

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

NOAA Award No. NA14NOS4830003 Report 05: 31 December 2014

Prepared for:

NOAA IOOS through NOAA Grants Online https://grantsonline.rdc.noaa.gov

Prepared by:

Rutgers University Institute of Marine and Coastal Sciences 71 Dudley Road New Brunswick, NJ 08901-8525

figh Kowty

Dr. Hugh Roarty MARACOOS HF Radar Coordinator 908-208-2970 hroarty@marine.rutgers.edu

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.

Dr. Hugh Roarty and Mr. Ethan Handel prepared the report.

1. PROGRAM INFORMATION AND HIGHLIGHTS

During the 4th quarter of 2014, the following progress was made:

A. Procurement

The work on the radar work is winding down as all the planned radar purchases have been made and delivered. A one day CODAR retreat took place on September 15th, 2014 to discuss future resiliency and improvement plans for Sandy affected sites. We are in the process of compiling the notes from this workshop and will share the results in the next progress report. Much progress has been made with installing the new equipment and also planning resiliency practices for the future to harden the network.

B. Site Installations

During the fourth quarter of 2014 the following progress was achieved:

- 1. Installation of full 13 MHz system in Bradley Beach, NJ (BRAD)
- 2. Installation of antenna at the Slaughter Beach, DE station (SLTR).
- 3. Installation of repaired receiver at Loveladies, NJ (LOVE).
- 4. Different methods of antenna calibrations. A paper was accepted to the IEEE Current, Waves and Turbulence Measurement Conference entitled "Evaluation of Three Antenna Pattern Measurements for a 25 MHz SeaSonde

Included in the following sections on the next page are photos of the new site installations and upgrades. Each site shows the new hardware (SeaSonde antenna, AIS antenna, or SeaSonde chassis).

1. Bradley Beach, NJ (BRAD)

On December 18th, a new 13.45MHz site, named BRAD, was installed in Bradley Beach, NJ, as a replacement for the former BELM site (Belmar, NJ). The BELM site had been located on the private fishing pier of the Belmar Fishing Club, but it was severely damaged in Hurricane Sandy and repairs have yet to be completed to the pier. So we sought permission from a neighboring town Bradley Beach and were granted permission to locate the equipment at a bathing facility located near the beach.



Figure 1: The waterproof, insulated, and air-conditioned electronics enclosure.



Figure 2: Hardware inside enclosure- including transmitter, receiver, computer, and UPS.



Figure 3: New 13MHz combined transmit/receive antenna at BRAD site.

2. Slaughter Beach, DE (SLTR)

The antenna at Slaughter Beach was damaged during Sandy. Delaware had a spare antenna available that was purchased through MARACOOS funds. This spare antenna was installed shortly after Sandy and the damaged antenna was sent to CODAR Ocean sensors for repair. A new antenna was purchased for the Slaughter Beach site. It was installed at the Cape Henlopen, DE site as the previous antenna developed problems. Rutgers provided assistance to University of Delaware with installation of a new 25MHz combined transmit/receive antenna at the HLPN site in Cape Henlopen State Park, DE. The antenna was installed December 2014.



Figure 4: New antenna installed at Cape Henlopen, DE.



Figure 5: New base constructed for the antenna.

3. Loveladies, NJ (LOVE)

On October 14th, the 5MHz dual-transmit site LOVE had its receiver re-installed after getting a soldering problem in its T/R module repaired by CODAR Ocean Sensors. Phase tuning for proper coupling of the two antennas' transmit signals was conducted, and an AIS receiver was also installed at the site for use in creating AIS-based Antenna Pattern Measurements (APM).

B. Site Inventory

As a way of keeping a record of all of the serial numbers located at each site, Rutgers created a spreadsheet as a method of organization. Every month has an inventory tab to assist in tracking when equipment was swapped and also when a piece of equipment gets sent back to CODAR for repairs.

The next page shows the inventory list of equipment and software keys installed up to the end of December where the fourth quarter ends. The highlighted rows indicate the sites being repaired due to the damage from Sandy. On the bottom of the sheet is a list of spare equipment, along with current RMAs that are in the process of being repaired by CODAR

