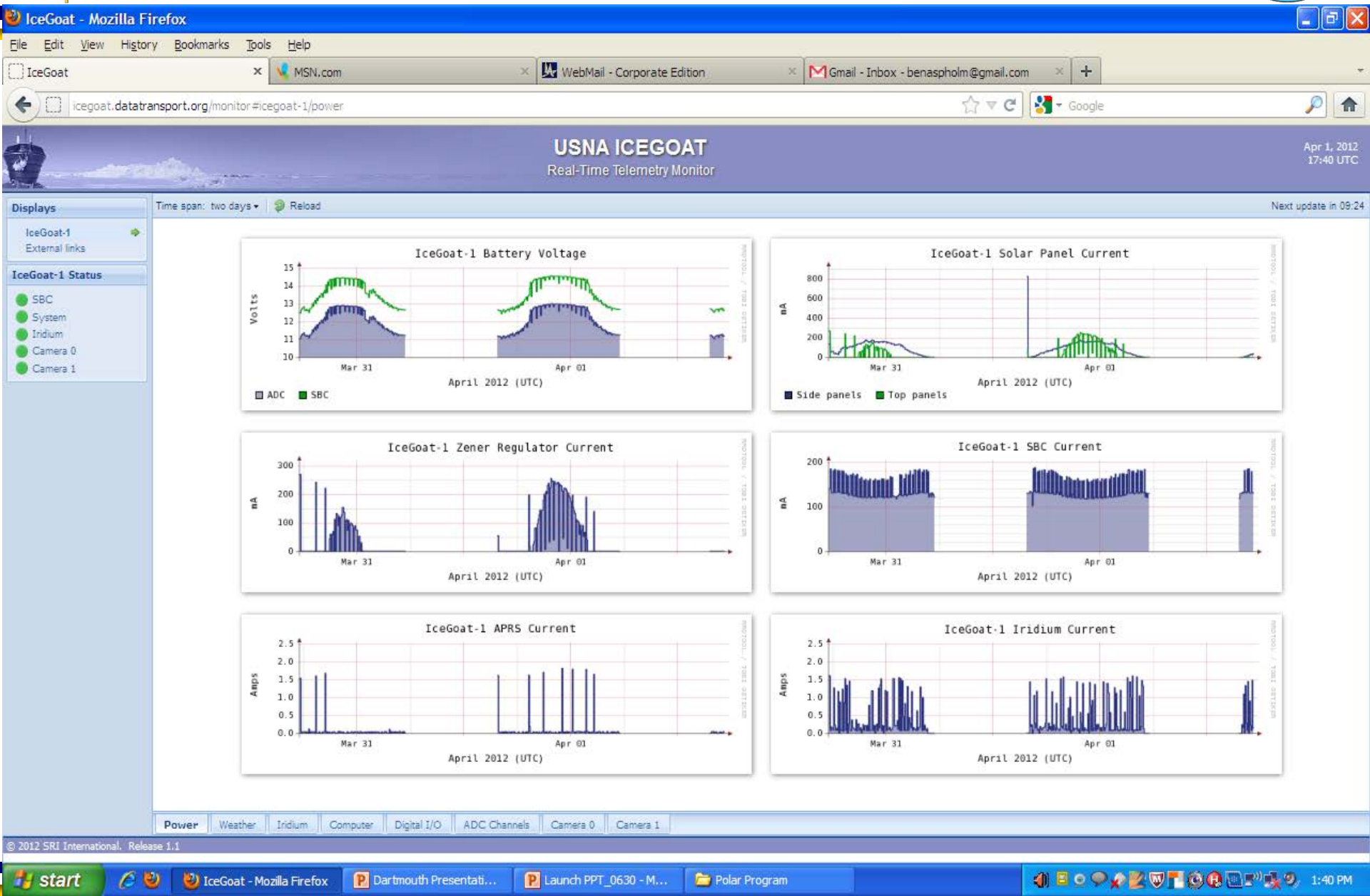
Partnership

- Todd Valentic, a Senior Research Engineer at Stanford University has done much of the programming for this system

