

Data Acquisition System in Support of the Rhode Island RSM Program



Dave Walsh, Kirk Bosma, MinhChau Vu


March 16, 2011

RSM Overview

Regional Sediment Management is a “systems-based approach” that seeks to solve sediment-related problems by designing solutions that fit within the context of a regional strategy. *(Wamsley, April 2005 National Demo Program)*

- Recognizes sediment as a integral resource
- Integrates management to achieve balanced sustainable solutions
- Makes local project decisions in context of the bigger picture
- Establishes partnerships with stakeholders

Managing sediment to benefit a region potentially saves money, allows use of natural processes to solve engineering problems, and improves the environment. *(USACE RSM Website)*

- Cost Savings
 - Increased knowledge
 - Re-introduction of sediment into littoral systems
 - Improved interagency and stakeholder relationships
 - Shared regional data management systems
- 

RSM Implementation

- Demonstration Program (2000-2005): Mission to improve sediment management practices within the Corps by demonstrating how to implement a system-based approach and how such an approach provides opportunities to achieve greater effectiveness and efficiency.



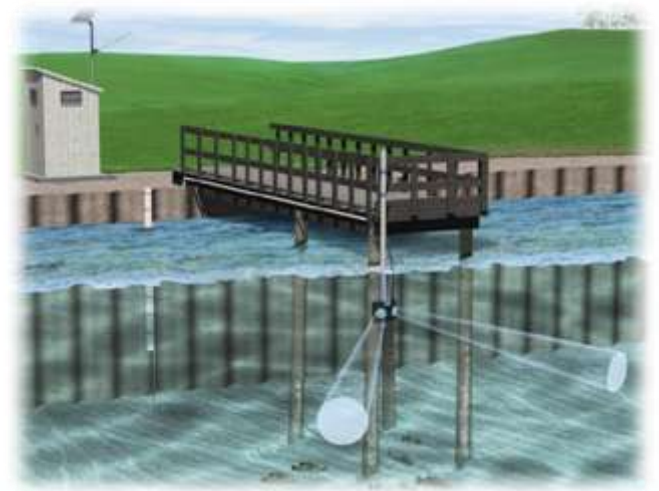
Photo courtesy of Monica Chasten, Phil. District

