

## *SERDP and ESTCP Webinar Series*

*Thank you for signing in early*

The webinar will begin promptly at  
12:00 pm ET, 9:00 am PT



# SERDP and ESTCP Webinar Series

***The webinar will begin promptly at 12:00 pm ET,  
9:00 am PT***

- You have two options for accessing the webinar
  1. Listen to the broadcast audio if your computer is equipped with speakers
  2. Call into the conference line: 303-248-0285  
Required conference ID: 6102000
- For any question or issues, please email [serdp-estcp@noblis.org](mailto:serdp-estcp@noblis.org) or call 571-372-6565

# “Remote Methods for Water Conservation”

July 14, 2016



# *SERDP and ESTCP Webinar Series*

## Welcome and Introductions

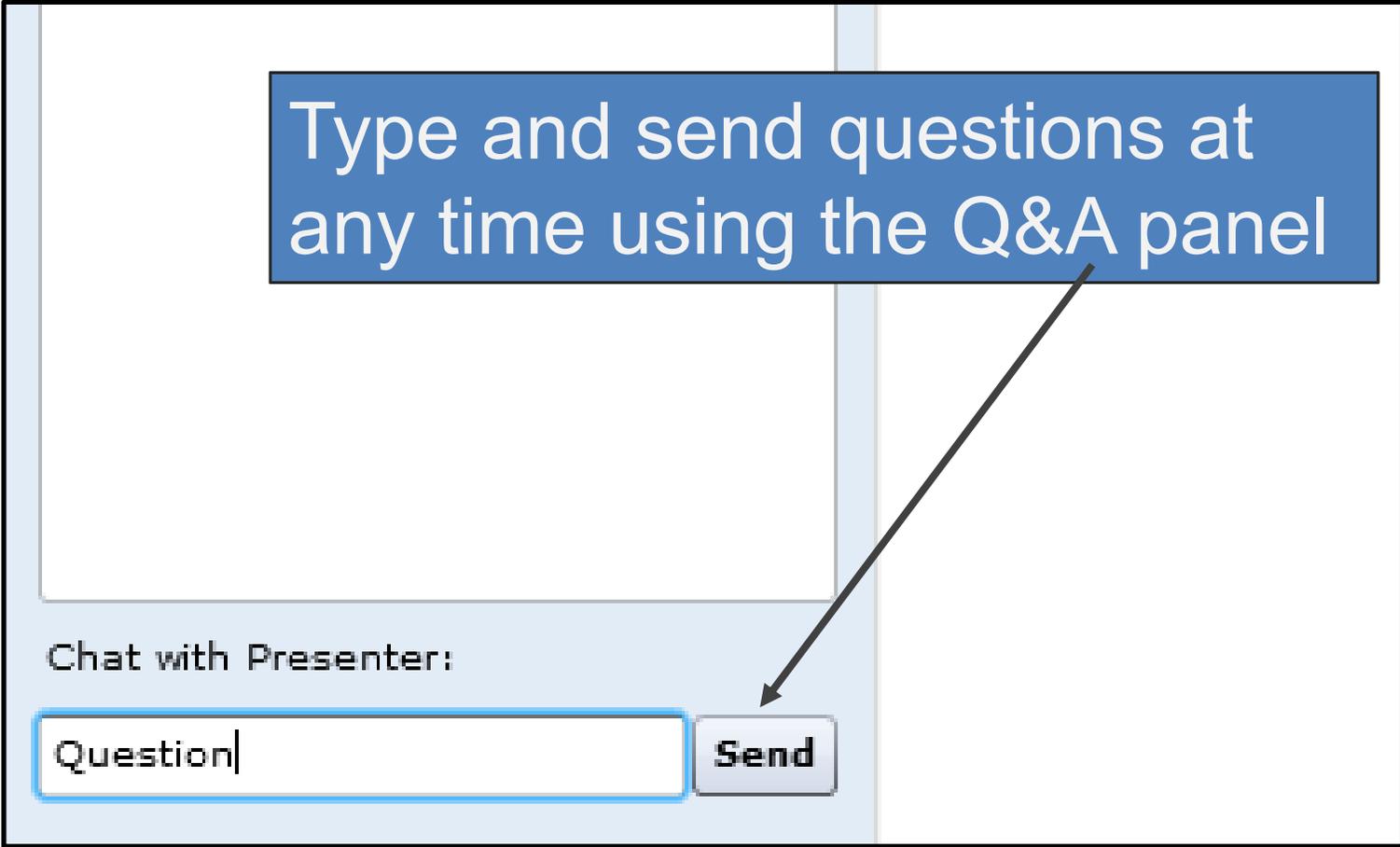
Rula A. Deeb, Ph.D.  
Webinar Program Coordinator



