RUTGERS
Coastal Ocean Observation Lab

NOS Integrated Ocean Observations Systems (IOOS)

Repair and Hardening of Mid-Atlantic Ocean Observing Assets After Hurricane Sandy

NOAA Award No. NA14NOS4830003

Report 01: 30 April 2014

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INTRODUCTION

Seventeen High Frequency radars were damaged within the Mid Atlantic Regional Association Coastal Ocean Observing System when Hurricane Sandy passed through the region in October 2012. The objective of this work is to repair and harden these observing system assets as well as some computer and ADCP assets lost during Sandy. The benefits of this work will increase the coverage and data quality of the surface current measurements in the region. The US Coast Guard uses the surface currents operationally for search and rescue, and the NOAA Office of Response and Restoration uses them for oil spill response. Other users of the data include New Jersey and Massachusetts Department of Environmental Protection offices, county health offices and Mid Atlantic Fishery Management Council. The technical networks that will be leveraged are the Mid-Atlantic Regional Association Coastal Ocean Observing System, NOAA National High Frequency Radar Network, DHS National Center for Secure and Resilient Maritime Commerce and the NJ Board of Public Utilities Radar Network.

1. PROGRAM INFORMATION AND HIGHLIGHTS

During the 1st quarter of 2014, the following technical progress was made:

A. Procurement

Three CODAR sites (Batch 1) were delivered to Rutgers on schedule in late February. These included a full 13 MHz CODAR site to replace the Sea Bright, NJ site and two upgraded systems with dual transmit capability for 5 MHz systems located in Sandy Hook, NJ and Hempstead, NY. Progress has been consistent if not ahead of the baselined schedule and is detailed in the following sections.

B. Site Installations

The new equipment delivered in Batch 1 has been installed at 2 sites located in Sandy Hook, NJ and 1 at Hempstead, NY. During the first quarter of 2014 the following progress was achieved:

1. A new site HOMR (Sandy Hook, NJ 13 MHz system) was installed as a replacement for SEAB (Sea Bright, NJ) which was completely destroyed by Sandy.
2. Upgraded old equipment at HOOK (Sandy Hook, NJ 5 MHz system).
3. Upgraded equipment at HEMP (Hempstead, NY 5 MHz system).

Included in the sections below are photos of each of the three sites takes immediately following Sandy and then in March 2014.

1. Hempstead, Long Island, NY (HEMP)

a. Immediately following Hurricane Sandy:

b. After installation of new equipment:

2. Sandy Hook, NJ (HOOK)

   a. Immediately following Sandy:

   b. After installation of new equipment:

3. Former Sea Bright, NJ site (SEAB)

   a. Immediately following Sandy

   b. After installation of new equipment (Location – Sandy Hook, NJ).

Rutgers University keeps a Google Drive log sheet of all of the serial numbers associated with the equipment located at each CODAR site. Table 1 below is a screenshot of the most updated version:

5 MHz							
Site	**Tx**	**Rx**	**Antenna**	**Radial Key**	**Elliptical Key**	**MDA Key**	**AIS Pattern Key**
MVCO	2013374	2013374					
NAUS							
NANT							
BLCK				101680672504435	N/A	N/A	N/A
MRCH	2006183	2006183		101762740130717	N/A	N/A	N/A
HEMP	200150	200149	2013195	101098442885353	N/A	N/A	801036075359955
LOVE	2002082	200039	2004170	101498835290737	N/A	N/A	N/A
BRIG	200043	200033	2013195	101916739562707	301504057130205	N/A	N/A
WILD	200039	2001059	2013164	101588161375581	301362673261907	N/A	N/A
HOOK	2007189	9814	2013196	N/A	N/A	N/A	N/A
13 MHz							
Site							
BRNT	2011334	2011334	2011073	101724448598979	301143439322081	N/A	N/A
BRMR	2011335	2011335	2011102	101758959828695	301186584481455	N/A	N/A
RATH	2011336	2011336	2011100	N/A	Y - No S/N	N/A	N/A
LOOK	N/A	N/A	N/A	N/A	N/A	N/A	N/A
HOMR	2013403	2013403	2013199	101346080061571		N/A	801134297971215
WOOD	2011333	2011333	2013156	101138543071215	N/A	N/A	801197178215987
25 MHz							
Sites							
SILD	2003097	2003097		N/A	N/A	N/A	N/A
PORT	200033	98013		101191365584637	301170776565521	501187042322183	N/A
CMPT							

Table 1. List of CODAR sites with associated serial numbers and software keys.