<u>5 MHz</u> Site	τ.,	Dv	Tv2	Antonno	Padial Kay	Elliptical Kay	MDA Kov	AIS Dottorn Kov	A10 m	AIC Antonno
	2013374	КХ 2013374	1 X 2	Antenna	101172238075300	Elliptical Key	MDA Key	AIS Pattern Key	AISTX	AIS Antenna
NAUS	2010014	2010074			101828618375501					
NANT					101768939147949					
BLCK	2014411			200166	101680672504435					
MRCH	2006183	2006183			101762740130717					
HEMP	200150	200149	2013405	2013195	101098442885353	301674215311207	501487367648297	801306075359955	208441	
НООК	200149	200039 (Dual	2014410	2013196	101646440244383	301142928941359		801179019472087	208447	A1K080360
LOVE	2007189	2007189		2013197	101572363284419	301038582600531		801486247965777	208577	
BRIG	200043	200033		2013164	101691691274383					
WILD	200039	2001059			101588161375581	301362673261907				
<u>13 MHz</u>										
Site	NI/A	NI/A		2012100	101246020061571			901124207071215		
	0814	08013		2013199	101070700860241	301868070035485		801130335372710	208442	
SPRK	2014412	2014412		2013202	101601533384887	301935411654205		801406477540937	208438	A1K080395
BRNT	2011334	2011334		2013201	101244806770423	301435328585447		801427251543715	208446	/
BRMR	2011335	2011335		2014220	101124931753073	301885643597113		801288720706207	208434	
RATH	2011336	2011336		2011102	101080799843501	301705026270391				
WOOD	2011333	2011333		2013156	101607178305171	301218432872073				
FURA	2003101	2003101			101084414102727		501179369711863			
CDDO	2004120	2004120			101423092935405		501983889092239)		
25 MHz										
Sites										
SILD	2003097	2003097		2014219	101192321603267	301105781685951		801362240217929	FTQ9RAIS	
PORI	2014413	2014413		2014218	101179839540429	301589026286115		801731738028269	208433	
CDADES.										
font =	9814	for LOVE	LOVE	2007271	Ethan desk	Ethan desk			208576	
= AG	Upgrade:	13/25		2011100	No Tag	No Tag			208435	
@ CODAR	Multi-frea	CODAR van		2004170	101724448598979	301143439322081				
Not @	CODAR	Going to		MHz)	101916739562707 - ?	301504057130205 - ?				
	Going to			(RMA 1882)	Josh					
				send to	Josh					
				MHZ) - Going	101430339193545					
				MHz (RMA	101758104831715					
					101536086605907					
					101536086605907 101498835290737					
					101536086605907 101498835290737 101138543071215			801197178215987		
					101536086605907 101498835290737 101138543071215 101191365584637	301170776565521	501187042322183	801197178215987		
					101536086605907 101498835290737 101138543071215 101191365584637	301170776565521	501187042322183	801197178215987		
					101536086605907 101498835290737 101138543071215 101191365584637	301170776565521	501187042322183	801197178215987		
0		AD (1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-			101536086605907 101498835290737 101138543071215 101191365584637	301170776565521	501187042322183	801197178215987		Pertention
Operating S	system COD	AR software	UI	PS	101536086605907 101498835290737 101138543071215 101191365584637 UPS Mode	301170776565521 el Ba	501187042322183 ttery Backup	801197178215987 Network Card	Lightning	Protection
Operating S OS X 10.	ystem COD	AR software	UI	PS	101536086605907 101498835290737 101138543071215 101191365584637	301170776565521 el Ba	501187042322183	801197178215987 Network Card	Lightning	J Protection
Operating S OS X 10. OS X 10. OS X 10.	tystem COD 6.8 6.8	AR software R7 R7_U2 R7_U1	U	PS	10135608605907 101498635290737 101138543071215 101191365584637	301170776565521 el Ba	501187042322183	801197178215987 Network Card	Lightning	Protection
Operating S OS X 10. OS X 10. OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4	AR software R7 R7_U2 R7_U1 R7	UI WPS T	PS Trinol ite	101336086605907 101498835290737 101138543071215 101191365584637 UPS Mod	301170776565521 el Ba	501187042322183	801197178215987 Network Card	Lightning) Protection
Operating S OS X 10. OS X 10. OS X 10. OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5	AR software R7 R7_U2 R7_U1 R7 R7 U1	UI WPS, T WPS, T	PS TrippLite	10135605605907 101498835290737 1013854307215 101191365584637 UPS Mode WPS VI, SMART150	301170776565521	501187042322183	801197178215987 Network Card	Lightning	Protection
Operating S OS X 10. OS X 10. OS X 10. OS X 10. OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5 9.5	AR software R7 R7_U2 R7_U1 R7 R7_U1 R7_U1 R7 U2	UF WPS, T WPS, T WPS, T	PS TippLite TippLite TippLite	10135605605907 101498635290737 10113543071215 101191365584637 UPS Mod WPS VI, SMART150 WPS VI, SMART150 WPS VI, SMART150	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXL2Ua	501187042322183	801197178215987 Network Card Y Y	Lightning	Protection
Operating S OS X 10. OS X 10. OS X 10. OS X 10. OS X 10. OS X 10. OS X 10.	ystem COD 6.8 6.2 9.4 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2	UI WPS, T WPS, T WPS, T WPS, T	PS	101336086605907 101438835290737 101138543071215 101191365584637 UPS Mode WPS Vi, SMART150 WPS Vi, SMART150 WPS Vi, SU32000 WPS Vi, SU322000	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua RTXL2Ua RTXL2U3	501187042322183 ttery Backup	801197178215987 Network Card Y Y Y	Lightning 20 ⁻ 20 ⁻	14094
Operating S OS X 10. OS X 10.	bystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite	101336086605907 101498835290737 10113843071215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU15000	301170776565521 el Ba MORMXL2Ua MORMXL2Ua RTXL2Ua TXLCD2U TXLCD2U	501187042322183	801197178215987	Lightning 20 ⁻ 20 ⁻ 20 ⁻	14094 14093