Data Website

http://icegoat.datatransport.org/monitor#icegoat-1

Power


IceGoat - Mozilla Firefox
File Edit View History Bookmarks Tools Help
IceGoat
MSN.com
WebMail - Corporate Edition
Gmail - Inbox - benaspholm@gmail.com
icegoat.datatransport.org/monitor#icegoat-1/power
Google
USNA ICEGOAT
Real-Time Telemetry Monitor
Apr 1, 2012
17:40 UTC
Displays
IceGoat-1
External links
IceGoat-1 Status
SBC
System
Iridium
Camera 0
Camera 1
Time span: two days
Reload
Next update in 09:24
IceGoat-1 Battery Voltage
Volts
Mar 31
Apr 01
April 2012 (UTC)
ADC
SBC
IceGoat-1 Solar Panel Current
mA
Side panels
Top panels
IceGoat-1 Zener Regulator Current
IceGoat-1 SBC Current
IceGoat-1 APRS Current
Amps
IceGoat-1 Iridium Current
Power
Weather
Iridium
Computer
Digital I/O
ADC Channels
Camera 0
Camera 1
© 2012 SRI International. Release 1.1
start
IceGoat - Mozilla Firefox
Dartmouth Presentati...
Launch PPT_0630 - M...
Polar Program
1:40 PM

ADC Channels

IceGoat - Mozilla Firefox

File Edit View History Bookmarks Tools Help

IceGoat | MSN.com | WebMail - Corporate Edition | Gmail - Inbox - benaspholm@gmail.com