# Agenda

- **Webinar Logistics**  
**Rula Deeb**, Geosyntec Consultants (5 minutes)
- **Overview of SERDP and ESTCP**  
**Timothy Tetreault**, SERDP and ESTCP (5 minutes)
- **Overview of Water Policy, Regulations and Current Challenges Facing Military Installations in Regions with Scarce Water Resources**  
**Kathryn Ostapuk**, Navy Region Southwest (25 minutes + Q&A)
- **Innovative Acoustic Sensor Technologies for Leak Detection in Challenging Pipe Types**  
**Mr. Gary Anguiano**, NAVFAC EXWC (25 minutes + Q&A)
- **Final Q&A session**

# How to Ask Questions



Type and send questions at any time using the Q&A panel

Chat with Presenter:

Question|

The image shows a screenshot of a Q&A panel interface. A large blue callout box with white text is positioned at the top, stating 'Type and send questions at any time using the Q&A panel'. Below this, the interface includes a text input field containing the placeholder text 'Question|' and a 'Send' button. A black arrow points from the bottom of the callout box to the 'Send' button.

# In Case of Technical Difficulties

- Delays in the broadcast audio
  - Click the mute/connect button
  - Wait 3-5 seconds
  - Click the mute/connect button again
  - If delays continue, call into the conference line
    - Call into the conference line: 303-248-0285
    - Required conference ID: 6102000
- Submit a question using the chat box

# SERDP and ESTCP Overview

Timothy Tetreault  
Energy and Water Program  
Manager



# SERDP

## ***Strategic Environmental Research and Development Program***

- Established by Congress in FY 1991
  - DoD, DOE and EPA partnership
- SERDP is a requirements driven program which identifies high-priority environmental science and technology investment opportunities that address DoD requirements
  - Advanced technology development to address near term needs
  - Fundamental research to impact real world environmental management

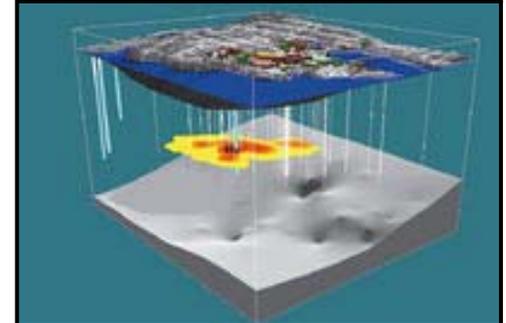
# ESTCP

## ***Environmental Security Technology Certification Program***

- Demonstrate innovative cost-effective environmental and energy technologies
  - Capitalize on past investments
  - Transition technology out of the lab
- Promote implementation
  - Facilitate regulatory acceptance

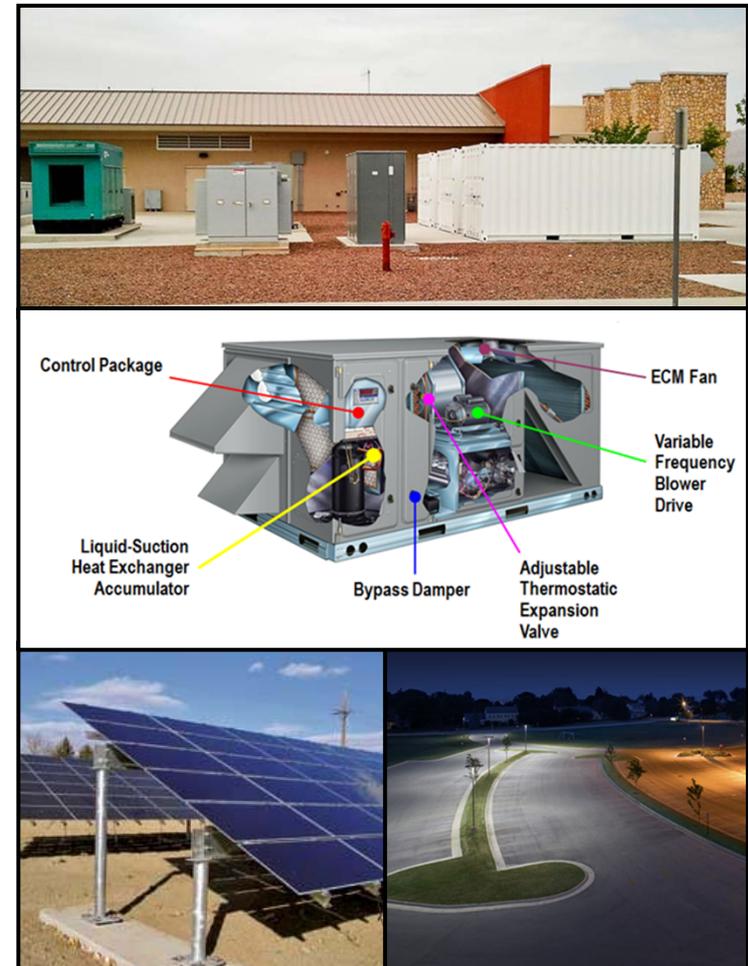
# Program Areas

1. Energy and water
2. Environmental restoration
3. Munitions response
4. Resource conservation and climate change
5. Weapons systems and platforms