C. Antenna Calibrations

Antenna calibrations are planned for each of the newly installed sites during April of 2014.

D. Data Processing & QA/QC

Data QA/QC checks and analysis are planned for April at HEMP, HOMR and HOOK.

2. ISSUES/RISKS & MITIGATION

Based on almost two decades of previous experience with CODAR HF-Radar site installations, high level potential risks to the success of this project include:

1. If the municipality, park or land owner of the potential installation site location refuses to allow installation of a site, then there could be delays in site installation or it could force us to move the site location to a less than optimal location.
    a. Mitigation: As these are replacement sites with previous approvals, this risk should not come to fruition.

2. If CODAR delays the delivery of sites due to a backlog of orders or lack of personnel, site installations could be delayed.
    a. Mitigation: There are two mitigation strategies here: The first strategy was to discuss and plan the orders with CODAR in August with a goal to insert these into the CODAR construction process; The second strategy was to build an additional 1-2 weeks of slack in the schedule based on delivery dates estimated by CODAR in August, and then again in late December.
3. If CODAR delivers faulty equipment, then we would be forced to ship the equipment back to CODAR for repair, thereby delaying potential installations of the systems by several weeks.
    a. Mitigation: The CODAR equipment will be delivered in four batches of 3 to 6 sites at a time. If some of the equipment is faulty, it can be shipped back to CODAR to be fixed while technicians, test, install, calibrate and retest another system in the batch.
4. If there is severe weather such as winter snows, frozen ground, or a hurricane/nor'easter causing beach destruction, then installations could be delayed.
    a. Slack has been built into the schedule for these events which will occur over the 2 years of the project at one or more of the site locations.
5. If a technician departs Rutgers or UConn, then the team will lose technical proficiency and some of our capability to install the sites in a timely manner.
    a. There are now additional technicians at Rutgers not currently funded through this project that could replace funded team members should they depart for another job.

3. SCHEDULING

The baseline schedule for this project is shown below in figure 1. As mentioned in the previous report, the exact dates and install sites were subject to change based on logistical challenges including but not limited to weather, municipality support/approval and strategic need. The first three sites originally scheduled for installation were HEMP (3/13/14), MVCO (4/22/14) and SEAB (6/5/14). Original installation date details are shown in figure 2. HEMP and SEAB (now HOMR) were installed, but HOOK was installed instead of MVCO as HOOK and HOMR are adjacent to each other in Sandy Hook, NJ.

The HOMR and HOOK sites were installed four and eight weeks ahead of schedule, however, the complete post installation work for each site, including HEMP, must still be

performed. QA/QC, calibration, antenna pattern measurements and data delivery to the national network must still be completed for all sites over the next 2 months. Overall, we estimate that the project is approximately 2-3 weeks ahead of the baselined schedule.

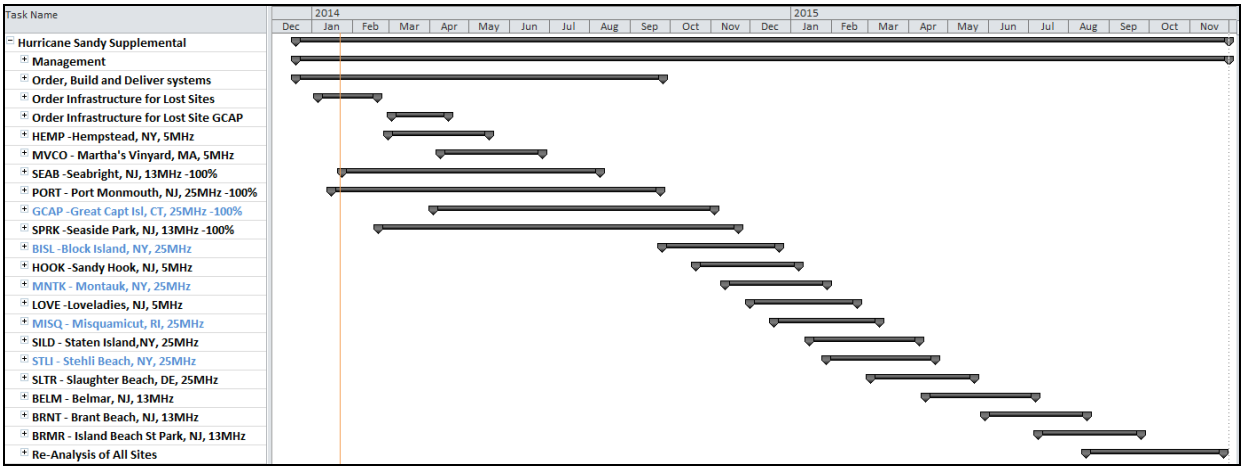


Figure 1. High level schedule for the CODAR installations.