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 10	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite	10135605605907 101498835290737 1013854307215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SMART150 WPS VI, SU2200R WPS VI, SU2200R	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXL2Ua TXLCD2U TXLCD2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:21:C6:B1	Lightning 20- 20- 20- 20- 20- 20-	14094 14093 14101
Operating S OS X 10.	ystem COD 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 10 9.5	AR software R7 R7_U2 R7_U1 R7 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2	WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	rippLite rippLite rippLite rippLite rippLite rippLite rippLite	10153605605907 101498835290737 101138543071215 101131365584637 UPS Mod WPS VI, SMART150 WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXL2Ua TXLCD2U TXLCD2U 500RM2U	501187042322183 ttery Backup	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:6F:81 00:06:67:22:8F:4A	Lightning 200 201 201 201 201	14094 14093 14101 14092
Operating S OS X 10.	iystem COD 6.8 6.8 9.4 9.5 9.5 9.5 9.5 10 9.5	AR software R7_U2 R7_U1 R7_U1 R7_R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite	101336086605907 101498835290737 101138543071215 101191365584637 UPS Mode WPS Vi, SMART150 WPS Vi, SU15000 WPS Vi, SU15000 WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU2200R	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U 500RM2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:23:C6:B1 00:06:67:22:BF:4A	Lightning 20° 20° 20° 20°	14094 14093 14101 14092
Operating S OS X 10.	ystem COD 6.8 6.8 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2	WPS, T WPS, T WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite	10135605605907 101498635290737 101138543071215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SU15007 WPS VI, SU15007 WPS VI, SU15007 WPS VI, SU15007 WPS VI, SU15007 WPS VI, SU2200R WPS VI, SMART15	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua RTXL2Ua RTXL2Ua TXLCD2U TXLCD2U 500RM2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:23:C6:B1 00:06:67:22:BF:4A	Lightning 200 200 200 200	14094 14093 14101 14092
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1	WPS, T WPS, T WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite	10135605605907 101498635290737 1013854307215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SMART150 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SMART11	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXL2Ua TXL2Ua TXLCD2U 500RM2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:0F:4A	Lightning 20° 20° 20° 20°	14094 14093 14101 14092
Operating S OS X 10. OS X 10.	iystem COD 6.8 6.8 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	rippLite rippLite rippLite rippLite rippLite rippLite rippLite	10133605605907 101498835290737 101138543071215 101191365584637 UPS Model WPS VI, SMART150 WPS VI, SU1500F WPS VI, SU1200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R	301170776565521 el Ba NORMXL2Ua TXL2Ua TXL2Ua TXLCD2U SOORM2U TXLCD2U SOORM2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:C6:B1 00:06:67:22:BF:4A	Lightning 200 200 200 200 200	14094 14093 14101 14092
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite	101336086605907 101498835290737 101138543071215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU1200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R	301170776565521 el Ba NORMXL2Ua NORMXL2Ua RTXL2Ua RTXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:6F:4A 00:06:67:22:BF:4A	Lightning 200 200 200 200 200 200	I Protection
Operating S OS X 10. OS X 10.	9.4 9.4 9.4	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2	UI WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite APC TrippLite	10135605605907 101498635290737 101138543071215 101131365584637 UPS Mode WPS VI, SMART150 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SMART1: WPS VI, SMART1: WPS VI, SMART1: WPS VI, SMART1:	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXLCD2U TXLCD2U 500RM2U TXLCD2U TXLCD2U 500RM2U 00RM2U 00RM2U	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:21:A4:1F 00:06:67:22:8F:4A 00:06:67:22:8F:4A	Lightning 20° 20° 20° 20° 20° 20°	14094 14093 14101 14101 14092 14092 14103 14108
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 N7_U2 R7_U2	UI WPS, T WPS, T	rippLite rippLite	10133605605907 101498835290737 101138543071215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SMART1: WPS VI, SMART1:	301170776565521 el Ba 00RMXL2Ua TXL2Ua TXLCD2U TXLCD2U 500RM2U TXLCD2U 500RM2U TXLCD2U 500RM2U JA, BP48V24-2U TVLCD2U	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:21:A4:1F 00:06:67:22:8F:4A 00:06:67:22:8F:4A	Lightning 200 200 200 200 200 200 200 200 200 20	I Protection
Operating S OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 R7_U1 K7_U2 K7_U2 K7_U1 K7_U2 K7_U1 K7_U2 K7_U1 K7_U2 K7_U1 K7_U2 K7_U1 K7_U2 K7_U1 K7_U1 K7_U2 K7_U1 K7_U1 K7_U2 K7_U1	UI WPS, T WPS, T	PS rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite	10133605605907 101498835290737 101138543071215 101191365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU15007 WPS Vi, SU2200R WPS Vi, SU2200R	301170776565521 el Ba ORMXL2Ua ORMXL2Ua TXLCD2U	501187042322183 ttery Backup	801197178215987 Network Card Y Y 00:06:67:21:A4:1F 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	I Protection