# Energy and Water

- Smart and secure installation energy management
  - Microgrids
  - Energy storage
  - Ancillary service markets
- Efficient integrated buildings and components
  - Design, retrofit, operate
  - Enterprise optimized investment
  - Advanced components
  - Intelligent building management
  - Non-invasive energy audits
- Distributed generation
  - Cost effective
  - On-site
  - Emphasis on renewables



# SERDP and ESTCP Webinar Series

Date	Topic
July 14, 2016	Remote Methods for Water Conservation
July 28, 2016	Geophysics 101: Realistic Expectations for Geophysics When Used for Site Characterization and Remediation Monitoring – Part 2
August 11, 2016	An Environmentally Acceptable Alternative for Fast Cook-off Testing, Demonstration, Validation and Implementation Efforts
September 8, 2016	Assessment of Redox-Based Groundwater Remediation Technologies
October 6, 2016	Cyber Security Requirements and Impacts on Installation Energy Systems

# *SERDP and ESTCP Webinar Series*

<http://serdp-estcp.org/Tools-and-Training/Webinar-Series>



## *SERDP and ESTCP Webinar Series*

# “Overview of Water Policy, Regulations and Current Challenges Facing Military Installations in Regions with Scarce Water Resources”

Kathryn Ostapuk, J.D.  
Navy Region Southwest



# Agenda

- Challenges facing military installations
- National perspective
- Legislative initiatives (California)
- Regulatory compliance (California)
- Military initiatives and solutions

# Military Challenges

- Few military bases produce their own water
- Acquiring sustainable sources of water
- Frequently changing water demand depending on mission
- Aging infrastructure
- Water reliant landscaping
- Financial constraints

# Executive Order 13693

- Planning for federal sustainability in the next decade
  - Improve agency water use efficiency and management
    - Reduction by 36 percent by fiscal year 2025
    - Installing water meters and collecting data
    - Reducing agency industrial, landscaping, and agricultural (ILA) water consumption
    - New construction standards for net-zero starting in 2020

# California Sustainable Groundwater Management Act (SGMA)



## SGMA (Cont'd)

- Department of Defense (DoD) Regional Environmental Coordination Office
  - “Federally reserved water rights to groundwater shall be respected in full”
  - Beneficial uses includes “the federal government, including, but not limited to, the military”
  - Adjudication

## SGMA (Cont'd)

- Requires formation of Sustainable Groundwater Agencies (GSAs)
- GSAs must create a sustainable groundwater management plan
- GSA members are local stakeholders
- Department of Defense participation
  - Joint Powers Agreement
  - Military as ex officio

# Regulatory Framework

- Recycled water for non potable uses
- Fines for excessive water use
- Wastewater for groundwater augmentation

# Future of Water Regulation

- Stormwater capture and recycling
- Wastewater treatment and recycling
- Desalinization

# Military Installation Initiatives

- Navy Region Southwest Water Strategy
  - 25% cut in water by 2020 based on 2013 consumption
    - Culture of conservation
    - Water conservation projects
    - Compliance improvement
    - Irrigation and landscaping
    - Water data acquisition

# Military Installation Initiatives (Cont'd)



One Drop Wasted  
is too much!



# Conclusions

- Water conservation and sustainability is a DoD priority
- DoD must work with their local municipalities for long term solution
- Financial investment is critical
- DoD must lead on innovation

# *SERDP and ESTCP Webinar Series*

## **Speaker Contact Information**

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# *SERDP and ESTCP Webinar Series*

## Q&A Session 1



## *SERDP and ESTCP Webinar Series*

# Innovative Acoustic Sensor Technologies for Leak Detection in Challenging Pipe Types

Gary Anguiano, P.E.  
NAVFAC EXWC



# Agenda

- Leak detection drivers
- Study basis and objectives
- Technology background
- Performance objectives and approach
- Test bed and field results
- Conclusions

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# Importance of Leak Detection for DoD Water Conservation

