The ExView System for Logistics Support in the Shallow Water '06 Experiment

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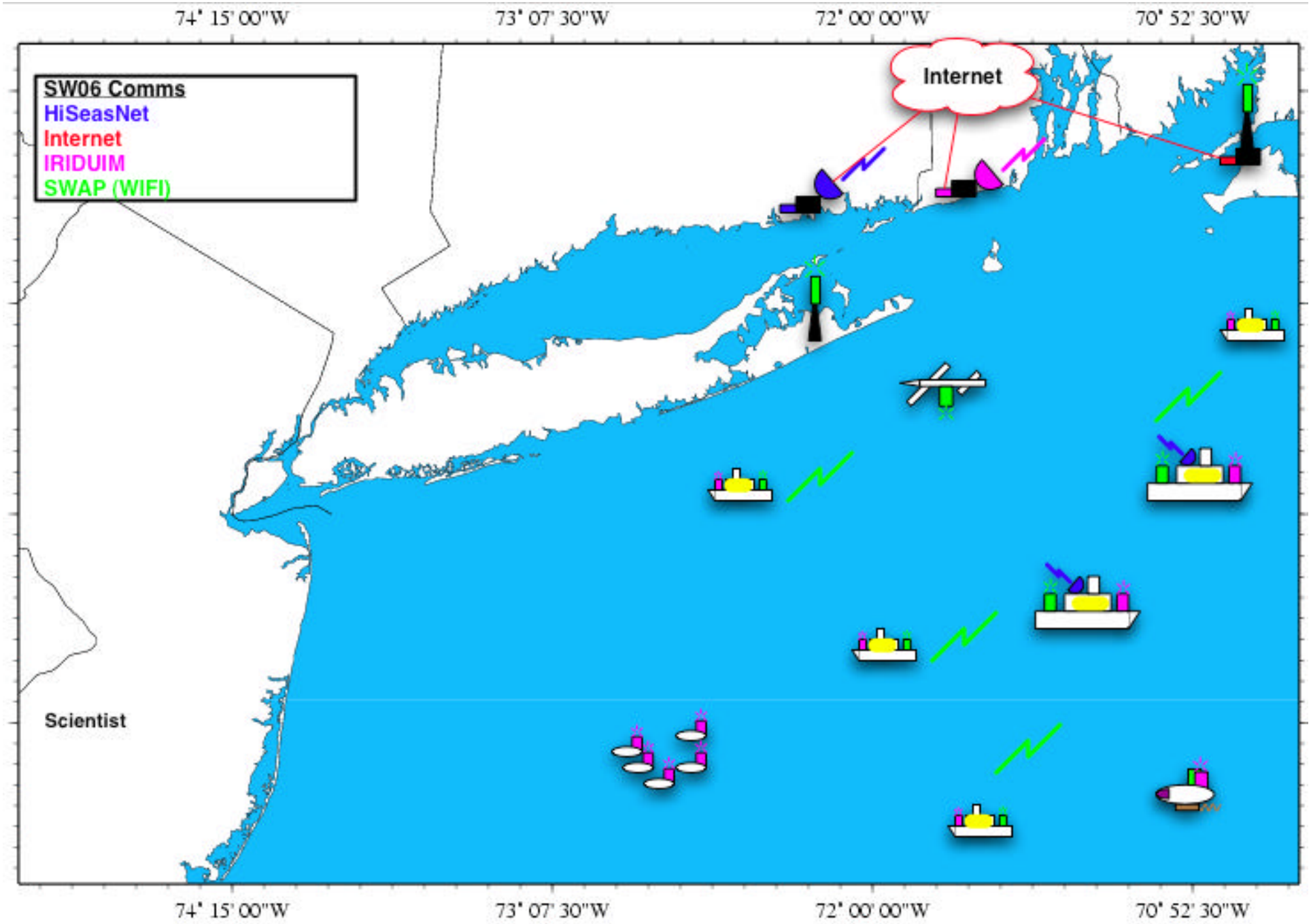
INMARTECH, October 18, 2006

SW06 Experiment Background

- ONR Sponsored (LEAR, AWACS, NLIWI)
  - Acoustics, Internal Waves, AUV ops, PO
- WHOI had primary logistics responsibility
  - Jim Lynch, Art Newhall
  - 2.5 months long, off coast of NJ
- Lots of things to keep track of
  - Knorr, Oceanus, Tioga, Endeavor, Sharp, Quest
  - 62 moorings, 5 Webb gliders, 2 aircraft, 3 AUVs, 3 CODAR stations
  - 25 PIs (the daunting number)
- Lots of sources of relevant information on ships and on the Internet

Tioga too


SHALLOW WATER EXPERIMENT "06"
CRUISE SCHEDULES - Revision 14
Knorr
Endeavor
Oceanus
Sharp
Quest
July
Miami Party Arrives
Nash Party Arrives
Lynch - Moorings
Sail 7/24 - 1100
12 Day Cruise
Arrive
WHOI - 8/4 - 0700
Tang / Dahl
Sail 8/07 - 1000
15 Day Cruise
Arrive
WHOI - 8/21 - 1000
Knobles / Hodgkiss
Sail 8/23 - 1100
16 Day Cruise
Arrive
WHOI - 9/7 - 1100
Lynch - Moorings
Sail 9/10 - 1300
6 Day Cruise
Arrive
WHOI - 9/15 - 0600
Unload
Aug.
Sept.
Arrive WHOI - 15:30
Load Henyey
Henyey / Becker
Sail 8/03 - 0900
19 Day Cruise
Arrive
WHOI - 8/21 - 1500
Load AWACS
Lynch - AWACS
Sail 8/24 - 1500
18 Day Cruise
Arrive
LDI - 9/10 - 0900
Unload
Moun Party Arrives
Moum / Nash
Sail 7/30 - 1015
29 Day Cruise
Arrive
WHOI - 8/27 - 1015
Frisk
Sail 8/30 - 1015
7 Day Cruise
Arrive
WHOI - 9/5 - 1015
Load Lynch
Lynch - Moorings
Sail 9/7 - 1015
7 Day Cruise
Arrive
WHOI - 9/13 - 1015
Unload
Load Turgut
Turgut / Goff
Sail 7/23 - 0900
9 Day Cruise
Arrive
Lewes - 7/31 - 1100
Baldey
Sail 8/02 - 1100
20 Day Cruise
Arrive
Lewes - 8/21 - 0800
Unload
Other Critical Notes:
Sailing times for all ships are best estimates
MSM Dock test 7-19
Sail Halifax - 7/17
Arrive SW06 Site - 7/19
10 Day Cruise
Depart SW06 Site - 7/25
Arrive WHOI - 7/26
WHOI Dock - 7/27
Sail WHOI - 7/28 - PM
Arrive SW06 Site - 7/29
8 Day Cruise
Depart SW06 Site - 8/2
Arrive Halifax - 8/4
Small Boat Transfer Schedules:
2-Aug
Kevin Williams
Quest - Oceanus
4-Aug
Kevin Williams
Oceanus - Endeavor
12-Aug
Kevin Williams
Endeavor - Knorr