Operating S OS X 10. OS	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 10 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2	UI WPS, T WPS, T	PS 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite te w/ backup V 'rippLite 'rippLite	10135605605907 101498635290737 101138543071215 10113165584637 UPS Mode WPS VI, SMART150 WPS VI, SU15007 WPS VI, SU15007 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU3200R WPS VI, SMART11 WPS VI, SU3200R WPS VI, SMART11 VIPS VI, SU3200R WPS VI, SMART11 VIPS VI, SU3200R WPS VI, SU3200R WPS VI, SU3200R	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXLCD2U	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:23:A4:1F 00:06:67:22:2F:4A 00:06:67:24:83:F2 Y 00:06:67:23:C6:B1 Y Y	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	Protection
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1	WPS, T WPS, T WPS, T WPS, T WPS, T WPS, TrippL WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite APC APC TrippLite te w/ backup V TrippLite TrippLite	10135605605907 101498835290737 101138543071215 101131365584637 UPS Mode WPS VI, SMART150 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SMART1 WPS VI, SMART11 WPS VI, SU2200R WPS VI, SMART11 VPS VI, SU2200R WPS VI, SMART11 VPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXLCD2U TXLCD2U 500RM2U TXLCD2U 500RM2U TXLCD2U IRM2UNC 500RM2U JA, BP48V24-2U TXLCD2U RRM2UNC 500RM2U JA, BP48V24-2U TXLCD2U RTXLCD2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:0F:4A 00:06:67:22:0F:4A 00:06:67:22:0F:4A 00:06:67:23:C6:B1 Y Y Y	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	14094 14093 14101 14092 14103 14104 14108 14104 11039 11041 11040
Operating S OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1	WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS rippLite rippLite rippLite rippLite rippLite rippLite rippLite rippLite te w/ backup V rippLite tite w/ backup V rippLite	101336086605907 101498835290737 101138543071215 101191365584637 UPS Mode WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU15000FXL2L WPS VI, SU15000FXL2L	301170776565521 el Ba 00RMXL2Ua TXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:8F:4A 00:06:67:22:8F:4A 00:06:67:22:8F:4A Y 00:06:67:22:3C6:B1 Y Y Y	Lightning 200 200 200 200 200 200 200 200 200 20	14094 14093 14101 14092 14103 141092 14103 14104 14104 11041 11041
Operating S OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite	101358086605907 101498835290737 101138543071215 101191365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU15000 WPS Vi, SU15000 WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU3500RTXL2L WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU1500RTXL2L	301170776565521 el Ba ORMXL2Ua TXL2Ua TXL2Ua TXL2Ua TXLCD2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:87:21:A4:1F 00:06:67:23:C6:B1 00:06:67:23:C6:B1 Y 00:06:67:23:C6:B1 Y Y	Lightning 200 200 200 200 200 200 200 200 200 20	I Protection I4094 I4093 I4101 I4092 I4103 I4108 I4108 I4108 I4108 I4108 I1039 I1041 I1039
Operating S OS X 10. OS X 10.	system COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.6 9.5 9.7 9.5 9.8 9.4 9.4 9.4 9.4 9.4 9.4 9.4	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, TrippL WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite APC TrippLite ite w/ backup V TrippLite TrippLite	10135605605907 101498835290737 101138543071215 10113145584637 UPS Mode WPS VI, SMART150 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SMART1: WPS VI, SMART1: WPS VI, SMART1: WPS VI, SMART1: WPS VI, SU2200R WPS VI, SMART1:	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua 7XL2Ua 7XL2Ua 7XL2Ua 7XLCD2U	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:21:A4:1F 00:06:67:22:8F:4A 00:06:67:22:8F:4A 00:06:67:22:8F:4A Y 00:06:67:23:C6:B1 Y Y Y	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	14094 14093 14101 14092 14092 14092 14103 14104 14104 11039 11041 11040
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, TrippL WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite APC APC TrippLite ite w/ backup V TrippLite TrippLite	10133605605907 101438835290737 101138543071215 101191365584637 UPS Mod WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SMART1: WPS VI, SU2200R WPS VI, SMART1: WPS VI, SU1500RTXL2L WPS VI, SU1500RTXL2L WPS VI, SU1500RTXL2L	301170776565521 el Ba 00RMXL2Ua TXL2Ua TXL2Ua TXLCD2U 500RM2U 500RM2U 500RM2U JA, BP48V24-2U TXLCD2U RM2UNC 500RM2U JA, BP48V24-2U TXLCD2U RTXL2Ua	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:0F:4A 00:06:67:22:0F:4A 00:06:67:22:0F:4A 00:06:67:23:C6:B1 Y Y	Lightning 200 200 200 200 200 200 200 200 200 20	I Protection
Operating S OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite	10133608605907 101498835290737 101138543071215 101191365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU15000 WPS Vi, SU15000 WPS Vi, SU2200R WPS Vi, SU15000TXL2L WPS Vi, SU15000TXL2L	301170776565521 el Ba ORMXL2Ua TXL2Ua TXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U RM2UNC 500RM2U TXLCD2U RM2UNC CTXL2Ua ORMXL2UA ORMXL2UA	501187042322183	801197178215987	Lightning 200 200 200 200 200 200 200 200 200 20	I Protection
Operating S OS X 10. OS	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T	PS 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite 'rippLite	10135605605907 101498635290737 101138543071215 101131365584637 WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU1200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU3200R WPS VI, SU3200R	301170776565521 el Ba 00RMXL2Ua RTXL2Ua RTXL2Ua RTXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U RTXL2Ua TXLCD2U RTXL2Ua RTXL2Ua	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:22:A4:1F 00:06:67:22:BF:4A 00:06:67:24:83:F2 Y 00:06:67:23:C6:B1 Y Y 00:06:67:23:C6:B1 Y Y 00:06:67:24:43:F2	Lightning 200 200 200 200 200 200 200 200 200 20	Protection