29	**HEMP -Hempstead, NY, 5MHz**	**55 days**	**Fri 2/28/14**	**Thu 5/15/14**
30	Pre Install Equip. Check - HEMP	5 days	Fri 2/28/14	Thu 3/6/14
31	Equipment installed - HEMP	5 days	Fri 3/7/14	Thu 3/13/14
32	Proper settings - HEMP	6 days	Fri 3/14/14	Fri 3/21/14
33	Data delivered to USCG/NOAA - HEMP	5 days	Mon 3/24/14	Fri 3/28/14
34	Apm performed - HEMP	4 days	Mon 3/31/14	Thu 4/3/14
35	Primary Installation Complete - HEMP	0 days	Fri 4/4/14	Fri 4/4/14
36	Post Install Analysis - HEMP	30 days	Fri 4/4/14	Thu 5/15/14
37	**MVCO - Martha's Vinyard, MA, 5MHz**	**56 days**	**Wed 4/9/14**	**Wed 6/25/14**
38	Pre Install Equip. Check - MVCO	5 days	Wed 4/9/14	Tue 4/15/14
39	Equipment installed - MVCO	5 days	Wed 4/16/14	Tue 4/22/14
40	Proper settings - MVCO	6 days	Wed 4/23/14	Wed 4/30/14
41	Data delivered to USCG/NOAA - MVCO	6 days	Thu 5/1/14	Thu 5/8/14
42	Apm performed - MVCO	4 days	Fri 5/9/14	Wed 5/14/14
43	Primary Installation Complete - MVCO	0 days	Thu 5/15/14	Thu 5/15/14
44	Post Install Analysis - MVCO	30 days	Thu 5/15/14	Wed 6/25/14
45	**SEAB -Seabright, NJ, 13MHz -100%**	**141 days**	**Fri 1/24/14**	**Fri 8/8/14**
46	Order Phone - SEAB	3 days	Fri 1/24/14	Tue 1/28/14
47	Order Power - SEAB	3 days	Wed 1/29/14	Fri 1/31/14
48	Pre Install Equip. Check - SEAB	6 days	Tue 5/20/14	Tue 5/27/14
49	Equipment install - SEAB	7 days	Wed 5/28/14	Thu 6/5/14
50	Proper settings - SEAB	6 days	Fri 6/6/14	Fri 6/13/14
51	Data delivered to USCG/NOAA - SEAB	6 days	Mon 6/16/14	Mon 6/23/14
52	Apm performed - SEAB	4 days	Tue 6/24/14	Fri 6/27/14
53	Primary Installation Complete - SEAB	0 days	Mon 6/30/14	Mon 6/30/14
54	Post Install Analysis - SEAB	30 days	Mon 6/30/14	Fri 8/8/14

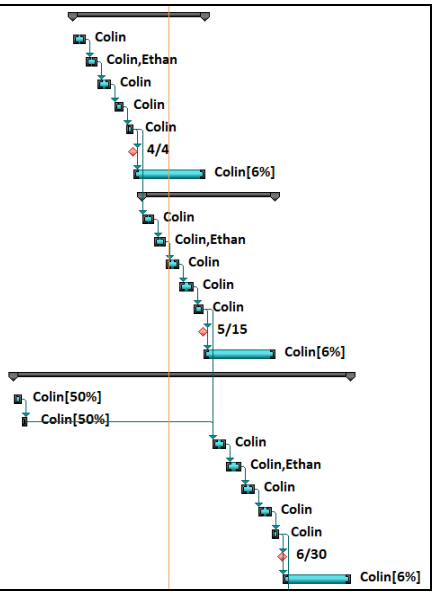


Figure 2. Detailed installation schedule of the first three installation sites.

There are 21 major milestones over the course of this project which include delivery of the four batches of CODAR systems to Rutgers and the University of Connecticut, and primary installation completion of each of the 17 sites. Table 2 lists the scheduled dates of the installations as well as current progress towards every milestone. It should be noted that we expect to maintain site installations for each date in the Milestone Table, however, the exact site installation may vary based on availability/permission of local authorities, communication installations, power installations, etc.