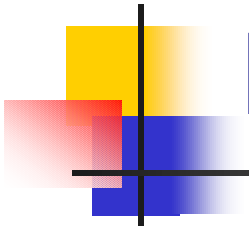

74° 15' 00"W
73° 07' 30"W
72° 00' 00"W
70° 52' 30"W
SW06 Comms
HiSeasNet
Internet
IRIDUIM
SWAP (WIFI)
Internet
Scientist
74° 15' 00"W
73° 07' 30"W
72° 00' 00"W
70° 52' 30"W

SW06 Logistics App. Goals

- Help to make sure vehicles don't run down moorings or each other.
- Provide a common context showing multi-disciplinary, multi-vehicle, multi-PI experiment for scientists
- Provide a way to get Internet-based information to all ships (even those without SATCOM)
- Provide a way to easily communicate information from ships to all participants
- Provide a way for shore and ship based staff to monitor status of the experiment
- Provide a historical record that can be built upon during post-experiment collaboration

SW06 Sample Data Sources

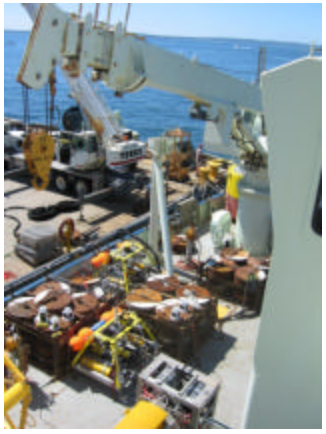
Type	Expected Frequency	Sample Size (excluding EIC size)
Codar Images	10 or so images per day	45-56KB per Codar image
Satellite SST Images	2-3 per day	69-93KB per SST image
Daily Plans	1 per day	EIC ONLY
Glider Updates (graphics and data)	(den+map+sal+ssp+tmp) x (?) glider mission-completes per day	(55+96+59+60+56)KB image files+1 EIC per mission complete
Daily Weather Forecasts	4 per day	(?)
Internal Wave Alerts	3-6 (?) per day (max)	50-100KB (?) - depends on image type provided
Ship Radar	2 ships x 6 per hour x 24 hour/day	700KB reduced down to ?? KB
Ocean Model Report	Up to 6 per day	EIC ONLY
Aircraft imagery	(?) linear runs per hour x (?) hours per day (clouds permitting)	128KB - 178KB
Ship position	6 ships x 1 position per minute x 1440 min per day	210KB per day
Logistics maps	5 map areas x 6 maps per hour x 24 hours per day	31-45 KB per map
Weather Report	2(?) reports per day	250-356KB per forecast
ExView Engineering Reports	24 per day from each ship	100 bytes per report



Results

- Exview worked well
- 62/62
- Lots (many terabytes) of scientific data was collected
- No accidents