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS 'rippLite	10133608605907 101498835290737 101138543071215 101191365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU1500F WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SMART1: WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L	301170776565521 el Ba ORMXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U RRMZUNC 500RM2U JA, BP48V24-2U TXLCD2U RTXL2Ua	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:21:A4:1F 00:06:67:22:3C6:B1 00:06:67:23:C6:B1 Y 00:06:67:23:C6:B1 Y 00:06:67:23:C6:B1 Y 00:06:67:24:R5:72 Y	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	I Protection
Operating S OS X 10. OS X 10.	iystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS TippLite TippLite TippLite TippLite TippLite TippLite TippLite TippLite te w/ backup V TippLite TippLite TippLite	10133605605907 101438635290737 101138543071215 101131365584637 UPS Mode WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU15000TXL2L WPS VI, SU15000TXL2L	301170776565521 el Ba ORMXL2Ua TXL2Ua TXL2Ua TXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U CXLCD2U CX	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A Y 00:06:67:24:B3:F2 Y 00:06:67:24:F5:30	Lightning 200 200 200 200 200 200 200 200 200 20	I4094 I4093 I4101 I4092 I4103 I4104 I4105 I4105
Operating S OS X 10. OS	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T	PS TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite TrippLite	10133608605907 101498835290737 10113843071215 10113145584637 UPS Mod WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU2200R WPS VI, SU3500RTXL2L WPS VI, SU3500RTXL2L WPS VI, SU3500RTXL2L WPS VI, SU3500RTXL2L WPS VI, SU3500RTXL2L WPS VI, SU3500RTXL2L WPS VI, SU3500RTXL2L	301170776565521 el Ba ORMXL2Ua TXL2Ua TXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U RMXLUA ORMXL2UA ORMXL2UA ORMXL2UA	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:23:C6:B1 00:06:67:24:B3:F2 Y 00:06:67:24:B3:F2 Y 00:06:67:24:F3:0	Lightning 200 200 200 200 200 200 200 200 200 20	Protection
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS 'rippLite	10133605605907 101498835290737 1011365584637 1011365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU1500F WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SMART11 WPS Vi, SU1500FTXL22 WPS Vi, SU1500FTXL22 WPS Vi, SU1500FTXL22 WPS Vi, SU1500FTXL21 WPS Vi, SU1500FTXL21 WPS Vi, SU1500FTXL21 WPS Vi, SU1500FTXL21 WPS Vi, SU1500FTXL21 WPS Vi, SU1500FTXL21 WPS Vi, SMART150	301170776565521 el Ba 00RMXL2Ua 00RMXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U RRMZUNC 500RM2U JA, BP48V24-2U TXLCD2U RTXL2Ua 0RMXL2UA 0RMXL2UA	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:21:A4:1F 00:06:67:22:8F:4A 00:06:67:22:8F:4A 00:06:67:22:8F:4A 00:06:67:23:66:B1 Y O0:06:67:23:C6:B1 Y O0:06:67:24:FE:30	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	I Protection
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T	PS 'rippLite	101336086605907 101438835290737 101138543071215 101191365584637 UPS Model WPS VI, SMART150 WPS VI, SU15000 WPS VI, SU15000 WPS VI, SU2200R WPS VI, SU15000F XL2200R WPS VI, SU15000F WPS VI, SU15000F	301170776565521 el Ba ORMXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U CTXLCD2U CTXLC	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A 00:06:67:22:BF:4A Y 00:06:67:23:C6:B1 Y 00:06:67:24:FF:30	Lightning 200 200 200 200 200 200 200 200 200 20	I4094 I4093 I4103 I4104 I4092 I4103 I4104 I1038 I4102 I4103
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T	PS TrippLite Tri	101358086605907 101498835290737 101138543071215 101191365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU15000 WPS Vi, SU15000 WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SU3500RTXL2L WPS Vi, SU3500RTXL2L WPS Vi, SU3500RTXL2L WPS Vi, SU3500RTXL2L WPS Vi, SU3500RTXL2L WPS Vi, SU3500RTXL2L WPS Vi, SU3500RTXL2L	301170776565521 el Ba ORMXL2Ua TXL2Ua TXL2Ua TXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U TXLCD2U CXLCD2U	501187042322183	801197178215987 Network Card Y Y Y 00:06:67:21:A4:1F 00:06:67:22:06:B1 00:06:67:24:83:F2 Y 00:06:67:23:C6:B1 Y Y 00:06:67:24:FF:30	Lightning 200 200 200 200 200 200 200 200 200 20	Protection
Operating S OS X 10. OS X 10.	ystem COD 6.8 6.8 6.2 9.4 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5 9.5	AR software R7 R7_U2 R7_U1 R7_U1 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U2 R7_U1 R7_U2 R7_U2 R7_U1 R7_U2	UI WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T WPS, T	PS 'rippLite	10133608605907 101498835290737 101138543071215 101191365584637 UPS Mod WPS Vi, SMART150 WPS Vi, SU1500F WPS Vi, SU2200R WPS Vi, SU2200R WPS Vi, SMART1: WPS Vi, SU2200R WPS Vi, SMART1: WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L WPS Vi, SU1500FTXL2L	301170776565521 el Ba 00RMXL2Ua TXL2Ua TXL2Ua TXLCD2U TXLCD2U TXLCD2U TXLCD2U S00RM2U JA, BP48V24-2U TXLCD2U RTXL2Ua ORMXL2UA ORMXL2UA	501187042322183	801197178215987 Network Card Y Y Y Y 00:06:67:21:A4:1F 00:06:67:22:3F:4A 00:06:67:22:3F:4A 00:06:67:22:3F:4A 00:06:67:23:3C6:B1 Y O0:06:67:23:C6:B1 Y O0:06:67:24:FF:30	Lightning 20° 20° 20° 20° 20° 20° 20° 20° 20° 20°	Protection