	Milestone Name	Date	Complete
1	Deliver Batch 1: of SEAB, MVCO, HEMP	2/28/2014	Yes
2	Deliver Batch 2: SPRK, PORT, HOOK, LOVE	5/2/2014	
3	Deliver Batch 3: of GCAP, BISL, SILD, MNTK, MISQ, SLTR, STLI	8/8/2014	
4	Deliver Batch 4: of BELM, BRNT, BRMT	9/26/2014	
5	Primary Installation Complete - HEMP	4/4/2014	In progress
6	Primary Installation Complete - MVCO	5/15/2014	
7	Primary Installation Complete - SEAB	6/30/2014	In progress
8	Primary Installation Complete - PORT	8/13/2014	
9	Primary Installation Complete - GCAP	9/23/2014	
10	Primary Installation Complete - SPRK	10/13/2014	
11	Primary Installation Complete - BISL	11/11/2014	
12	Primary Installation Complete - HOOK	11/26/2014	In Progress
13	Primary Installation Complete - MNTK	12/18/2014	
14	Primary Installation Complete - LOVE	1/12/2015	
15	Primary Installation Complete - MISQ	1/27/2015	
16	Primary Installation Complete - SILD	2/26/2015	
17	Primary Installation Complete - STLI	3/10/2015	
18	Primary Installation Complete - SLTR	4/9/2015	
19	Primary Installation Complete - BELM	5/26/2015	
20	Primary Installation Complete - BRNT	7/6/2015	
21	Primary Installation Complete - BRMR	8/14/2015	

Table 2. The 21 Major project milestones include deliveries of the four batches of CODAR systems as well as primary installation of each of the 17 sites.

4. BUDGET AND EXPENDITURES

Table 3 highlights the budget by line item, expenses, commitments (largely CODAR hardware) and the remaining balance of the account. Subcontractors are listed as single line items.

Description	Budget	Expenses	Commitment	Adjustment	Balance
Salaries Regular Employee	$132,600.00	$19,142.71	$0.00	$0.00	$113,457.29
Fringe Benefits Manual Adj	$58,477.00	$0.00	$0.00	$0.00	$58,477.00
Fringe Benefits - FICA	$0.00	$1,159.41	$0.00	$0.00	-$1,159.41
Fringe Benefits - Medicare	$0.00	$271.17	$0.00	$0.00	-$271.17
Fringe Benefits 12000	$0.00	$7,216.80	$0.00	$0.00	-$7,216.80
Project Supplies DCGA	$4,324.00	$3,935.32	$1,450.00	$0.00	-$1,061.32
PERM EQP-DCGA < $5,000	$18,000.00	$1,249.55	$0.00	$0.00	$16,750.45
Telephone Charge	$3,600.00	$0.00	$0.00	$0.00	$3,600.00
Postage	$0.00	$117.90	$0.00	$0.00	-$117.90
Other Services	$185,600.00	$0.00	$0.00	$0.00	$185,600.00
PERM EQP-DCGA > $5,000	$1,145,095.00	$371,099.95	$719,495.00	$0.00	$54,500.05
Travel Domestic DGCA	$20,000.00	$3,192.20	$0.00	$0.00	$16,807.80
Facility & Admin Costs	$99,520.00	$7,257.02	$0.00	$42,047.50	$50,215.48
U Connecticut	$401,713.00	$0.00	$401,713.00	$0.00	$0.00
U Delaware	$48,409.00	$0.00	$48,409.00	$0.00	$0.00
U Rhode Island	$203,170.00	$0.00	$203,170.00	$0.00	$0.00
Rent Equipment DGCA	$10,002.00	$0.00	$0.00	$0.00	$10,002.00
	$2,330,510.00	**$414,642.03**	**$1,374,237.00**	**$42,047.50**	**$499,583.47**

Table 3. Sandy Supplemental budget by line item with subcontractors listed at the bottom of the table.