- Aging water infrastructure challenge for DoD and nation
  - \$248 billion over 20 years needed to repair and replace drinking water distribution systems (EPA, 2013)
  - Average leak rates @ 0.27 per mile per year
- Growing need for water conservation efforts
  - Historic stressors such as drought in California
  - Executive Order (EO) 13693 goal to achieve 36% potable water consumption intensity reduction by 2025
- DoD response: Accurate leak detection technologies
  - Efficient detection allows for timely repairs



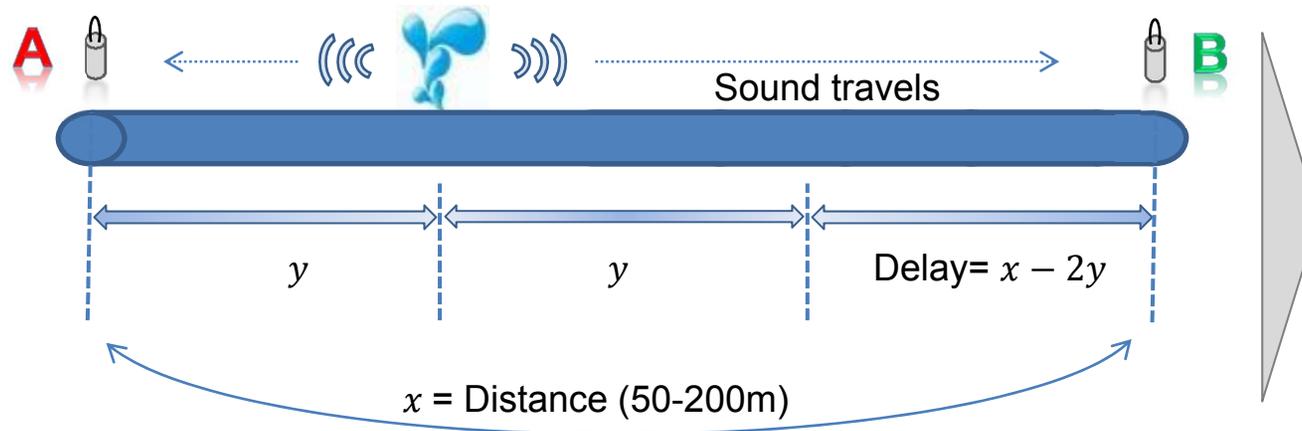
# Study Basis and Objectives

- Problem
  - DoD needs a sustainable approach to water security
  - Common practice: React to surface leaks or high water use
- State-of-the-art acoustic technologies with cross-correlation
  - Continuous Remote Monitoring Network (ZoneScan Alpha)
  - Intermittent Inspection (LeakFinderRT and Correlux)
- Objectives
  - Detect and locate simulated leaks in challenging pipe type (test bed)
  - Detect and locate leaks on an operational water distribution system (field)

# Technology Background

## *How does acoustic cross correlation work?*

- Technology locates leak when signal is detected by two sensors
- Leak sound will arrive at each sensor at a slightly different time
- Location estimate depends on velocity of sound in pipe material
- Accurate information on pipe diameter and material important