Rhode Island RSM Implementation

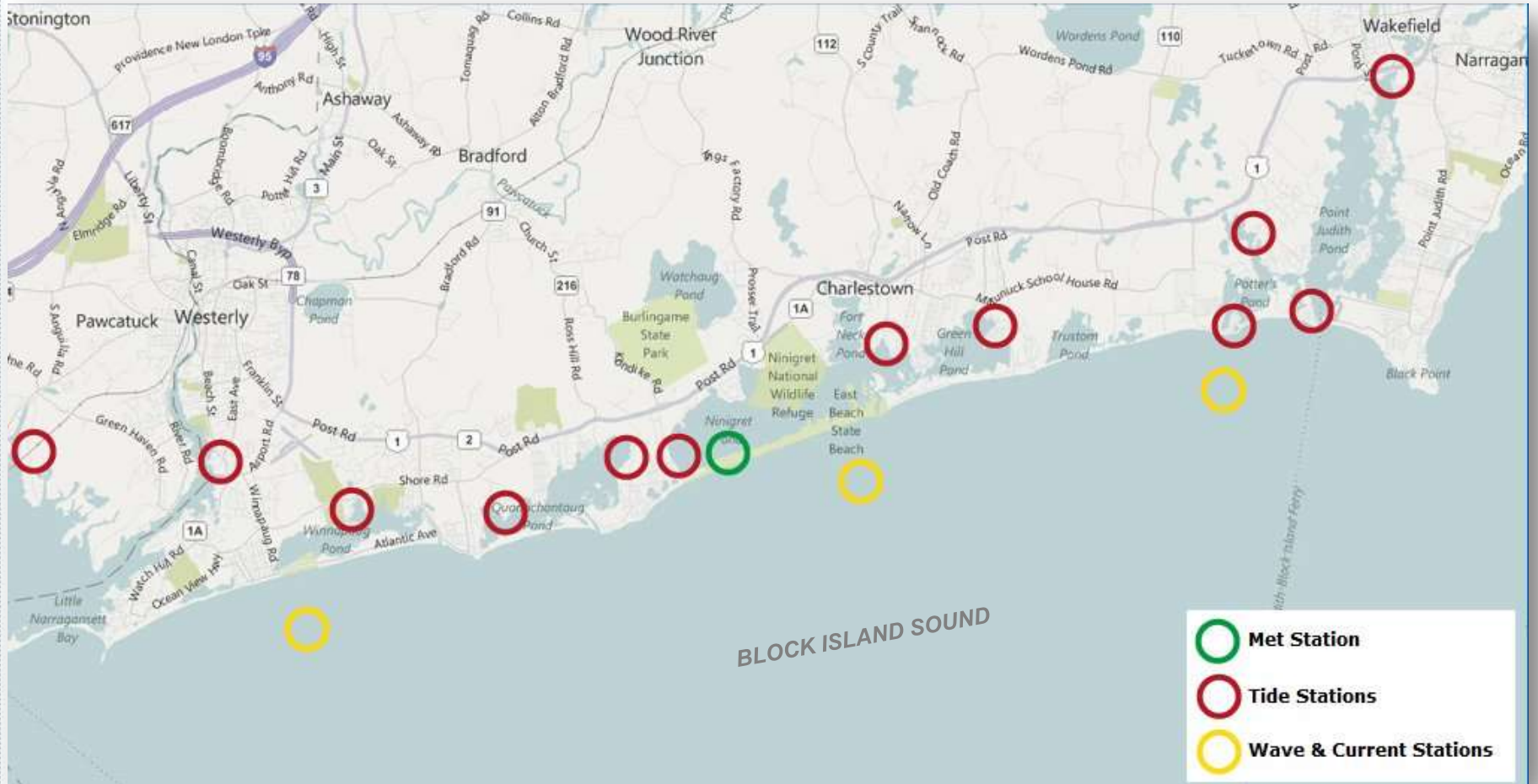
- Focused on collection of data and scientific analysis/modeling to develop improved understanding of sediment movement and budgets for Rhode Island's South Shore
 - Phase I: Data Collection
 - Phase II: Numerical Modeling
 - Phase III: Develop sediment budgets and management plans for the south coast, incorporating sediment, sea level rise, and ecosystem concerns

RI-RSM Phase I: Data Collection

- 1-Year Data Collection Period
- Real-Time Tide and Salinity Stations
- Real-Time MET Station
- Real-Time Wave and Current Stations
- Inlet Currents and Turbidity Observations
- Website presenting real-time Observations ([www .rirms.org](http://www.rirms.org))



RI-RSM Real-Time Data Stations



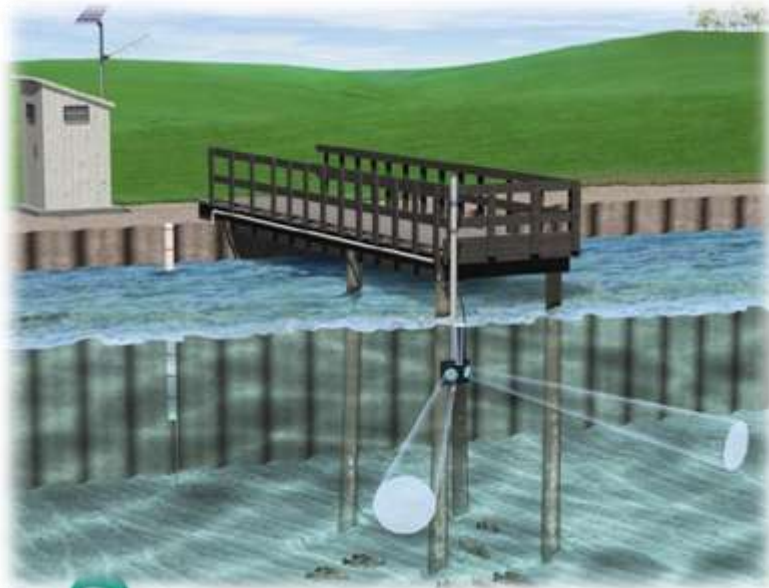
MET Station

- 30 foot tower, located in center of study area (East Beach State Park)
- Two redundant wind sensors
- Air temperature, humidity, and barometric pressure
- Data collected every second with various gust information