Figure 6: Rutgers HF radar inventory as of January 2015.

C. Antenna Calibrations

Antenna pattern calibrations were performed at seven of the sites to correct for bearing errors at the radial level. Walking, boat, and AIS-generated patterns will be compared in the following sections. Loop 1 is depicted as the red line and loop 2 is shown as the blue line.

1. BRAD

An AIS antenna and receiver were also installed as part of the BRAD site equipment. Initial AIS-based CODAR loop measurements show the system will likely be very useful for future calibration work.



Figure 7: LOOP file from Bradley Beach AIS pattern.



Figure 8: Bradley Beach AIS pattern plotted on a map of New Jersey.

2. LOVE

A walking pattern for Loveladies was performed on October 29, 2014. The results are shown in Figure 9. We attempted to create an AIS pattern for this station but were unsuccessful in creating a valid pattern. We are working with CODAR Ocean Sensors to remedy this deficiency.



Figure 9: LOOP file from Loveladies walking pattern.

3. BRNT

On October 1, 2014 a walking APM was conducted at the BRNT site, in Brant Beach, NJ. This was performed as a training exercise as Carlos Garcia Moreno from University of Puerto Rico and CARICOOS was at Rutgers for HF radar training. The pattern shows only minimal loop distortion, and has been processed and installed on the site's computer.



Figure 10: LOOP file from the Brant Beach walking pattern.



Figure 11: Brant Beach walking pattern placed on a map of New Jersey.

4. SILD

On October 21st, an AIS-based APM was processed from one day's worth of AIS data from vessels in Raritan Bay and around New York Harbor. This pattern also shows only minimal loop distortions, and has been processed and installed on the site's computer.



Figure 12: LOOP plot of AIS pattern from SILD.



Figure 13: Staten Island AIS pattern placed on a map of NY Harbor.

Below is a table that indicates the report that included that particular antenna pattern measurement type. For instance, the walking pattern for HOOK was published in report 3 and the AIS generated pattern was published in report 4 The entire table will be filled out by the end of the project.

Table 1: List of Rutgers Sandy repais stations with antenna pattern type and the report the pattern was published.

		Walk	AIS	Boat
1	MVCO			
2	HEMP	3	3	
3	HOOK	3	4	
4	LOVE	5	5	
5	SILD	4	4,5	4
6	BELM		5	
7	BRNT	4,5		
8	BRMR	4	4	
9	PORT	4		4
10	SEAB	3	4	
11	SPRK		4	

Antenna Pattern	Measurement	Туре

D. Data Quality

Several QA/AC methods are implemented to analyze the quality of the data reaching Rutgers and the National Network. Radial vector count, average radial velocities, radial coverage, and data latency are just a few qualities that are examined to determine how well a site is operating.