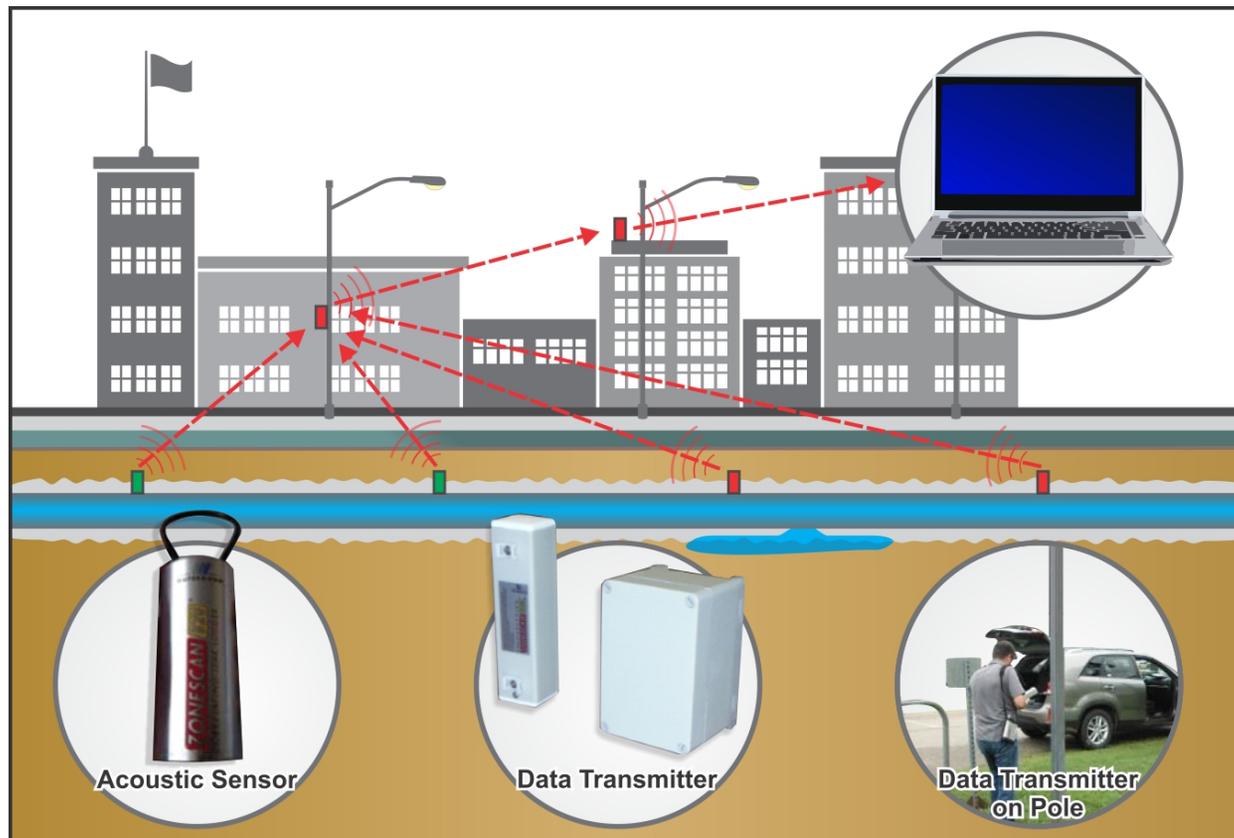
Courtesy of NAVFAC EXWC

## Cross correlation

- Mathematical algorithm
- Compares the two sound recordings
- Difference in travel times used to compute distance

# Continuous Monitoring System

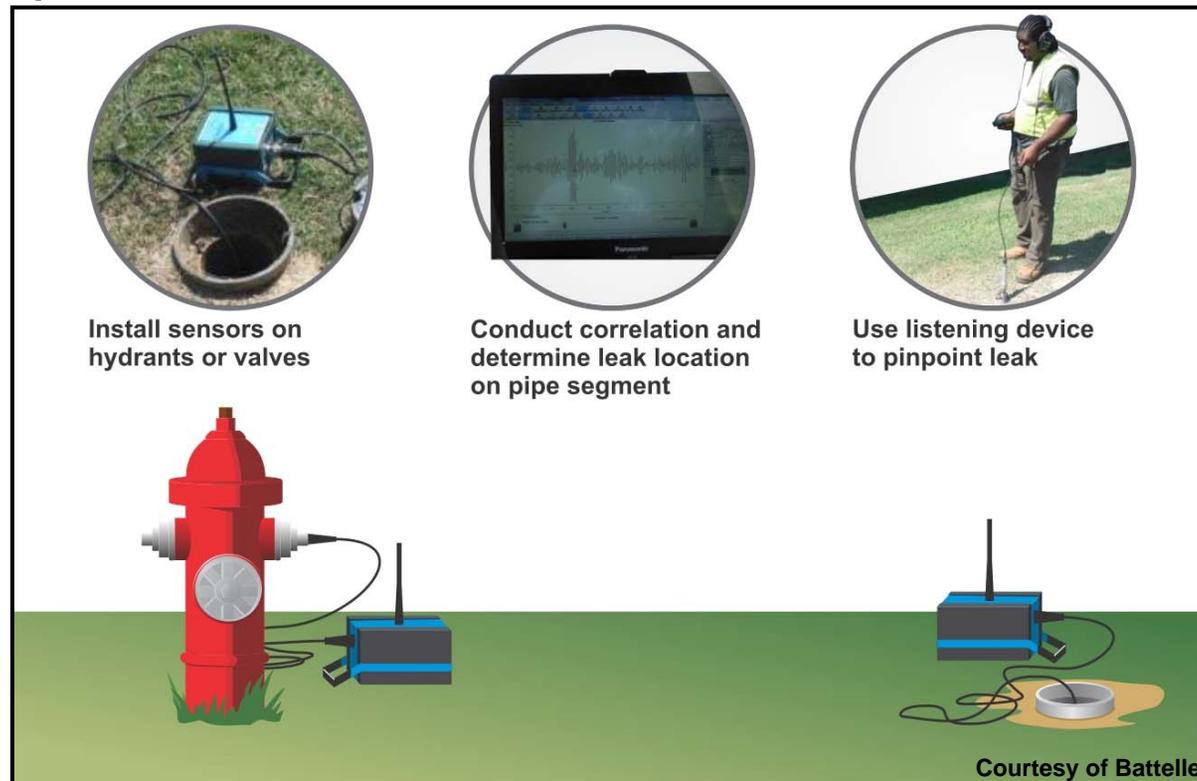
ZoneScan Alpha automatically correlates signals from sensor network each night to detect and locate leak signatures