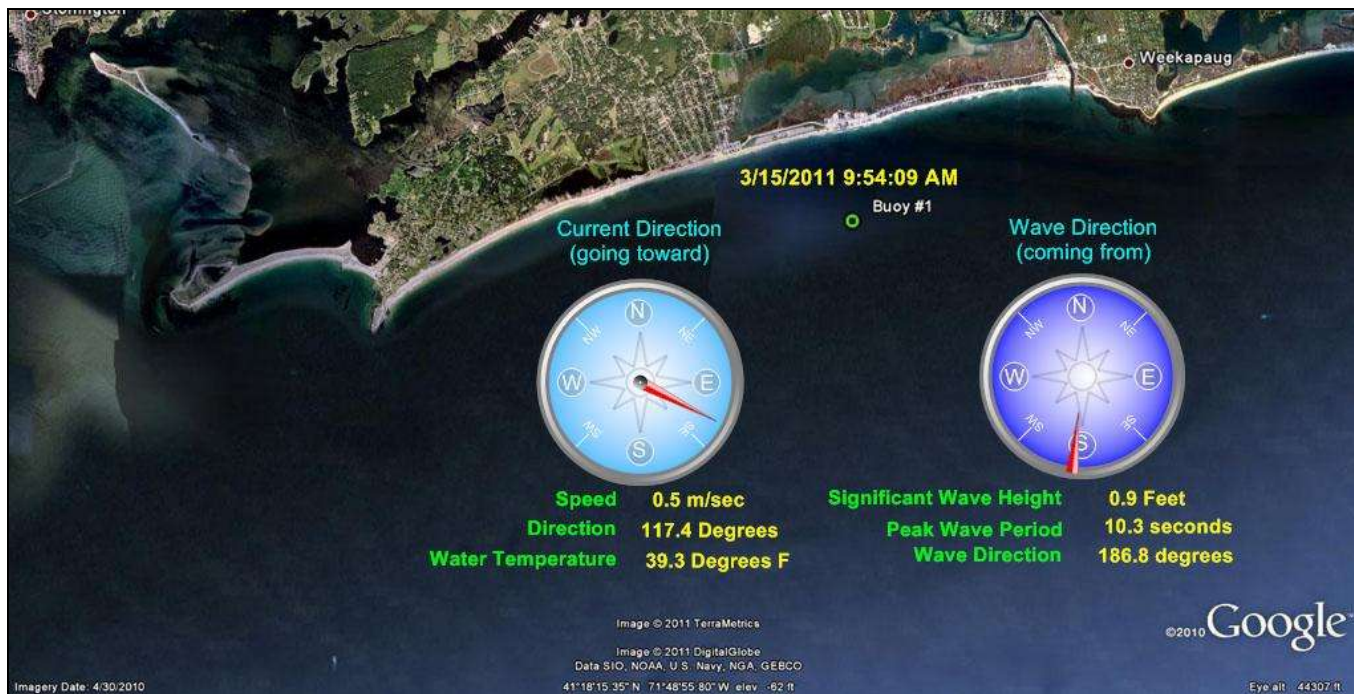
Inlet Currents and Turbidity

- Two observation periods: Summer (1 month) and Winter (2 months)
- Five stations at major inlets:
 - 3 Horizontal ADPs (Weekapaug, Quonochontaug, and Point Judith Ponds);
 - 2 Vertical ADPs, 2-MHz Nortek AQP with 90° head (Ninigret Pond and Green Hill Pond)
- Two vessel-based ADCP surveys at each inlet (winter and summer, neap and spring tides); turbidity measured via OBS during each survey.