62/62



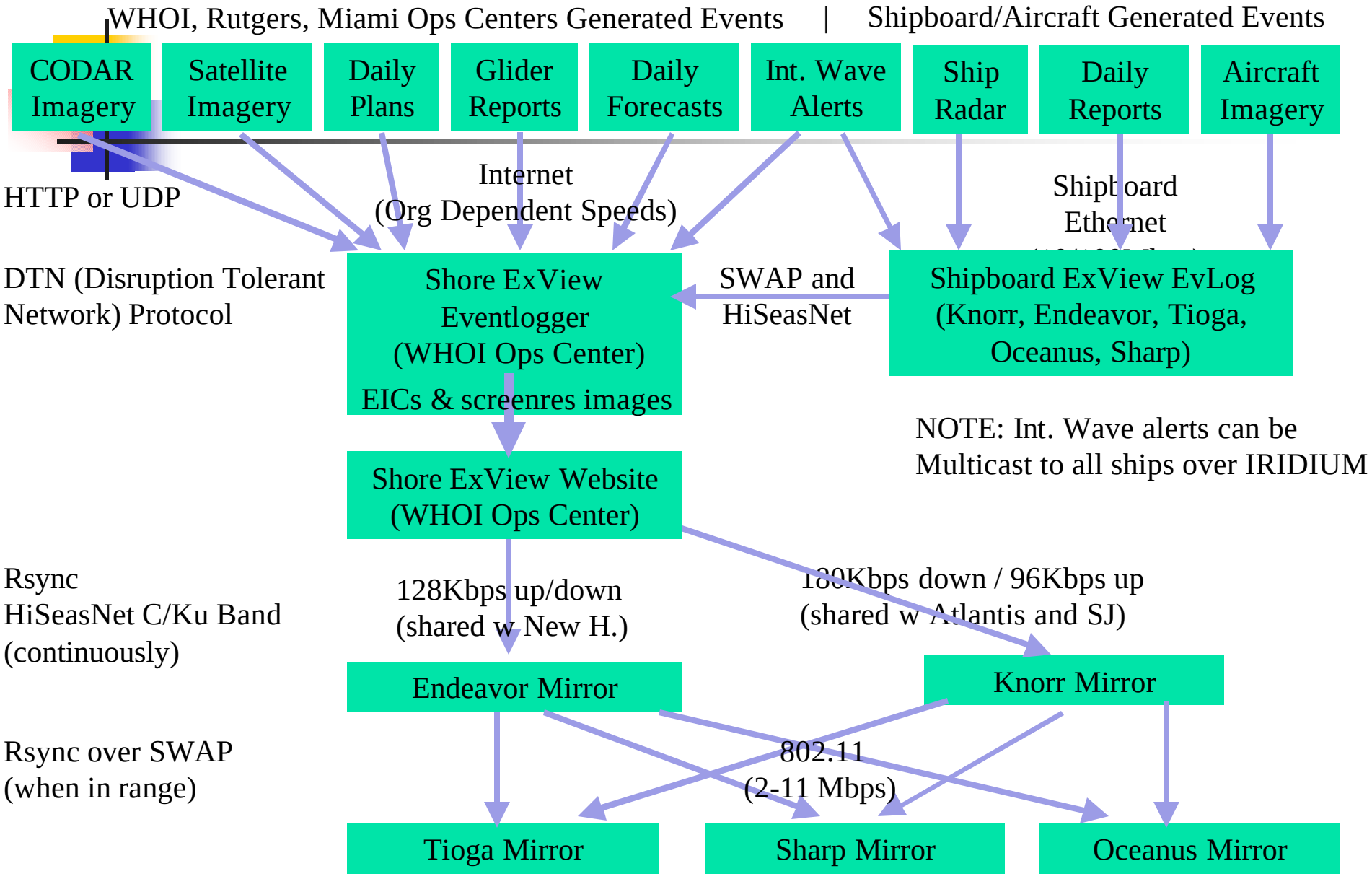
How we did it

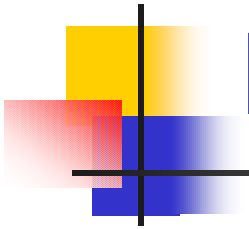
- ExView: Customized webapp built for this experiment (using WHOI 4DGeoBrowser Tech)
- Shore-based webserver collecting info
- Dedicated, synchonized laptops, hosting a mirrored website, was installed on each ship
- Wireless network built with HiSeasNet and SWAP
- Supportive science and shipboard staff during design and implementation
- Dedicated support staff on shore during ops
- Luck

Philosophy

- Complement existing Data Acquisition Systems
- Snapshot real-time data
- Provide composite view of data (templates)
- Provide (interesting) real-time displays for Q/A
- Simple web-based capabilities for on-ship and on-shore
- Self-contained on-ship, take advantage of Satellite-Communications where available
- Must run unattended

Architecture



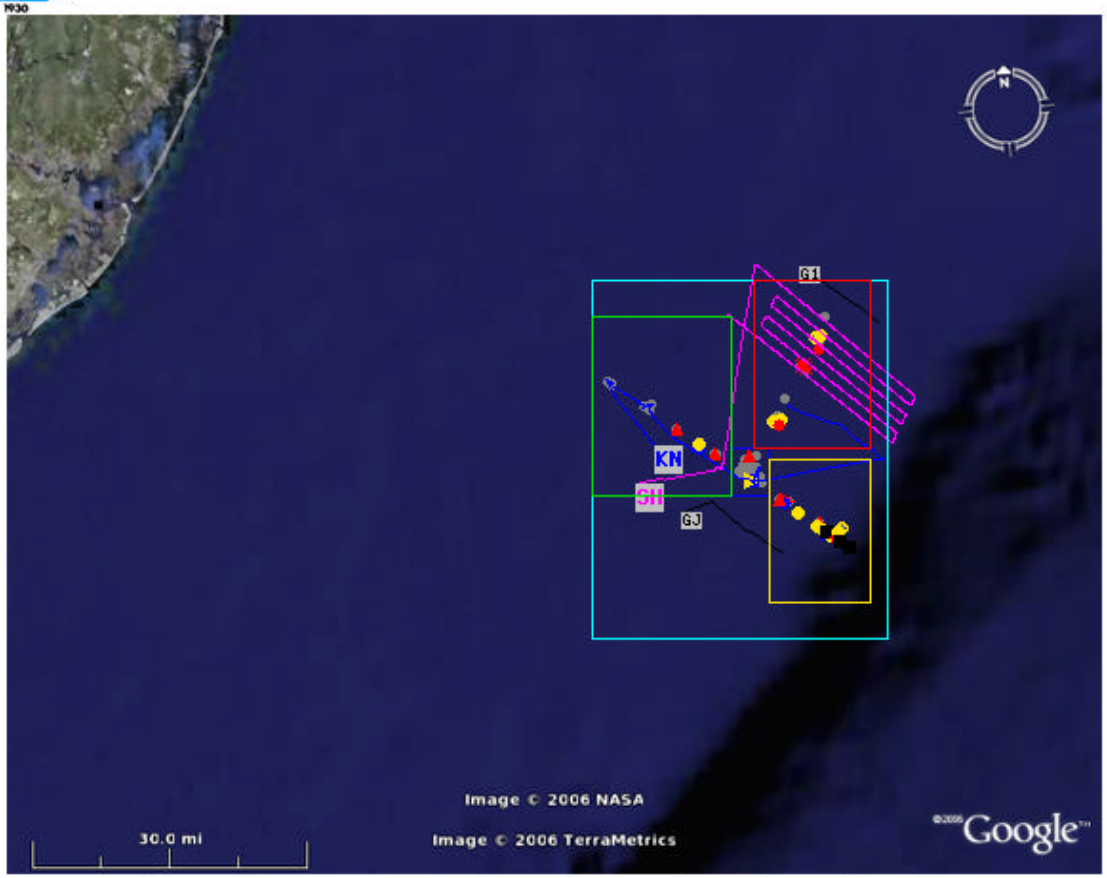


ExView

- Experiment Viewer
- Front-end designed by scientist “experts” involved in the experiment
- Back-end driven by WHOI’s 4DGeoBrowser technologies
- Displays information grabbed off Internet
  - NOAA weather, Satt. SST, Rutgers glider tracks and plots,...
- Display info from ships
  - Navigation and underway data
  - Daily reports from any participant
  - ...