Figure 14: Radial coverage map for the Bradley Beach radar from December 22-28, 2014.



Figure 15: Radial coverage map for the Loveladies radar from November 3-9, 2014

HOOK- the 5MHz dual transmit site HOOK, in Sandy Hook, NJ has been suffering from poor data coverage, and new experiments have been planned aimed at improving the quality and consistency of data from this site.

AWG Firmware Update Note-

Codar Ocean Sensors issued a firmware update for the Advanced Waveform Generator (AWG) modules inside SeaSonde Receiver units. This update was successfully completed at all sites, except for SLTR, in Slaughter Beach, DE, and at BRNT, in Brant Beach, NJ. The AWG modules from those two sites were sent back to Codar Ocean Sensors for factory re-programming.

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. Original installation date details are shown in figure 2.





10.1	190397 charlysteed, 111, 28ms	All dept	As sylaxifye	the MADE	and the second s		
10	Pre-manafilipaia Denk -reiner-	A charges	ALCONT.	17m 2/6/14	B. total		
14	digitational testalistic restant	i dest	An aptropa	74-272/04			
10	Proper settings - HEAD	- in white the	HINDARE !!	H15/25/54	da, taño		
14	these entries and to infill the Antipati-	A shape-	mar pitelini	He 8/18/14	is one		
10.	April performant - HERD	- d- House	Anna Million	14-8/9/14	h. fate		
10.	Printing transferring Complete - 18547	-D shaqiy	má aphonia	10-6/6/54	644		
10	that month intelligity . 19587	all planat-	that agring/from	104-10103/04	Emana Origina		
10	WVD Burlaty Washington Mill, 19490	M days	8424/54	Mad KOK/M			
14	the total classic sheet: which	1.000	where nothing	here's a fair and a second	in two		
10	ingenerate sensitive which	i den	where the local set	frame (\$100 frame)	de Cale, China China		
40.7	Proper settings - \$5400	it depty	West with plant	Mind 4/00/14	die take		
40 C	Data deformed to 17030/40146 - MACE	it streets	Yes MUSE	The UR14	da, tune		
44	April performed MACD	A charge	IN STREET	Med 5/14/14	\$.5 m		
-	Amura Insulation Complete MICCO	d states	10-1/11/14	fm/3/00/04	2414		
100	from monal manager, Admitth	All House	The 5/15/54	Wand 8/17/14	Exempt internet		
-	1 Million Americany Inc. Colomb. 108975	\$41 date	ALL/10/104	IVANIA			
-	Under Prices 18.48	3-shine-	the bringing	The s/miles	& CANCERNIC		
-	titule Asset - 304	1 stage.	wheel to Obdivia	310 B/05/84	E concerne		
-	An Intelligial (Sect. 1848)	it-sheets	That \$700yhet	Aur 10/10/04	In take		
-	Support cost 104	7 date	where full before	10+10/5/54	da talutter		
24	Array with a table	it depty	111 8-26/7-10	evial table	die faster		
14	Data deferred to UNIX Addate . 6046	A chinese	Water April 201	44-1-1/10/14	Ra note-		
14	April partnessed - 10100	4 days	Aur 2/14/14	4110/22/14	\$		
14	Resource Interplation Conjugates - MARE	S-dayle	NAMES AND ADDRESS OF	Mon-6/30/34	1 sm		
14	they must makely \$2.48	dil stani-	income that the little	in alarka	Renners Calego		