Wave and Current Stations

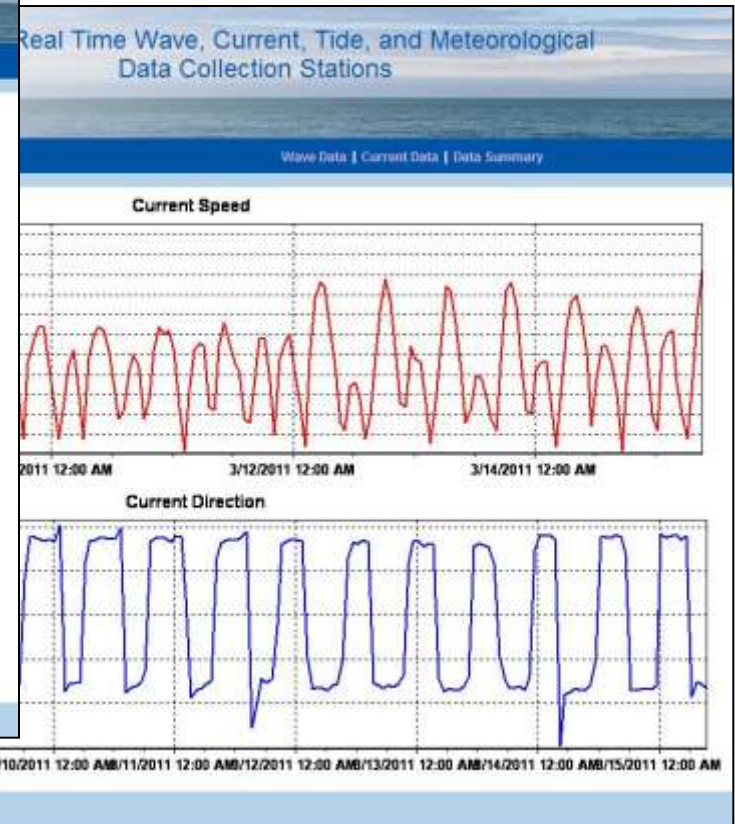
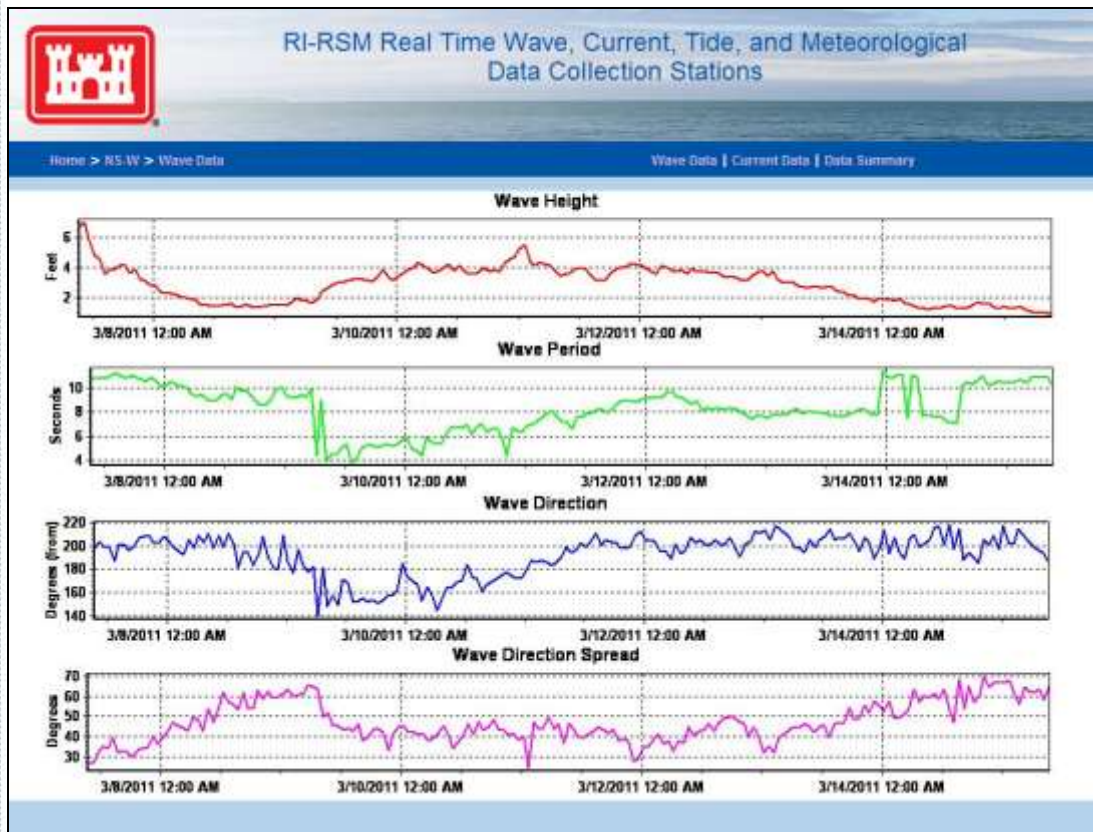
- 3 Stations distributed along the 24 miles coastline, 30 foot water depth
 - MSI trawl-resistant bottom mount (TRBM) equipped with Nortek AWAC, LinkQuest UWM4000 acoustic modem, and Benthos 867A acoustic release with pop-up buoy
 - MSI G-2000 surface buoy equipped with Linkquest UWM4000 acoustic modem, Campbell Scientific CR-1000-ST logger, and a Sierra Wireless IP modem (via Verizon); Powered by 4 x 20watt SunTech solar panels