SW06 Logistic Map - *Actual* Display

Current Time: 2006/08/05 10:25:50 GMT Display Time: 2006/07/31 00:44:00



Plan Actual Zoom: Full SW06 CTR NW NE SE

Events

07/30 21:46	codar	new codar update
07/30 21:46	glider	new glider update
07/30 22:33	weather	new weather update
07/30 22:46	codar	new codar update
07/30 22:46	glider	new glider update
07/30 23:46	codar	new codar update
07/30 23:46	glider	new glider update
07/31 00:44	weather	new weather update
07/31 00:47	codar	new codar update
07/31 00:47	glider	new glider update
07/31 01:47	codar	new codar update
07/31 01:47	glider	new glider update
07/31 02:47	codar	new codar update

Submit Text Event:

2006

Jul: 21 22 23 24 25 26 27 28 29 30 31

Aug: 01 02 03 04 05

Hour: 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

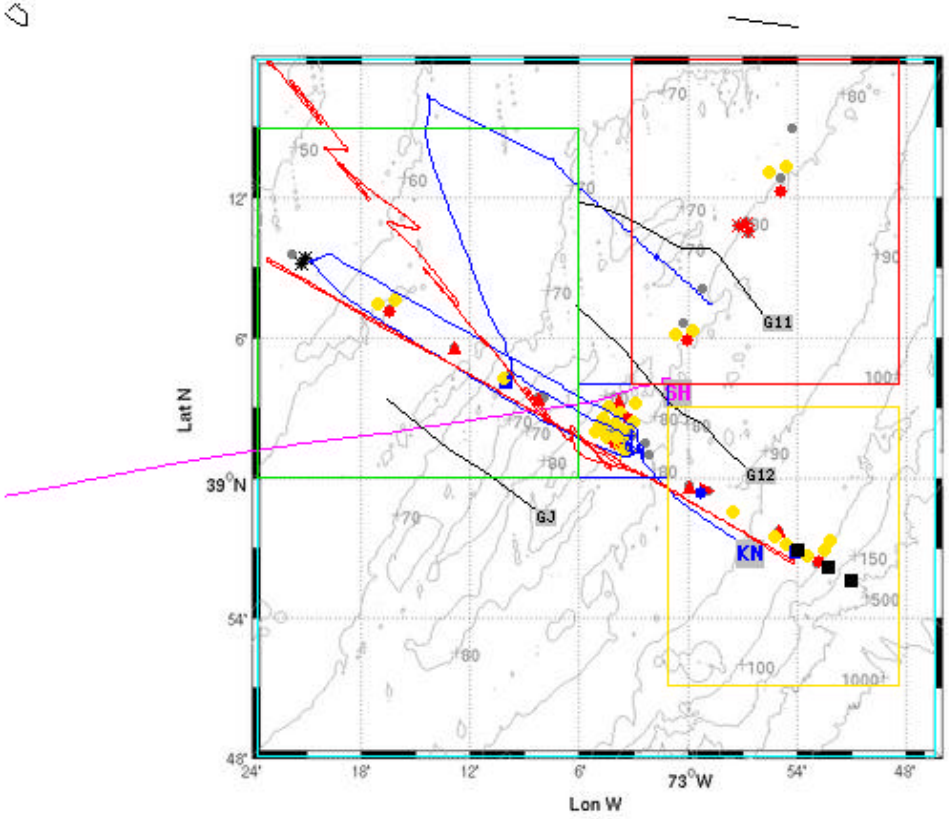
View *Live!*

Report Viewers and Summaries

Significant Events	Daily Reports	Weather Reports	Logistics Forms	Related Links
Codar/SST Reports	Glider Reports	Model Reports	Satellite SAR	
Platforms	Ship Sch	Sat Sch	Freq Sch	Comms

SW06 Logistic Map - *Actual* Display

Current Time: 2006/08/05 10:30:45 GMT Display Time: 2006/08/03 00:54:11



Plan Actual Zoom: Full SW06 CTR NW NE SE

Events

08/02 21:49	weather	new weather update
08/02 21:53	codar	new codar update
08/02 21:53	glider	new glider update
08/02 22:53	codar	new codar update
08/02 22:53	glider	new glider update
08/02 22:54	glider	new glider update
08/02 23:54	codar	new codar update
08/02 23:54	glider	new glider update
08/03 00:54	codar	new codar update
08/03 00:54	glider	new glider update
08/03 01:00	weather	new weather update
08/03 01:54	codar	new codar update
08/03 01:55	glider	new glider update
08/03 02:55	codar	new codar update

Submit Text Event:

2006

Jul: 21 22 23 24 25 26 27 28 29 30 31

Aug: 01 02 03 04 05

Hour: 00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

View *Live!*

Report Viewers and Summaries

Significant Events	Daily Reports	Weather Reports	Logistics Forms	Related Links
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Platforms	Ship Sch	Sat Sch	Freq Sch	Comms

SW06 Daily Report Viewer

Environmental Highlights Powerpoint for July 24.