Courtesy of Battelle

# Intermittent Inspection System\*

LeakFinderRT correlates signals from “lift and shift” sensors temporarily installed on hydrants, valves, or pipe surface; hydrophones and accelerometers used for this study



\* Intermittent inspection every ~3-5 years

# Intermittent Inspection System\*

Correlux correlates signals from “lift and shift” sensors temporarily installed on hydrants, valves, or pipe surface; accelerometers used for this study



Courtesy of Vivax-MetroTech

Correlux Correlator Unit and Sensor Pair



Courtesy of Battelle

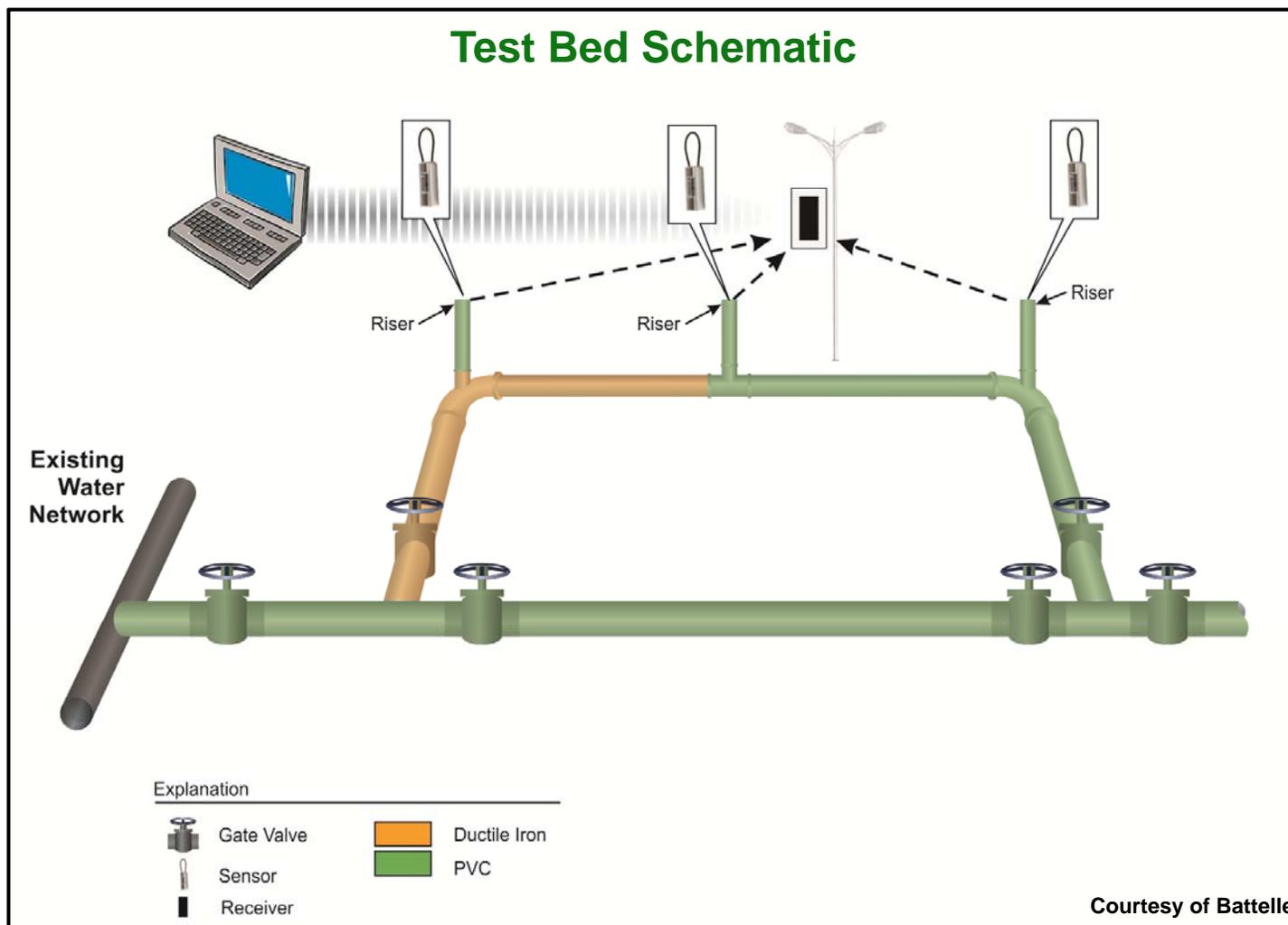
Installed on pipe surface,  
hydrant or valve