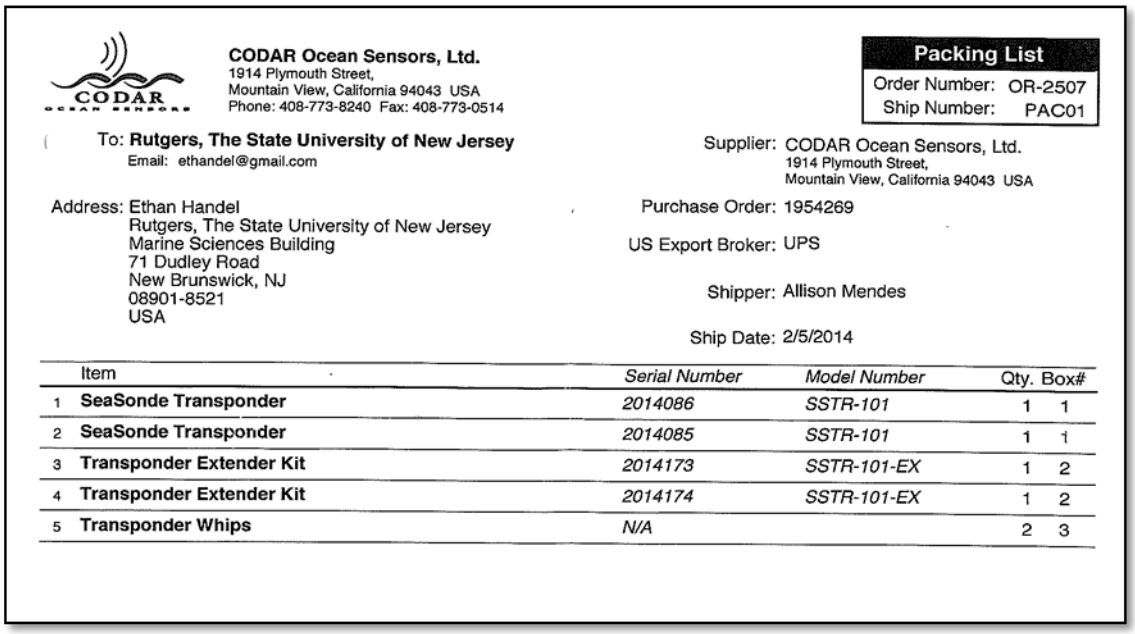
5. Appendix 1:

Rutgers is repairing and hardening 11 of its HF radar stations through this grant. The delivery schedule is given in table 4.

Table 4: Delivery dates for CODAR Ocean Sensors equipment for project.

Batch	Delivery Date	Station Equipment
1	February 14, 2014	SEAB, HOOK, HEMP
2	May 1, 2014	SPRK, PORT, MVCO, LOVE
3	July 11, 2014	SILD, BELM, BRNT, BRMR

Prior to Batch 1, the first radar equipment arrived on February 7, 2014, which included the two transponders used to measure antenna patterns of the receive antennas. The packing list for this equipment is given in figure 3.



CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA
Phone: 408-773-8240 Fax: 408-773-0514

Packing List
Order Number: OR-2507
Ship Number: PAC01

To: **Rutgers, The State University of New Jersey**
Email: ethandel@gmail.com

Address: Ethan Handel
Rutgers, The State University of New Jersey
Marine Sciences Building
71 Dudley Road
New Brunswick, NJ
08901-8521
USA

Supplier: CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA

Purchase Order: 1954269

US Export Broker: UPS

Shipper: Allison Mendes

Ship Date: 2/5/2014

	Item	Serial Number	Model Number	Qty.	Box#
1	**SeaSonde Transponder**	*2014086*	*SSTR-101*	1	1
2	**SeaSonde Transponder**	*2014085*	*SSTR-101*	1	1
3	**Transponder Extender Kit**	*2014173*	*SSTR-101-EX*	1	2
4	**Transponder Extender Kit**	*2014174*	*SSTR-101-EX*	1	2
5	**Transponder Whips**	*N/A*		2	3

Figure 3: Packing list for SeaSonde Transponders delivered to Rutgers on February 7, 2014.

The first major delivery equipment was Batch 1. This included a 13 MHz SeaSonde for Sea Bright, NJ (SEAB, which is now HOMR) and a 5 MHz receive antenna and dual transmitter for Sandy Hook, NJ (HOOK) and Hempstead, NY (HEMP). This equipment was delivered to Rutgers on February 24, 2014. Pictures of the delivered equipment are shown in figures 4 through 6. The packing list for this equipment is given in figures 7a-7c.

Figure 4: Three receive antenna masts and one 5 MHz transmit antenna.

Figure 5: Equipment as part of Batch 1 delivery.

Figure 6: Three 5 MHz transmit antennas.

CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA
Phone: 408-773-8240 Fax: 408-773-0514

Packing List
Order Number: OR-2516
Ship Number: PAC01

To: **Rutgers, The State University of New Jersey**
Email: hroarty@marine.rutgers.edu
Phone: 732-445-2717

Address: Hugh Roarty
Rutgers, The State University of New Jersey
Coastal Ocean Observation Laboratory
71 Dudley Road
New Brunswick, NJ
08901
US

Supplier: CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA

Purchase Order: 1962828

US Export Broker: Panalpina Inc.

Shipper: Allison Mendes

Ship Date: 2/20/2014

	Item	*Serial Number*	*Model Number*	Qty.	Box#
1	**SeaSonde Receiver CE**	*2013403*	*SSRX-100A-SG-1325*	1	1
2	**Dual TX Upgrade Receiver** Modified Under RMA #1836	*9814*	*SSRX-100A-LRD0513*	1	3
3	**SeaSonde Transmitter**	*2013403*	*SSTX-100-1300-110*	1	2
4	**Dual TX Upgrade Transmitter** Modified Under RMA #1836	*2007189*	*SSTX-100-0500-110*	1	3
5	**Dual TX Upgrade Transmitter** 2007189 & 2013404 are tuned together.	*2013404*	*SSTX-100-0500-110*	1	4
6	**Dome Antenna Mast (13MHz)**	*2013199*	*SSRA-SA310-13*	1	19
7	**Dome Antenna (13MHz Dome Only)**	*2013199*	*SSRA-SA101-13TR*	1	14
8	**Extended Lightning Protection Kit - 1 Tx Antenna** For Combined TX/RX Antenna	*2014092*	*LT-E1*	1	5
9	**Extended Lightning Protection Kit for Twin Tx Antenna**	*2014093*	*LT-E2*	1	5
10	**Extended Lightning Protection Kit for Twin Tx Antenna**	*2014094*	*LT-E2*	1	5
11	**AIS Receiver**	*208441*	*NMEA0183/USB*	1	5
12	**AIS Receiver**	*208446*	*NMEA0183/USB*	1	5
13	**AIS Receiver**	*208447*	*NMEA0183/USB*	1	5
14	**Keyboard/Mouse**	*N/A*	*N/A*	1	13
15	**19" Color Computer Monitor**	*Z6MXHCLD501743R*	*SSDA-100M*	1	13
16	**Mac Mini Computer**	*CO7L52RYDWYL*	*SSDA-100*	1	13
17	**Receive Antenna Cable (100m)**	*N/A*	*RXCBL-STD*	1	10
18	**Receive Antenna Cable (100m)**	*N/A*	*RXCBL-STD*	1	11
19	**TR Antenna Cable (75m)**	*N/A*	*TRCBL-Std*	1	12
20	**Dome Antenna (5MHz Dome Only)**	*2013195*	*SSRA-SA101-05*	1	15
21	**J Bolts Set**	*N/A*	*JBolts*	3	24
22	**Dome Antenna Mast (5MHz)**	*2013195*	*SSRA-SA310-05RX*	1	18
23	**Dome Antenna (5MHz Dome Only)**	*2013196*	*SSRA-SA101-05*	1	16
24	**Dome Antenna Mast (5MHz)**	*2013196*	*SSRA-SA310-05RX*	1	17
25	**Long Range Transmit Antenna Assembly**	*121*	*SSTA-201-5*	1	20

Transmitter serial number 200150 and Receiver serial number 200149 under RMA #1838 have not yet arrived at our office.

Page 1 of 2

Figure 7a: Packing list for Batch 1 equipment order.

CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA
Phone: 408-773-8240 Fax: 408-773-0514