Slide 1:

First, the surface data.
CODAR surface currents illustrate a direct path from the
NY Bight Apex out along the Hudson Shelf Valley that merges
with a general flow to the south in the SW06 area.
The same path is observed in the morning SST.
Warmer waters long the HSV out to about the 80 m isobath
that then turn south.
On the inner shelf, the strong upwelling from the recent
bursts of southerly winds dominates.

Slide 2:

On to the subsurface.
RU01 and Jane continued their weekend progress to the 100 m isobath.
The most striking feature here is the difference in the depth averaged

Select Source:	ALL
Title:	NWLI Daily Report
Source:	cool
Submitter:	Scott Glenn
Submitted:	2006/07/24 00:00:00
Descrip File:	cool.txt

2006

Jun: 16 18 19 20 21 22 23 26 27 28 29 30

Jul: 07 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

Aug: 01 02 03 04

Daily Report 1 of 2

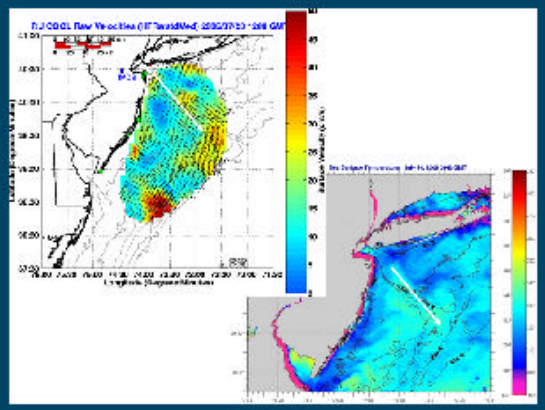


Figure 1

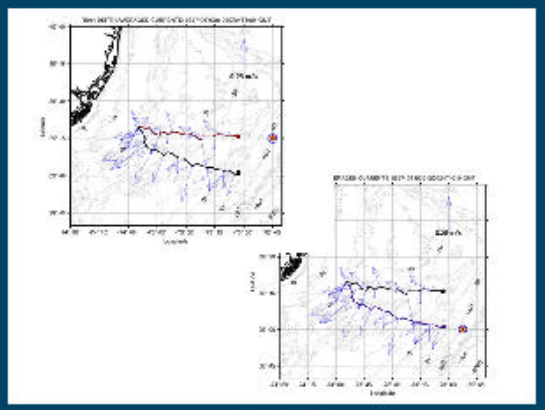


Figure 2

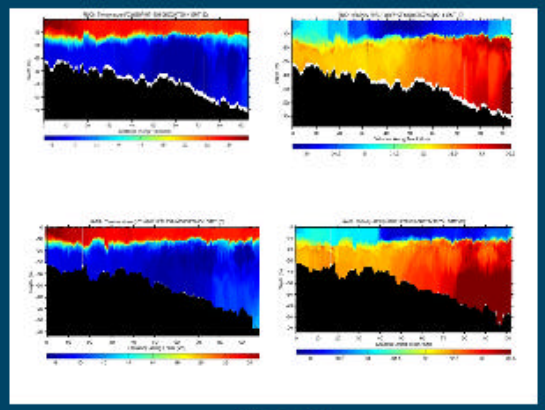
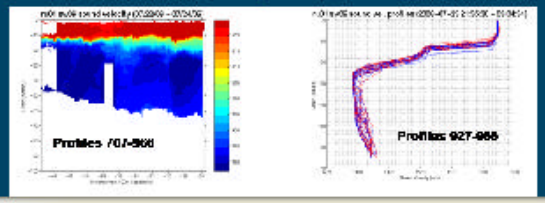
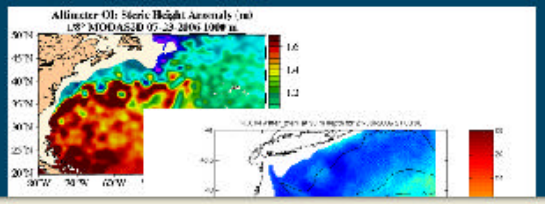
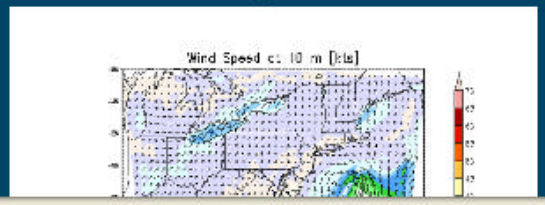


Figure 3







Synchronized Laptops

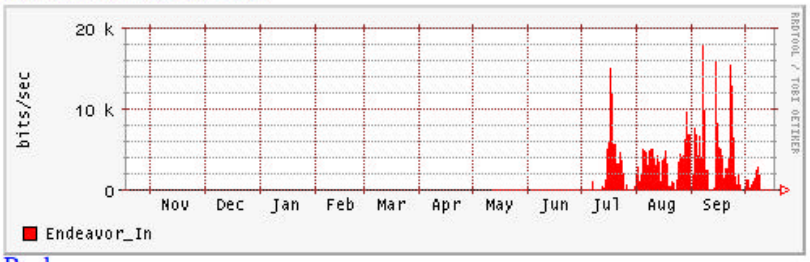
- Refurbished, “cookie-cutter” laptops that are easily replaced when they fail.
  - Linux, Apache, Rsync are workhorses
  - 2 Ethernet connections for each laptop
- Installed SWAP and Serial/Ethernet converters (for GPS) where necessary
- Configured rsync in a restricted manner
  - All directories have only one author
    - Shore ExView: Cgi-bin, html, and data directories
    - Ship ExView: toshore/from-oceanus, toshore/from-knorr, ...
    - No files deleted
  - RSYNC IS SIMPLY MAGIC

Wireless network

Comm Technology	Disruption Characteristics	Link Speed
Knorr HiSeasNet (C)	~93% up (good antenna location)	180Kbps down, 96Kbps up (shared w Atlantis, SJ)
Endeavor HiSeasNet (Ku)	~50% (heading and weather dependent)	128Kbps up/down (shared w New Horizon)
RVTEC SWAP	Within 7nm. when antennas in sight of one another	2-11Mbps
Shipboard LAN	24x7	10/100 Mbps