\* Intermittent inspection every ~3-5 years

# Performance Objectives

- Number of leaks detected
  - 90% of known leaks detected
- Leak location accuracy
  - Locate with  $\pm 4$  ft
- Minimum detectable leak size
  - Ability to detect leaks above 1 gpm
- False positives
  - Less than 5% of leaks detected false positives
- System availability/reliability
  - >95% system uptime
- Estimated water and energy savings
  - Savings-to-investment ratio > 1.0

# Technical Approach



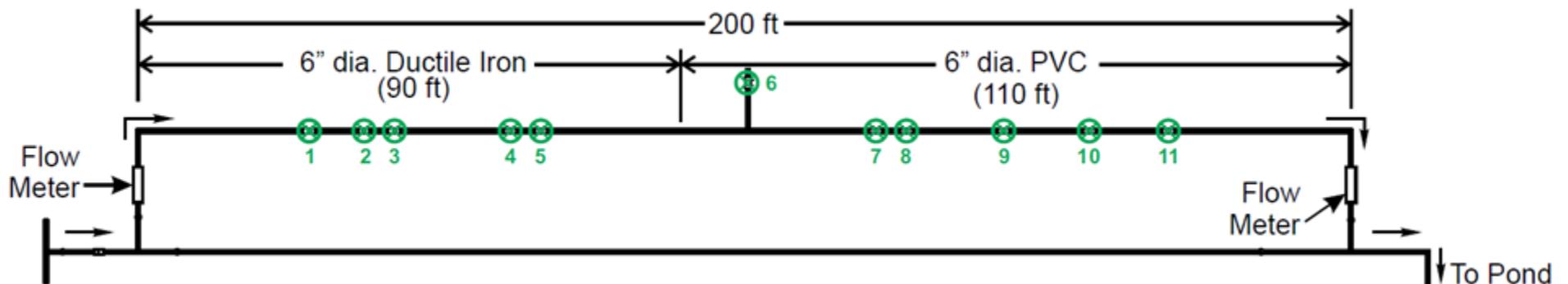
# Technical Approach (Cont'd)