Packing List
Order Number: OR-2516
Ship Number: PAC01

26	**Long Range Transmit Antenna Assembly**	*122*	*SSTA-201-5*	1	21
27	**Long Range Transmit Antenna Assembly**	*123*	*SSTA-201-5*	1	22
28	**Long Range Transmit Antenna Assembly**	*124*	*SSTA-201-5*	1	23
29	**AIS Antennas**	*N/A*		3	25
30	**SeaSonde Radial Suite Rel7 (Existing License Upgrade)** NEW Multi-Static Data Processing License, NEW AIS-Enabled AutoAPM software license	*101098442885353,*	*SSDA-RAD7-ON*	1	1
31	**SeaSonde Radial Suite Rel7 (Existing License Upgrade)** NEW Multi-Static Data Processing License, NEW AIS-Enabled AutoAPM software license	*101346080061571,*	*SSDA-RAD7-ON*	1	1
32	**SeaSonde Radial Suite Rel7 (New License for the new 13 MHz unit)** NEW Multi-Static Data Processing License, NEW AIS-Enabled AutoAPM software license	*101138543071215,*	*SSDA-RAD7-ON*	1	1
33	**Transmit Antenna Cable (75m)**	*N/A*	*TXCBL-STD*	1	6
34	**Transmit Antenna Cable (75m)**	*N/A*	*TXCBL-STD*	1	7
35	**Transmit Antenna Cable (75m)**	*N/A*	*TXCBL-STD*	1	8
36	**Transmit Antenna Cable (75m)**	*N/A*	*TXCBL-STD*	1	9
37	**Dual Transmit Tuner Kit**	*N/A*	*N/A*	2	5
38	**Interconnector Cable Kit**	*N/A*	*ICBL*	1	1

Figure 7b: Packing list for Batch 1 equipment order.

CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA
Phone: 408-773-8240 Fax: 408-773-0514

Packing List
Order Number: OR-2516
Ship Number: PAC02

To: **Rutgers, The State University of New Jersey**
Email: hroarty@marine.rutgers.edu
Phone: 732-445-2717

Address: Steve Levenson
Marine Sciences Building
71 Dudley Road
New Brunswick, NJ
08901
US

Supplier: CODAR Ocean Sensors, Ltd.
1914 Plymouth Street,
Mountain View, California 94043 USA

Purchase Order: 1962828

US Export Broker: UPS

Shipper: Allison Mendes

Ship Date: 3/11/2014
Batch 1B

	Item	*Serial Number*	*Model Number*	Qty.	Box#
1	**SeaSonde Transmitter (5MHz)**	*2013405*	*SSTX-100-0500-110*	1	1
2	**SeaSonde Transmitter (5MHz)** RMA#1838	*200150*	*SSTX-100-0500-110*	1	2
3	**SeaSonde Receiver (5MHz)** RMA#1838	*200149*	*SSRX-100A-LRD-0513*	1	2

Figure 1c: Packing list for Batch 1 equipment order.

In the proposal, Rutgers had requested funds for the team to travel to manufacturer of the HF radar equipment and inspect the production. This trip took place on March 3, 2014. Dr. Hugh Roarty and Mr. Ethan Handel from Rutgers met with CODAR to inspect the production of the equipment. Representatives from CODAR provided a tour of the production facility and allowed for an inspection of Batch 2 equipment (Figure 2), which is scheduled for delivery on May 1, 2014.

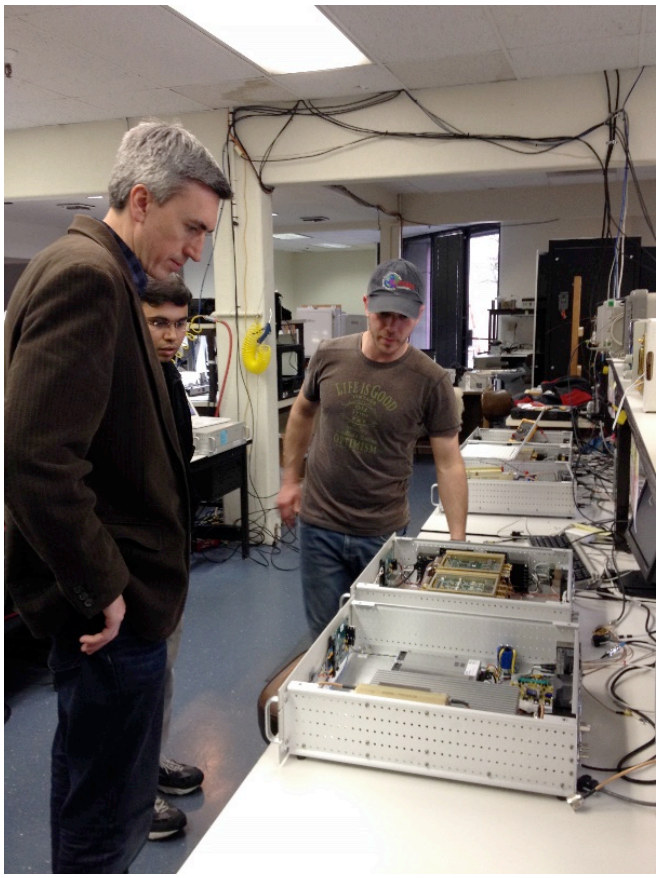


Figure 2: Project Manager Dr. Hugh Roarty, CODAR Engineer Hardik Parikh and Rutgers Radar Technician Mr. Ethan Handel inspect the production of the radar equipment at CODAR Ocean Sensors headquarters in Mountain View, CA.