1.5 Gbytes in 3 months = 1550bps

Statistics for the last Year:



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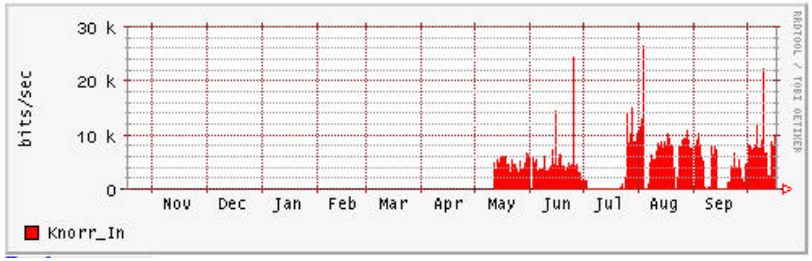
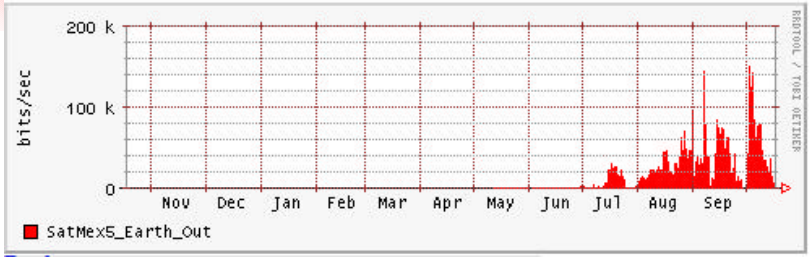
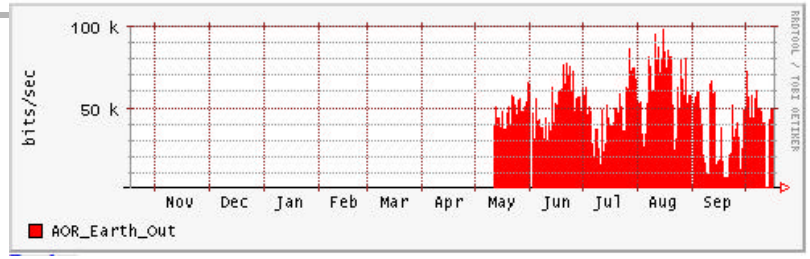


Statistics for the last Year:

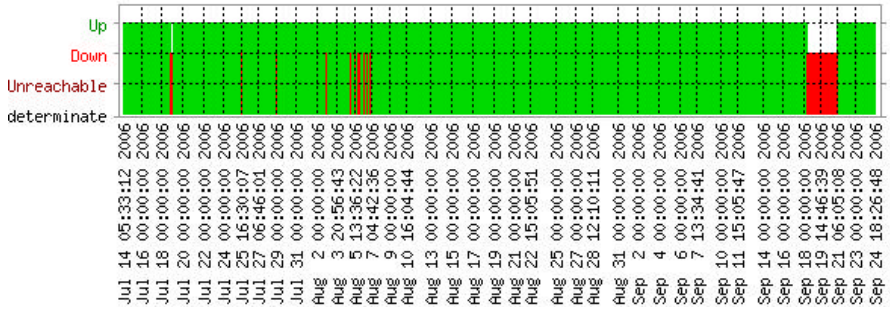


Statistics for the last Year:



State History For Host 'rv-knorr-gw'

Fri Jul 14 05:33:12 2006 to Sun Sep 24 18:26:48 2006



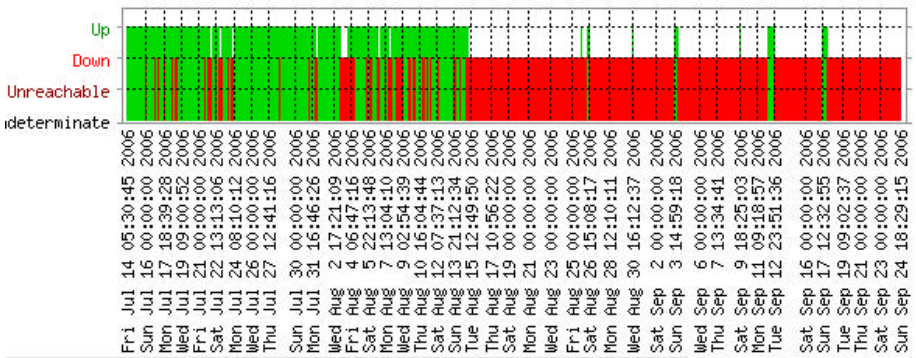
State Breakdowns:

Up : (93.580%) 67d 21h 7m 22s
Down : (6.370%) 4d 14h 54m 7s
Unreachable : (0.050%) 0d 0h 52m 7s
Indeterminate: (0.000%) 0d 0h 0m 0s

Report Produced By:
Nagios®

State History For Host 'rv-endeavor-gw'