icegoat.datatransport.org/monitor#icegoat-1/adcchannels

Google

USNA ICEGOAT

Real-Time Telemetry Monitor

Apr 1, 2012
17:42 UTC

Displays

IceGoat-1

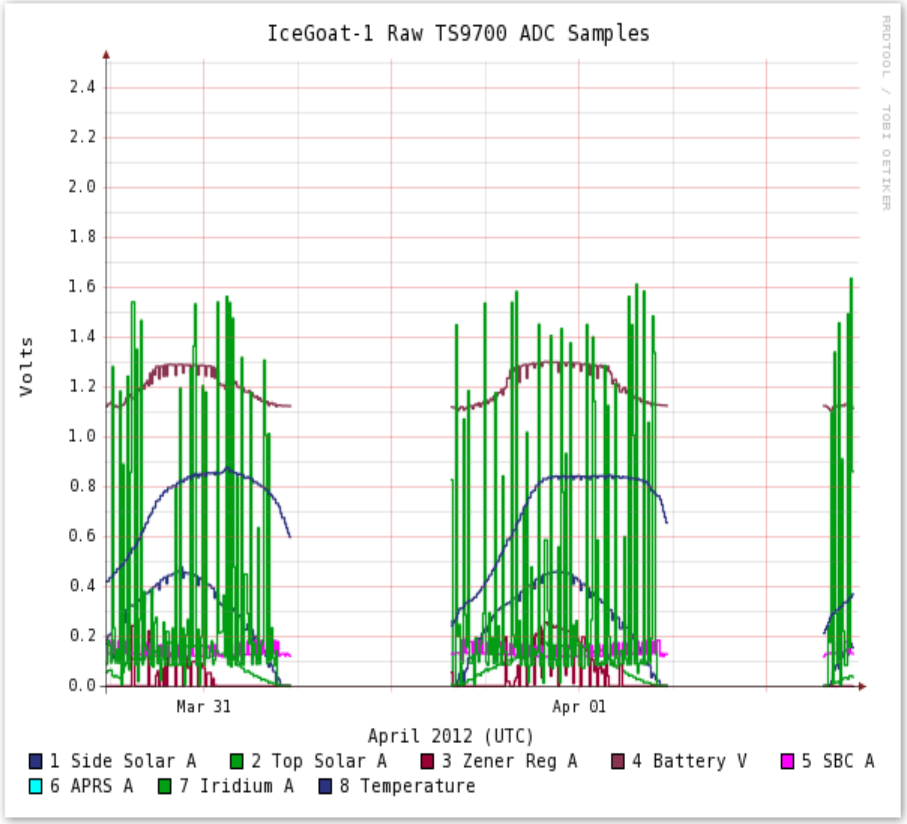
External links

IceGoat-1 Status

- SBC
- System
- Iridium
- Camera 0
- Camera 1

Time span: two days | Reload

Next update in 09:45



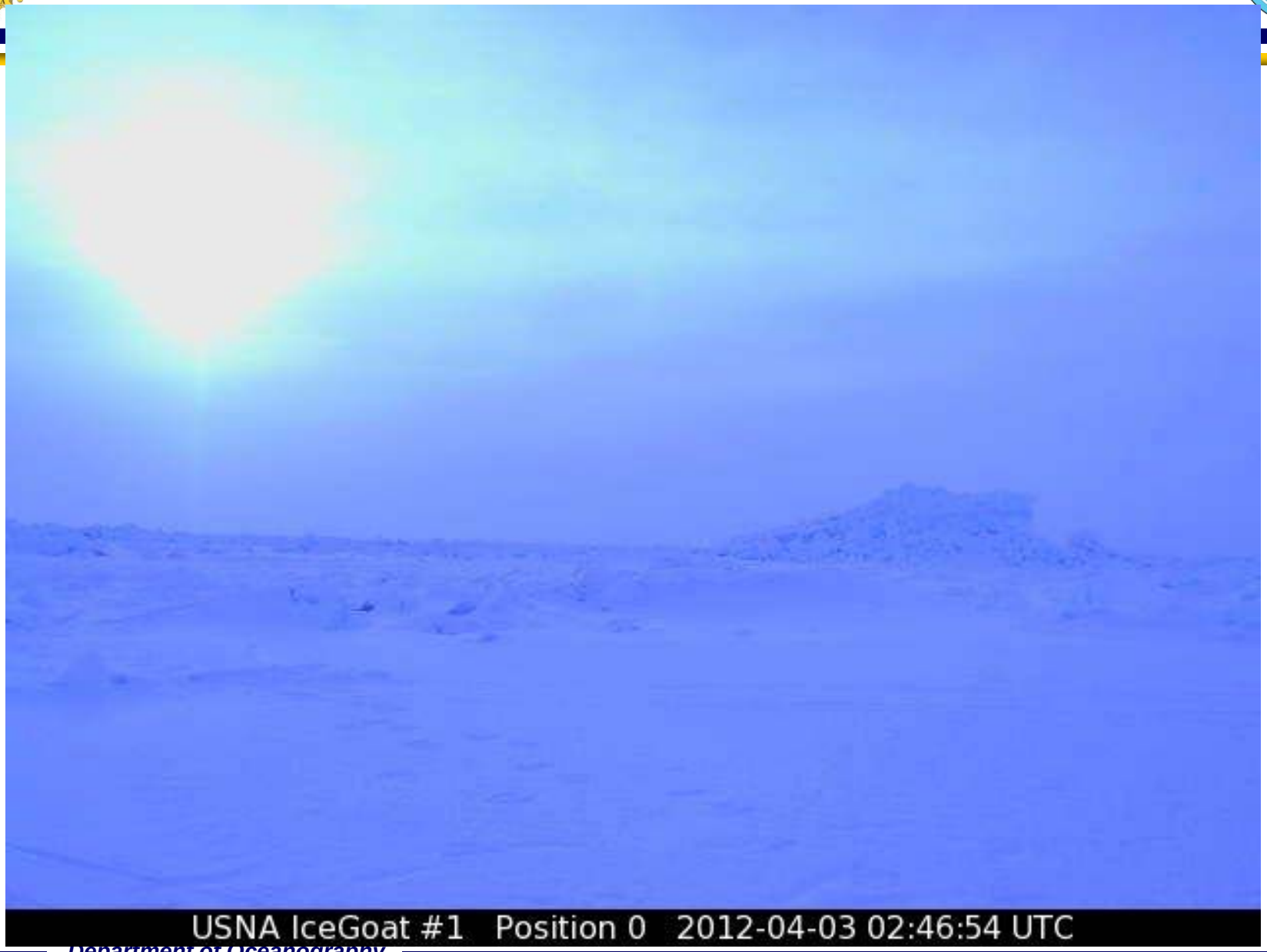
Deployment

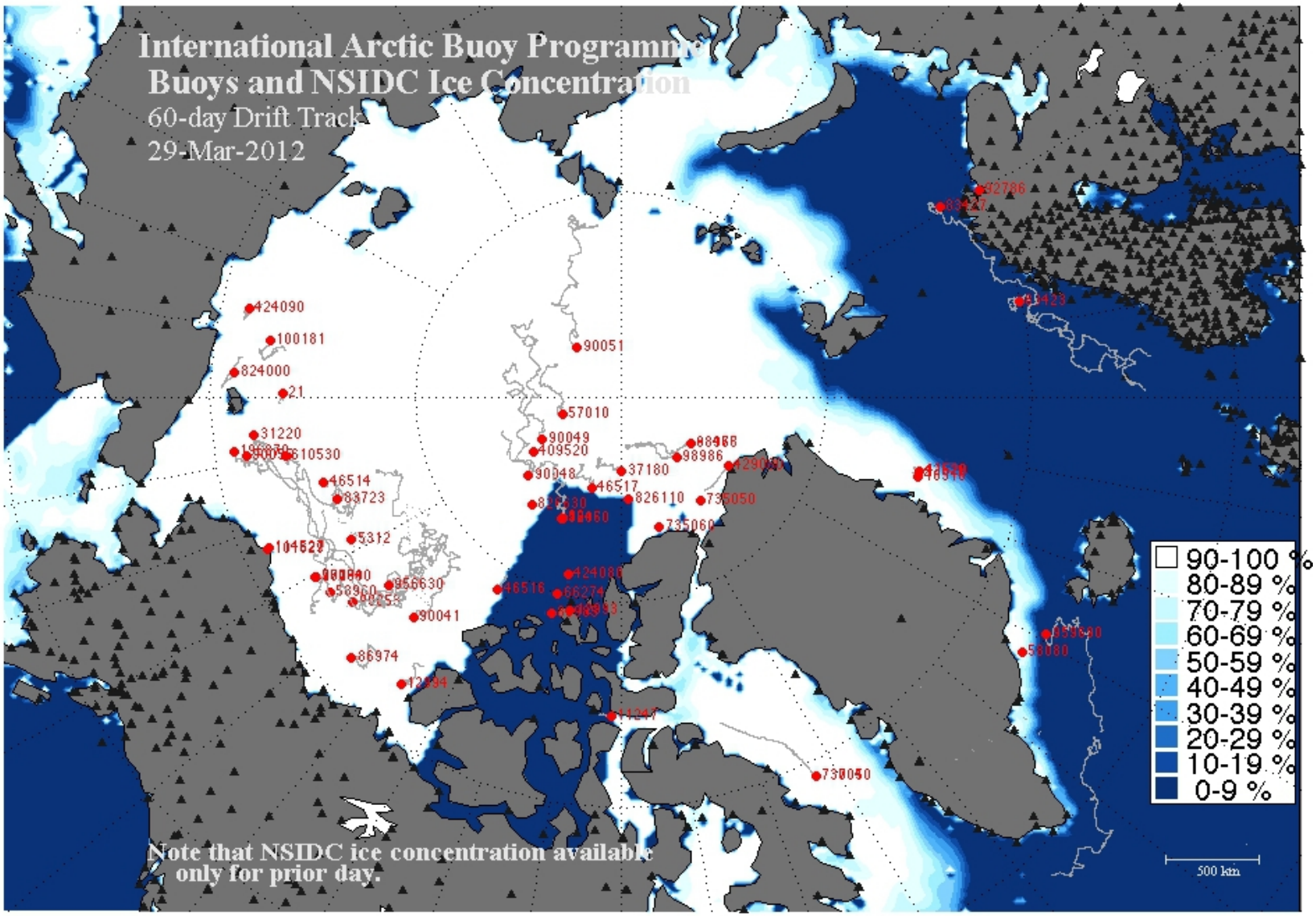
Deployment

Deployment

Deployment

Deployment


USNA IceGoat #1 Position 0 2012-04-03 02:46:54 UTC

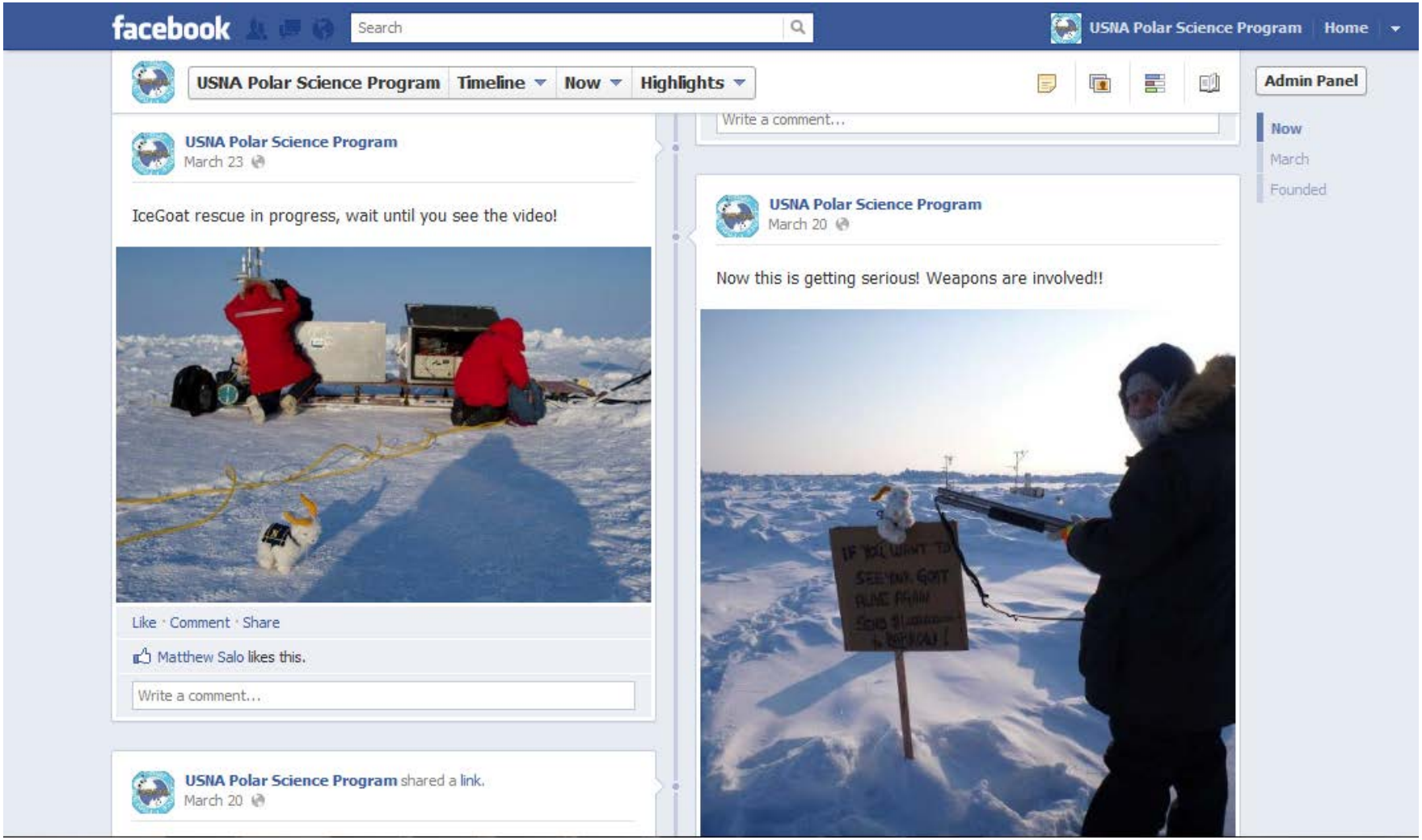

International Arctic Buoy Programme
Buoys and NSIDC Ice Concentration
60-day Drift Track
29-Mar-2012
424090
100181
824000
21
31220
46514
83723
5312
90051
57010
90049
409520
90048
37180
46517
826110
735050
98986
735060
90041
86974
66274
46516
90 - 100 %
80 - 89 %
70 - 79 %