As part of the equipment purchase on this grant, we requested $10,000 for computer disk storage for the New York Harbor Observing and Prediction System (NYHOPS). A copy of the specifications for the disk storage is given in Figure 9a and 9b. These discs are replacements for the discs damaged by Sandy. This disk storage hardware was purchased in February 2014 and delivered to Stevens Institute of Technology on March 25, 2014 (Figure 10).

QUOTATION

Quote #:	**674406952**
Customer #:	**121087562**
Contract #:	**WN88ABZ**
CustomerAgreement #:	**70256-WSCA/NASPO**
Quote Date:	**01/30/2014**
Date: 1/30/2014 **Customer Name:**	**RUTGERS THE STATE UNIV OF NJ**

Thanks for choosing Dell! Your quote is detailed below; please review the quote for product and informational accuracy. If you find errors or desire certain changes please contact your sales professional as soon as possible.

Sales Professional Information

SALES REP:	FRANK L PLEMONS	**PHONE:**	1800 - 4563355
Email Address:	Frank_Plemons@DELL.com	**Phone Ext:**	5139347

GROUP: 1 QUANTITY: 1 SYSTEM PRICE: $9,911.45 GROUP TOTAL: $9,911.45

Description	Quantity
PV MD1200,RKMNT,SAS, 12 Bay (224-7198)	1
HD Multi-Select (341-4158)	1
2 Encl Mgmt Modules, SAS Only (330-6058)	1
Bezel ASSY,MD1200 (313-8850)	1
6Gb SAS Cable, 2M (330-6060)	1
6Gb SAS Cable, 2M (330-6060)	1
PERC H810 RAID Adapter for External JBOD, 1GB NV Cache, LPF (342-4948)	1
PERC H810 RAID Adapter for External JBOD, 1GB NV Cache, LPF (342-4948)	1
No Rack Rails or Cable Management Arm (330-3479)	1
Power Supply, AC 600W, Redundant (332-0746)	1
Power Cord, NEMA 5-15P to C13, 15 amp, wall plug, 6 feet / 2 meter (310-9965)	1
Power Cord, NEMA 5-15P to C13, 15 amp, wall plug, 6 feet / 2 meter (310-9965)	1
Dell Hardware Limited Warranty Extended Year(s) (954-4566)	1
DECLINED CRITICAL BUSINESS SERVER OR STORAGE SOFTWARE SUPPORT PACKAGE-CALL YOUR DELL SALES REP IF UPGRADE NEEDED (909-1729)	1
Basic: Business Hours (5X10) Next Business Day On Site Hardware Warranty Repair Initial Year (954-4573)	1
Basic support covers SATA Hard Drive for 1 year only regardless of support duration on the system (994-4019)	1
Basic: Business Hours (5X10) Next Business Day On Site Hardware Warranty Repair 4 Year Extended (954-4576)	1
Dell Hardware Limited Warranty Initial Year (954-4565)	1
On-Site Installation Declined (900-9997)	1
Proactive Maintenance Service Declined (926-2979)	1
2TB 7.2K RPM Near-Line SAS 6Gbps 3.5in Hot-plug Hard Drive (342-0002)	12

Figure 3a: Page 1 of specifications for the disk storage purchased for the New York Harbor Observing and Prediction System (NYHOPS).

SOFTWARE & ACCESSORIES **GROUP TOTAL: $88.50**

Product	Quantity	Unit Price	Total
ReadyRails II Static Rails for 4-post Racks, Customer Kit (332-1819)	1	$88.50	$88.50

***Total Purchase Price:**	**$9,999.95**
Product Subtotal:	$9,999.95
Tax:	$0.00
Shipping & Handling:	$0.00
State Environmental Fee:	$0.00
Shipping Method:	LTL 5 DAY OR LESS
	(Amount denoted in $)*

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Figure 9b: Page 2 of specifications for the disk storage purchased for the New York Harbor Observing and Prediction System (NYHOPS).

Figure 10: Photo of the disk storage hardware installed on the campus of Stevens Institute of Technology.