Wave and Current Stations

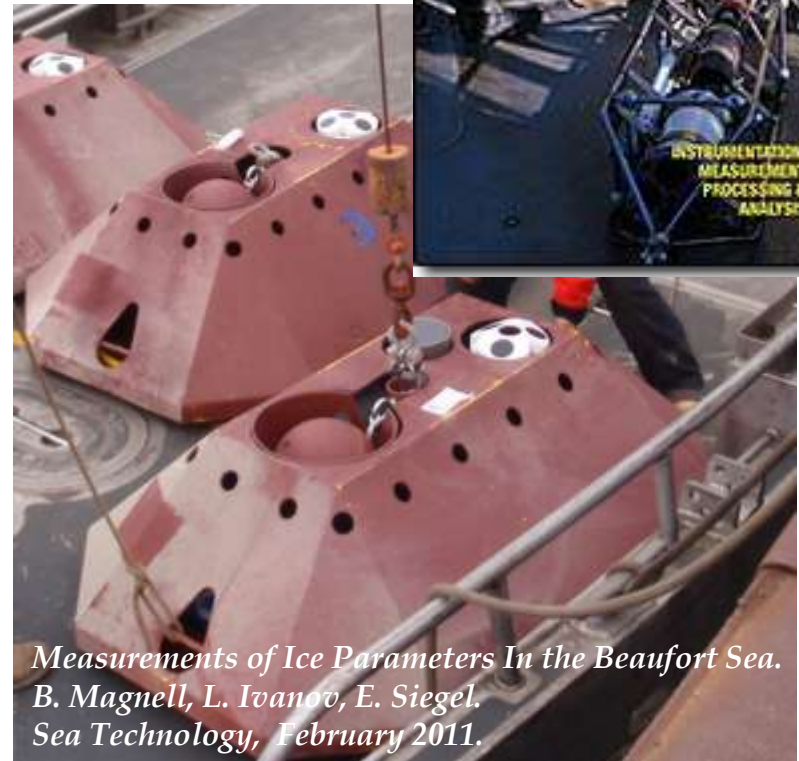
Nortek AWAC-AST observing waves, currents, and water levels

- AWAC equipped with ProLog internal processor
- Data collected every 20 minutes



Previous Experience - Nortek AWAC-AST

- One-year measurement program (2008-2009) on the North Slope, AK to measure waves, currents, and ice.
- 3 TRBM platforms equipped with Nortek 1-MHz AWAC-AST and the “NIP” (Nortek Internal Processor)
 - AWAC-AST with “NIP” was chosen for its ability to process, reduce, and store large volumes of raw data during long-term deployments
 - Successful, quality AST measurements (water/air and ice/water interface) for entire deployment period
 - Data validated with co-located ASL-Environmental Sciences IP-5