60 - 69 %
50 - 59 %
40 - 49 %
30 - 39 %
20 - 29 %
10 - 19 %
0 - 9 %
500 km
Note that NSIDC ice concentration available only for prior day.

STEM at USNA entails a different approach to recruiting and retaining technologists. We engage elementary, middle, and high school students and teachers in a wide variety of science and engineering activities

STEM Camps and Mini-Camps, Tours of USNA technical laboratories, Teacher Training, Visits to local schools by USNA personnel to provide demos and displays, Science-fair judging, Competitions, contests, and showcases, Midshipmen Outreach Activities,

http://www.usna.edu/STEM/

Like us on facebook!



http://www.facebook.com/USNAPolarScienceProgram?ref=tn_tnmn

Special Thanks

Questions?

Deployment

- Wave energy instrument on future buoy.

- Figure out how to put accelerometers onto the SBC side of the buoy.
- Talk to people presenting on stuff in wave zones or measuring waves and then talk to todd about feasibility

APRS

- What is APRS?
- Required Modifications
- Application on IceGoat 1

International Space Station Footprint

PCSAT Footprint

USNA Polar Science Program (PSP)

- Interdisciplinary, project based, current, field activities
- Invited into International Arctic Buoy Program
  - Arctic Buoy Project “IceGoat1” will be deployed Spring Break 2012 at NASA JPL BROMEX field campaign out of Barrow, AK
  - North Pole 2013, ICEX 2014

Team

- Oceanography Dept
  - LCDR Woods, Jimmy Aisquith, MIDN 1/C Crowder, MIDN 2/C Lange
- Computer Science Dept
  - CDR Blenkhorn, **MIDN X**
- **Aerospace Engineering Capstone Student (Iridium and Solar)**
  - **1/C Kren, 1/C Aspholm**
- Systems Dept **Future Students?**
- Hydro Lab (John Z., Louise, Dan Rhodes)
- Materials/Mechanics/Structures Lab; **Future Students?**
- LBI (buoy manufacturer)
  - Peter Legnos
  - Possible Visit Mid January
- SRI (Stanford Research Institute) **Possible Internships**
  - Todd Valentic
  - Computer Set Up, Iridium comms
- STEM Office
  - Education/Outreach

Research Support AY11

- ~$25K in end of year funds
  - Buoy $6K
  - Sensor Suites $16K
  - Gear $3K
- Continued Support in AY12?
  - Participation Support for BROMEX
  - Development for North Pole in AY13

USNA AXIB Hybrid

	AXIB	USNA
Transmitter	ARGOS PTT transmitter onboard computer and GPS	Iridium
Instrumentation	Single Unit Temp, Humidity, SLP (METOCEAN Pkg)	7602 Single Board Computer, Webcam, APRS
Lifetime	Proven 4 years continuous	Life of buoy
Batteries	Lithium Ion Batteries	Solar Package, Lead-Acid