River & Estuary Observation Network
Rio Grande Valley

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• Mission: “Make knowledge-based policy and decision making possible with regards to water resource management.”
• Focus on addressing monitoring needs of under-served areas to ensure technology and monitoring solutions are available to all
• Support and facilitate collaborative efforts between stakeholders such as municipalities, academic institutions, not-for-profits, conservancy & environmental groups as well as state and federal regulatory agencies
Tools for Knowledge-Based Decision Making

- Working to make the tools needed for monitoring and knowledge-based decision making attainable by the smallest entity
  - Lower the cost of the equipment using in-house designs
  - Extend the duty cycle of instruments to make O & M costs more manageable
  - Make them modular and customizable to enable user-friendly sensor integrations and rapid deployment
River and Estuary Observatory Network (REON)
Paradigm shift in Monitoring

Lavaca Bay
Total Suspended Solids
July 1996 to March 1998

Blue line represents the mean. Red line represents 1 standard deviation.
NSF Waters: Corpus Christi Bay Test Bed
Mobile Platform

- Multiple real-time instruments
- Undulating tow-body
- Shallow-water operation
Rivers and Estuaries Observatory Network (REON)
Compliance/Enforcement, Resource Management of contaminated sediments removal at the Superfund site
HF Radar

• Remotely measures ocean surface currents using High Frequency (HF) radio spanning 3-30 MHz

• Radio signal is propagated over electrically conductive ocean surface beyond line of light.

• Technology relies on Bragg scattering
  • Return radar signal scatters off water waves with wavelength = ½ HF radio wavelength
  • In absence of ocean currents, there is no Doppler frequency shift.
  • Actual wave speed is shifted plus or minus the surface currents, resulting in Doppler frequency shift. Allows determination of surface currents.
HF Radar Applications

• Oil Spill Response
• Navigation/Port Management
• Database for Bay Modeling
  • Hydrodynamic modeling
    • Dredge analysis
    • Storm events
  • Ecological modeling (salinity)
Atlantic and Gulf of Mexico HF Radar Coverage

- Codar current data is provided to NOAA
- Applications include: Modeling, Spill Response, Search and Rescue, Navigation Safety
- Northern and Western GoM is lacking coverage
HF Radar unit in action
RATES HF Radar Experience

- Previously operated 8 stations along the Texas Coast.
  - 2000-2009
  - ~250 miles of coast line coverage
  - ~20,000 square miles
- 8 remote stations between Corpus Christi and Bolivar Peninsula
  - Corpus Christi Bay (25 MHz)
  - GoM 12 and 5 MHz

Total velocity vectors generated during mobile radar deployment used in U.S. Coast Guard Spill Exercises

Mobile Radar Unit on Galveston Seawall
RGV-Observatory Opportunities
Reduce Capital Cost

- Sensor technology.
- Enabling technology borne through low-cost microprocessors (Teensy)
- Incorporated into sensor designs.
  - Stage height
  - Precipitation
  - Water quality
  - Integrated network
  - Standardized/modular designs
  - Integrated systems

Developed water quality sonde can be built for approximately $2,000. Comparable commercially available sonde ~$20-25K with sufficient performance to characterize parameter variability and range.
Reduce Unit Data Costs
• Application of surrogate measurements

• Minimize service requirements through maximizing service intervals.

• Maximize parameter counts of developed sensors and sensor nodes (pH, DO, salinity, turbidity, chlorophyll, CDOM, atmospheric conditions, water level, water temp, etc.)
Stage Height/Water Temp

- Low Power
- Easily deployed and maintained
- Small size makes them easily adaptable
- Durable
- Low Cost (~$200.00)
- Real-Time
- Large Range/High Accuracy
Stage Height/Water Temp

Islam et al. (2016) Environmental Engineering Science, 33, DOI: 10.1089/ees.2016.0106
Water Quality Sonde

- Measured parameters
  - pH
  - Dissolved Oxygen
  - Conductivity/Salinity
  - Chlorophyll
  - Turbidity
- Low cost
- Good Field performance, comparable to YSI Multi-Parameter sonde
- Ambient light reduction
- Tested to 100 psi submersible depth
Precipitation Gauge

- Low power
- Extended duty life
- All season performance
- Results comparable to NOAA observations
RTHS
Real-Time Hydrologic Station
Real-Time Hydrologic Station (RTHS)

- COTS Meteorological Pole
  - Wind Speed/Direction
  - Relative Humidity
  - Air Temperature
  - Barometric Pressure
- Can be solar powered or grid tied
- Master control box
  - Raspberry Pi Microcomputer
  - Sensor Circuit Boards
  - Solar Controller
  - Cell Stick
Real-Time Hydrologic Station (RTHS)

- In-House designed sensors operate “plug and play” with RTHS
- Modular customization allows for use of COTS sensors
- Stage height, precipitation and sonde all tie back to base station with buried conduit and cable
Real-Time Hydrologic Station (RTHS)

- Customizable sensor mounts all for installation in many different environments or conditions
Instruments

- Ecomapper AUV
- Acoustic Doppler Current Profiler
- Acrobat Undulating Towbody
- StreamPro Shallow Water ADCP
- YSI Handheld Multi-Parameter Sondes
- YSI EXO Series Sondes
- Robotic Platforms
- Oxygen Optodes
- Fluorometers
- Conductivity/Temp/Depth
- pH/Redox
- Flow Probes
- Optical Backscatter Sensors
River & Estuary Observatory Network (REON)

- Series of ~60 land-based sensor nodes coupled with deployable floating profiling platforms
  - Address “paradigm shift” in terms of monitoring needs
  - Make sensor systems more cost effective
  - Develop and implement an effective cyber infrastructure
  - Field test to validate and improve
The Growing REON Network

National (59...And Counting)

New York (56+10)

South Texas (3+?)

Alabama

- Proposed commissioning of 15-RTHS at strategic locations
  - Promote inter-jurisdictional engagement and collaborative decision making
  - 3-demonstration deployments were commissioned Fall 2019 to support LLMEP-Phase 1
  - Stream gauging for discharge rating curves by SWTF
Regional Deployment Plan

Top Down
Local Deployment Plan
Bottom Up