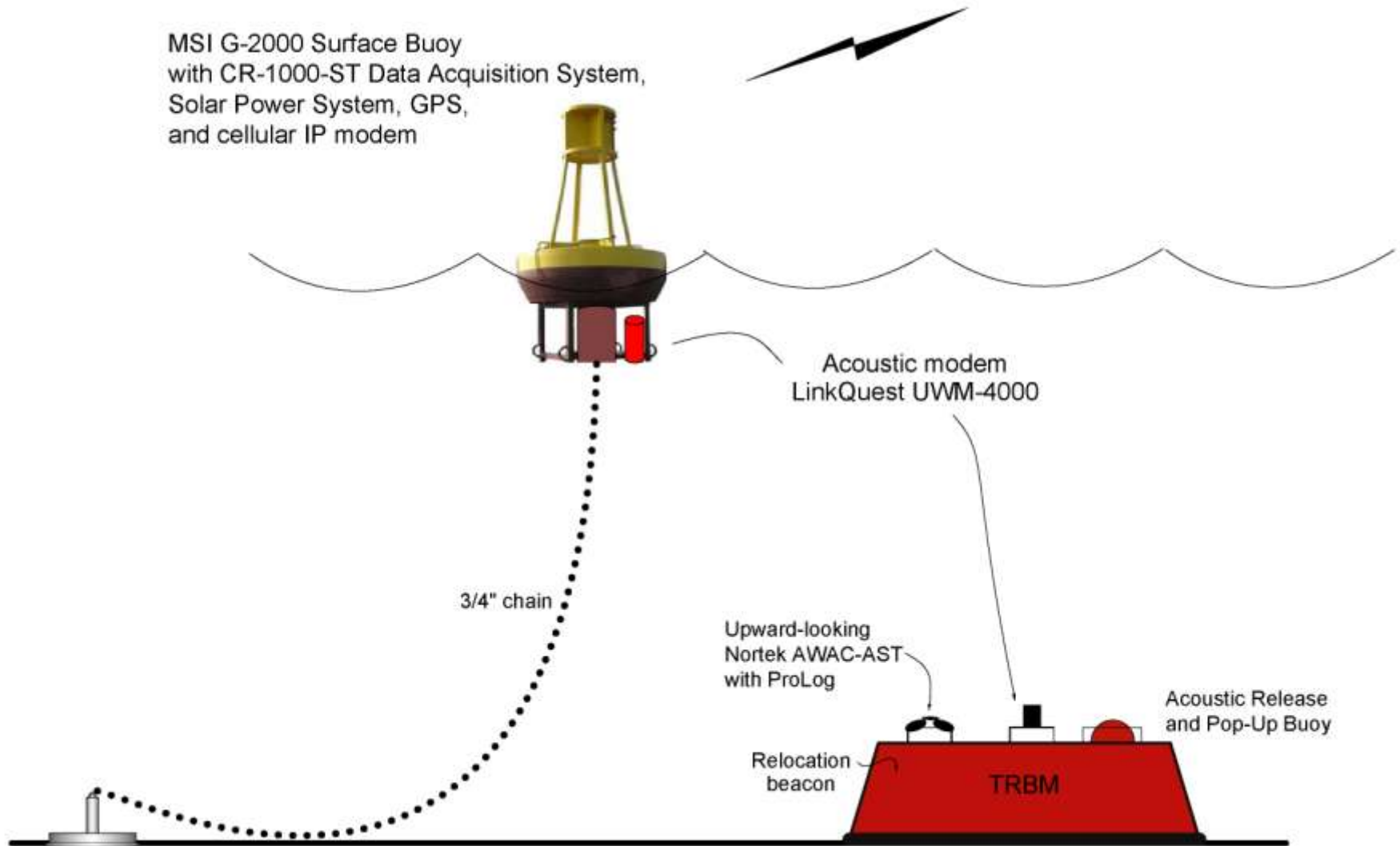
*Measurements of Ice Parameters In the Beaufort Sea.
B. Magnell, L. Ivanov, E. Siegel.
Sea Technology, February 2011.*

Nortek Development: “NIP” to “ProLog”

- The Nortek Processor and Logger (ProLog) replaced “NIP” in 2009, improving design and interface.
 - ProLog is a micro computer with a 4GB SD-HC recorder within the AWAC; this represents an increase in memory from $\leq 352\text{MB}$ in a standard AWAC
 - Both raw and processed data files are stored
 - Easily configured with the standard AWAC software
 - Similar to NIP, the ProLog’s primary function is to reduce raw wave data to standard wave estimates (e.g. H_s , T_p , θ)
 - Beneficial for use of low bandwidth/payload communications such as acoustic modems. NMEA output string

Wave and Current Stations - RI-RSM Configuration

MSI G-2000 Surface Buoy
with CR-1000-ST Data Acquisition System,
Solar Power System, GPS,
and cellular IP modem