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

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	Commitments	Adjustments	Balance
Salaries Regular Employee	\$132,600.00	\$70,981.05	\$0.00	\$57,489.13	\$4,129.82
Other Compensation	\$0.00	\$640.00	\$0.00	\$0.00	-\$640.00
Fringe Benefits Manual Adj	\$58,477.00	\$0.00	\$0.00	\$0.00	\$58,477.00
Fringe Benefits - FICA	\$0.00	\$4,206.20	\$0.00	\$3,155.83	-\$7,362.03
Fringe Benefits - Medicare	\$0.00	\$983.74	\$0.00	\$738.03	-\$1,721.77
Fringe Benefits 12000	\$0.00	\$26,759.86	\$0.00	\$27,364.27	-\$54,124.13
Project Supplies DCGA	\$4,324.00	\$14,046.47	\$3,809.55	\$0.00	-\$13,532.02
PERM EQP-DCGA < \$5,000	\$18,000.00	\$5,027.59	\$0.00	\$0.00	\$12,972.41
Mobile Phone Charges	\$0.00	\$249.85	\$0.00	\$0.00	-\$249.85
Telephone Toll Charg	\$3,600.00	\$0.00	\$0.00	\$0.00	\$3,600.00
Business Meeting Exp	\$0.00	\$82.50	\$0.00	\$0.00	-\$82.50
Conference Exp DGCA	\$0.00	\$474.75	\$0.00	\$0.00	-\$474.75
Postage	\$0.00	\$363.17	\$0.00	\$0.00	-\$363.17
Other Services	\$185,600.00	\$392.00	\$0.00	\$0.00	\$185,208.00
PERM EQP-DCGA > \$5,000	\$1,145,095.00	\$1,105,594.95	\$9,650.00	\$0.00	\$29,850.05
Travel Domestic DGCA	\$20,000.00	\$3,692.70	\$0.00	\$0.00	\$16,307.30
Facility & Admin Costs	\$99,520.00	\$35,579.99	\$7,691.91	\$17,749.45	\$38,498.65
Repair & Maint Equipment	\$0.00	\$18,837.61	\$0.00	\$0.00	-\$18,837.61
Repair & Maint Vehicles	\$0.00	\$898.56	\$0.00	\$0.00	-\$898.56
Subcontract <\$25000	\$75,000.00	\$50,000.00	\$25,000.00	\$0.00	\$0.00
Subcontract >\$25000	\$578,292.00	\$324,663.11	\$253,629.89	\$0.00	-\$1.00
Rent Equipment DGCA	\$10,002.00	\$0.00	\$1,200.00	\$0.00	\$8,802.00
F	\$2,330,510.00	\$1,663,474.10	\$300,981.35	\$106,496.71	\$259,557.84

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



Figure 16: Budget spending chart showing the forecasted spending (blue) and actual (red).

6. Appendix 2:

University of Connecticut Progress Report 1. PROGRAM INFORMATION AND HIGHLIGHTS

During the 4th quarter of 2014, the following progress was made:

A. Procurement

None

B. Site Installations

All communication issues at all sites have been resolved. A trip on 10/31/2014 was made to Misguamicut to install a customized GPS antenna base and finish configuring the communication system. The machine shop has finished fabricating a new antenna mount that will be installed on the roof at Stehli beach. Installation of the antenna will be complete once a good weather day is available. All other equipment installation has been done at Stehli. Great Captain was installed on 10/29/2014. Arrangements were made with the Island caretaker to transport the equipment from the dock over the beach to the building site of the current installation. All of the equipment was loaded into a boat and ferried to the south dock on Great Captain Island in Greenwich, CT. The Island caretaker met us at the dock with a front-end loader tractor and a gator 4 wheel drive vehicle. Between the two pieces of equipment we transported the new hardware to the site location and then brought back the equipment being replaced back to the dock. The operation took place during low tide while a roadway is exposed along the beach connecting the area where the dock is located and where the installation site is (see figure 1 for aerial detail). A second trip on 11/5/2014 to GCAP was made to finish up a few details with the installation. MNTK was visited 11/20/2014 to install the upgrades to the site. The transmitter had not been working and was determined the power supply was faulty. A new power supply was purchased and installed in the transmitter. Another trip on 12/3/2014 to MNTK was made to reinstall the repaired transmitter and finish configuring the communications. The current installation of all 5 sites is detailed in the images below

1. Block Island

Figure 17: Pictures from the Block Island 25 MHz radar install, antenna (top left), cabling conduit (top right) and site hardware (bottom left).

2. Misquamicut, RI



Figure 18: Antenna installation at Misquamicut, Rhode Island

3. Montauk, NY



Figure 19: Antenna installation at Montauk, NY.

4. Stehli Beach, NY



Figure 20: Antenna installation at Stehli Beach, NY.

5. Great Captain Island, CT



Figure 21: Antenna installation at Great Captain Island, CT (left) and hardware installation (right).

The proposed timeline to complete repairs and harden the sites is below.

TASK	Timeline	Status
1. Repair		
a. Replace control computers at both sites (Mac Mini computers)	July 2014	Complete
b. Replace air conditioners at both sites	July 2014	Complete
c. Replace antennae and cables at both sites (from CODAR)	Oct –Nov 2014	In Progress
d. Replace transmitter and receiver at GCAP (from CODAR)	Oct –Nov 2014	Complete
e. Calibrate both sites	November 2014	In Progress
2. Hardening		
a. Install waterproof enclosures at GCAP	Oct –Nov 2014	Complete
b. Install lightening protection kit at GCAP (from CODAR)	Oct –Nov 2014	Complete
c. Install GPS timing at both sites at GCAP (from CODAR)	Oct –Nov 2014	Complete
d. Install multi-static processing software at both sites (from CODAR)	Oct –Nov 2014	In Progress
e. Install backup satellite communications for both sites		In Progress
f. Install power outage protection		In Progress
g. Acquire backup antennae and cables for use at GCAP, STLI, BISL, MNTK and MISQ		Complete
h. Acquire backup transmitter for use at GCAP, STLI, BISL, MNTK and MISQ		Complete
i. Acquire backup control computer for use at GCAP, STLI, BISL MNTK, and MISQ		Complete