Fri Jul 14 05:30:45 2006 to Sun Sep 24 18:29:15 2006

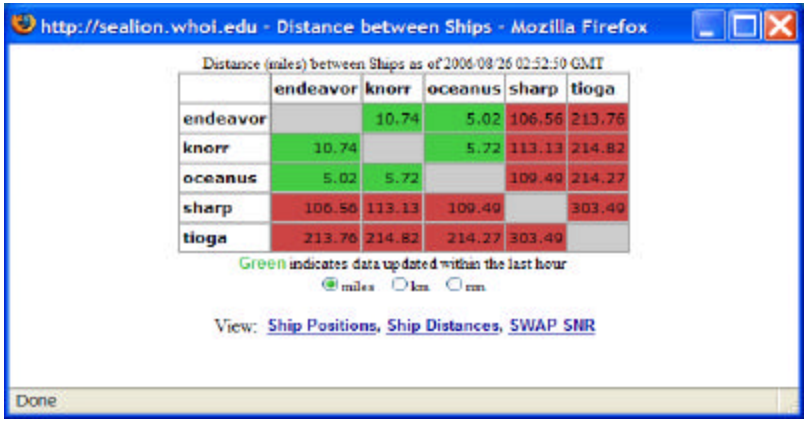


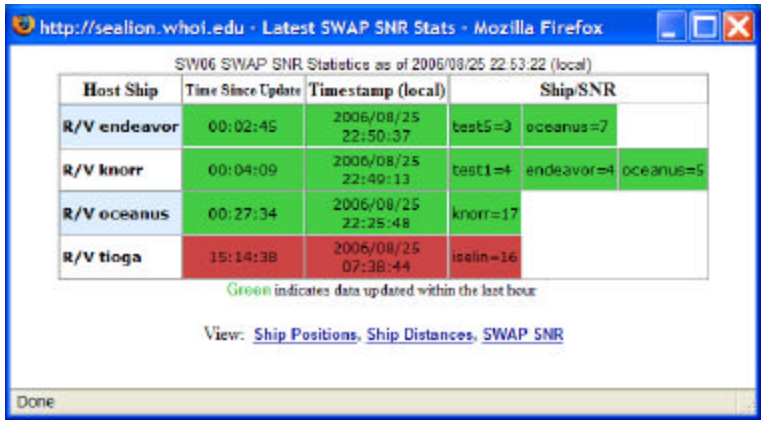
State Breakdowns:

Up : (34.833%) 25d 6h 25m 32s
Down : (65.167%) 47d 6h 32m 58s
Unreachable : (0.000%) 0d 0h 0m 0s
Indeterminate: (0.000%) 0d 0h 0m 0s

Report Produced By:
Nagios®
http://www.nagios.org

Feedback on SWAP Health



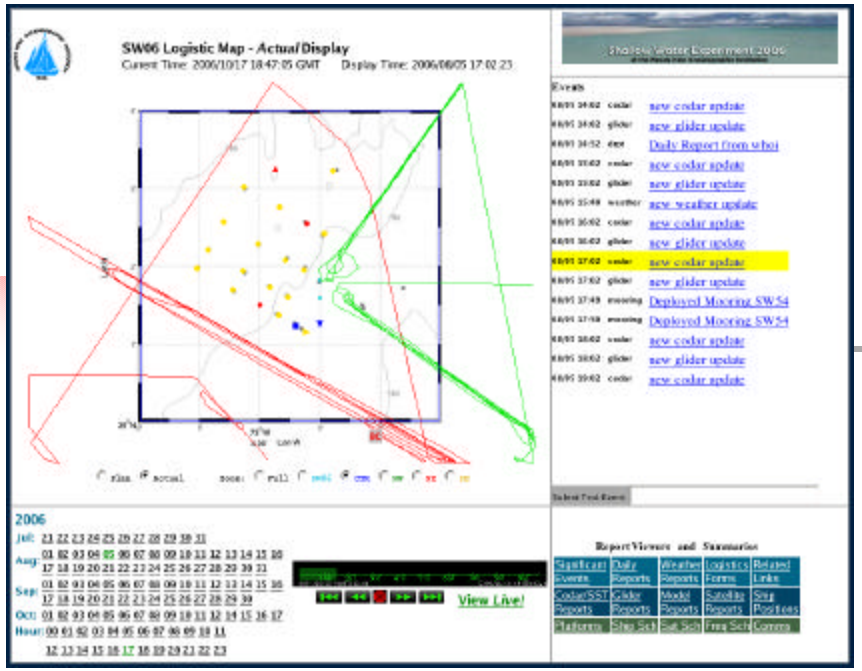


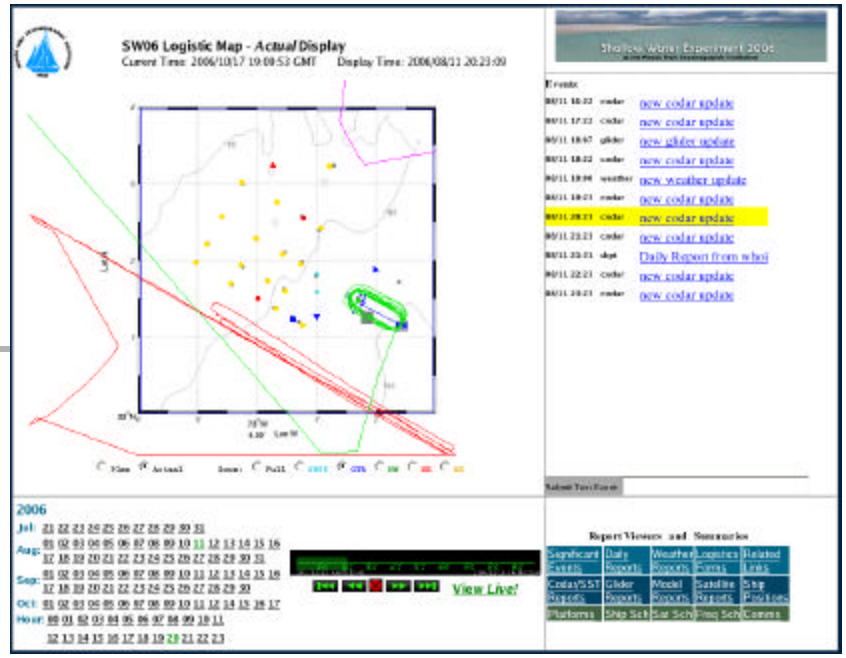
Supportive participants

- Rutgers COOL Lab Latte ‘06 cruise used as pre-SW06 prototype.
- Rutgers Daily Reports provided every day during SW06
- Various labs modified their procedures so that information was automatically submitted to the shoreside webserver for distribution to ships
- Shipboard staff closely monitored comms and kicked equipment when necessary