Wave and Current Stations

Pop-up
Buoy

Release

Acoustic
Modem

AWAC-AST



TRBM Platforms



Wave and Current Stations



Deployment: July 2010,
R/V Connecticut, UCONN

Service visits performed
using *R/V Shanna Rose*, URI

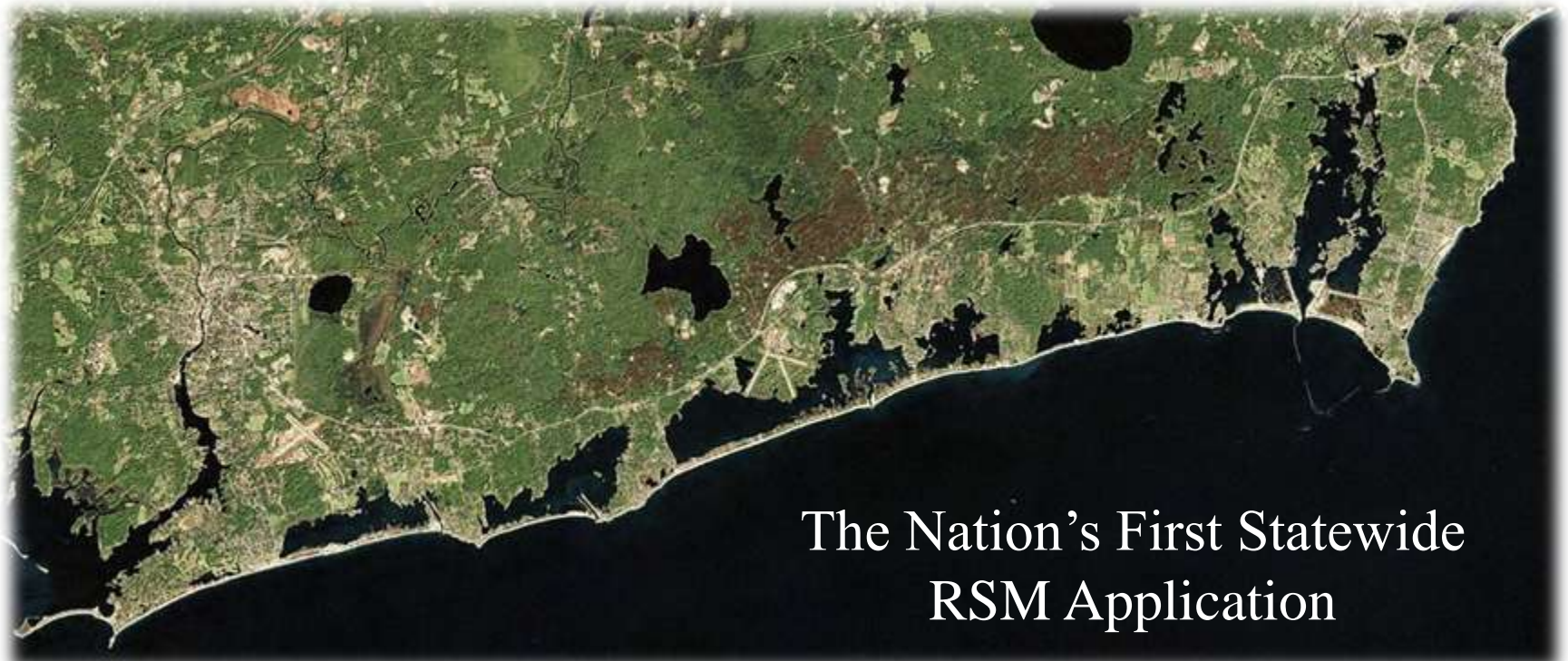


System Performance

- Nortek AWAC-AST have successfully collected and recorded data over the entire deployment to date, without flaws.
 - Due to scope of work, in-depth QA/QC of data will not start until data collection is complete
- One LinkQuest acoustic modem system (central station) has been transmitting partial data strings due to ground issue in the bottom unit, however data are being stored in the AWAC (verified); two other stations (east and west) are performing as expected
 - Issue has prevented data from the central station from being updated on the rirsm.org website
 - Expect this problem to be resolved on next service visit (March)

RI-RSM: Upcoming Schedule

- Phase I - Data Collection: expected to continue until August 2011, when all systems are scheduled for recovery.
- Phase II - Numerical Modeling: preliminary work underway at USACE-NAE



The Nation's First Statewide
RSM Application