Dedicated Support Staff

- Cindy Sellers on shore
- Hand holding of information suppliers and ship/shore information viewers
- Noticed when things did not seem to be going quite right (from science perspective)
- Provided sense of humor and a positive attitude


SW06 Logistic Map - Actual Display
Shallow Water Experiment 2006
Report Viewers and Summaries
View Live!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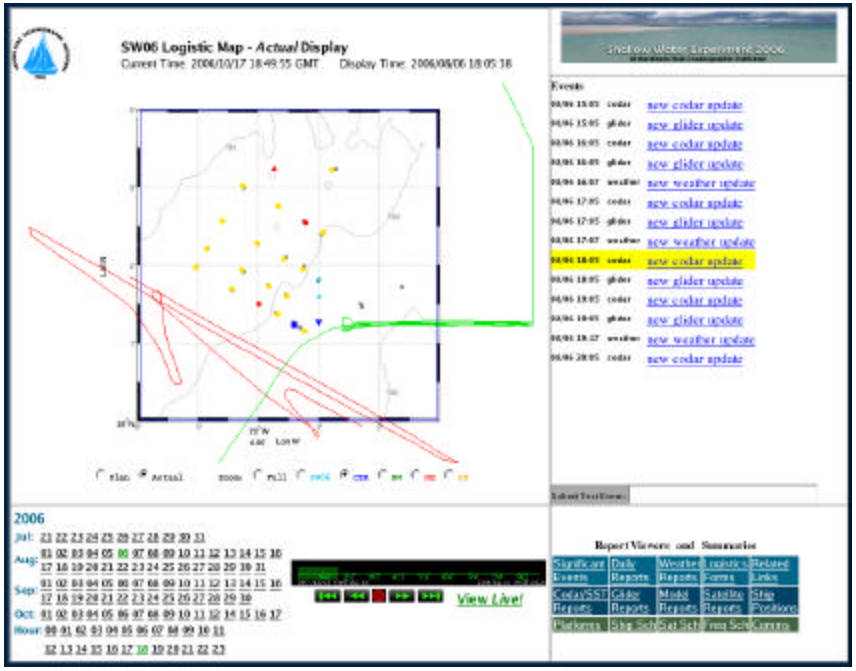
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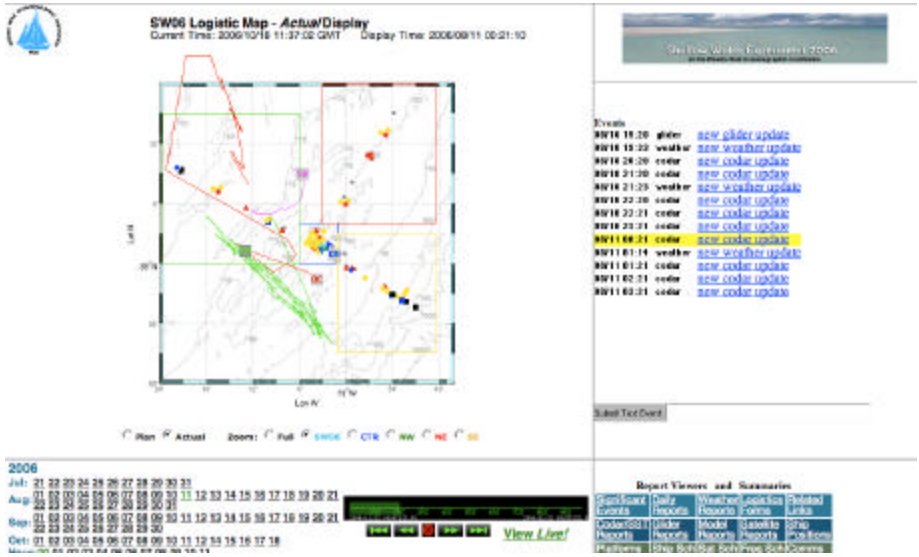
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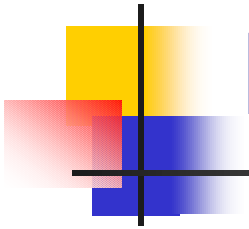

Luck

- SWAP stayed up and running at experiment site even though there were many problems with it at dock
- 2 HiSeasNet ships meant connectivity to Internet was usually available via one or other
- Rsync worked much better than we expected
- No one tried to send huge files during SW06 (we discouraged its use for data files -- send matlab plots instead!)

Lessons Learned (1)

- Antenna location and weather conditions affect HiSeasNet availability significantly
- SWAP has big problems when 4 swap-equipped ships are sitting at a dock
- 2 antennas are not always better than one for SWAP
- Complaints about disrupted communications from shipboard users can be made much less by having them interact with synchronized websites as much as possible. (web-caching might be a good strategy for HiSeasNet)

Lessons Learned (2)

- Use of “Daily Reports” to transfer files rather than providing a more general file transfer mechanism can be a powerful tool for science
- The use of synchronized “laptop-websites” on UNOLS vessels is much easier than we thought before we did SW06.

Next Steps

- Consider building a WHOI ship generic ExView template to replace SW06 template
- Scale ExView to continuous operations and larger number of ships
- Connect Iridium modem to laptop as high-priority channel (for ships without HiSeasNet)
- Implement Aircraft as 802.11 relay
- Integrate Google Earth more fully

Thanks to ...

- WHOI ExView Team
  - Jim Akens, Steve Lerner, Jim Lynch, Andy Maffei, Art Newhall, Cindy Sellers, Laura Stolp, Barrie Walden
- COOL Lab - Scott Glenn and his team
- Shipboard Staffs - Udel, URI, WHOI, Quest
- SW06 - Ellen Livingston other ONR program mgrs, scientists, engineers

Google Earth

QuickTime™ and a
YUV420 codec decompressor
are needed to see this picture.