Courtesy of Battelle and ERDC

Installed underground simulated leaks with orifice plates of varying sizes

All Artificial Leak Points



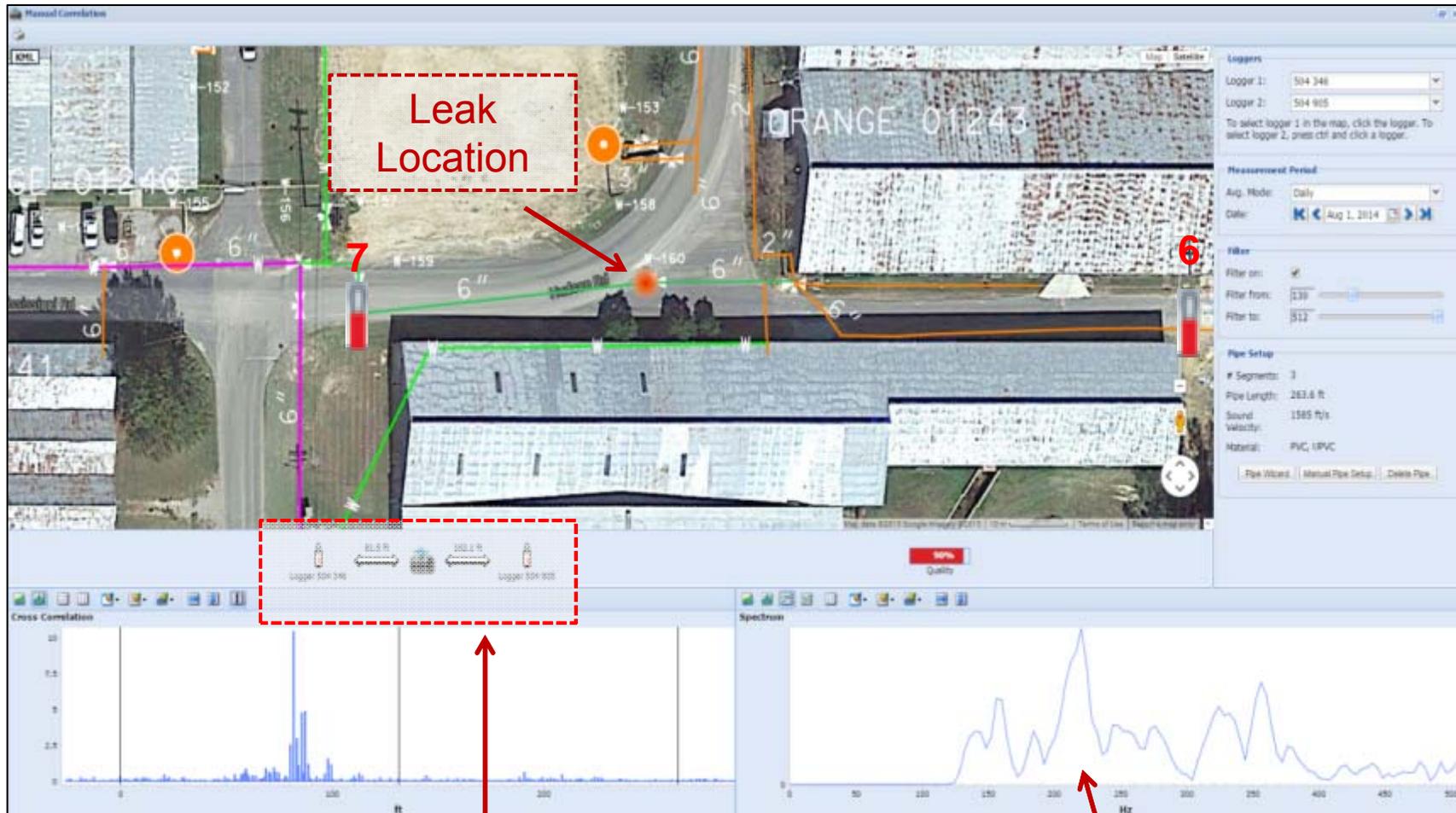
# Test Bed Results Overview

Performance Objective	Success Criteria	ZoneScan Alpha	LeakFinder™ (Accelerometer)	LeakFinder™ (Hydrophone)	Correlux
Detect Known Leaks	90% of known leaks detected	100% (14/14)	100% (14/14)	86% (12/14)	100% (14/14)
False Positives	< 5% of leaks detected were false positives	25% (2/8)	33% (3/9)	22% (2/9)	0% (0/9)
Leak Location Overall	Locate ± 4 ft	86% (12/14)	100% (14/14)	50% (7/14)	93% (13/14)
Leak Location PVC	Locate ± 4 ft	100% (7/7)	100% (7/7)	86% (6/7)	86% (6/7)
Leak Location DI	Locate ± 4 ft	71% (5/7)	100% (7/7)	14% (1/7)	100% (7/7)
Minimum Detectable Leak Size	Detect leaks above 1 gpm	1.0 gpm	1.0 gpm	1.0 gpm	1.0 gpm

# Test Bed Results Overview (Cont'd)

- Overall findings
  - Best location accuracy with each pipe material bracketed with sensors
  - When 2+ leaks were active in the same bracket, correlations were not as accurate as with only one leak
  - When hydrophones were used, the correlations were not as accurate

# ZoneScan Alpha Field Results



Courtesy of Gutermann

Correlated Location (ft)

Noise Signal (Hz)

# ZoneScan Alpha Field Results

- Leak was correlated to be 81.5 ft west of Sensor 7 and 182.1 ft east of Sensor 6
- Investigation revealed a valve was within 4.3 ft of the correlated leak location
- Valve box was full of water
- Leak later resolved by tightening valve; facility decided not to excavate



Courtesy of Battelle

# LeakFinderRT Fields Results

## ■ Results

Item ID	Area	Leak or POI	Leak Type	Estimated Size	Site Address	Calculated Leak Size (gpm)
1	B	POI	Main	Small	3281 Mississippi Rd.	11.1
2	B	Leak	Main	Large	3281 Mississippi Rd.	59.3

- Vendor estimated water loss
  - 101,376 gal per day estimate
  - ~\$104,000 per year value
    - Based on water rate of \$2.80/1,000 gal

# LeakFinderRT Fields Results (Cont'd)

- Facility excavated leak location
- Leak did not appear to be on the main, but under foundation
- DPW turned water off to building
- Plan to abandon line under foundation and install new line



Courtesy of Battelle

# Field Test Results

- Performance objectives for the field testing could not be fully evaluated
  - Two leaks identified with intermittent inspection
  - One leak identified with continuous monitoring
- Location of known leak could not be accurately located
  - Intermittent inspection system detected leak but not able to pinpoint
    - Under slab foundations difficult to accurately access
- Continuous monitoring system accurately detected and located leak at intermediate valve box

# Conclusions

- Overall technology performance (test bed)
  - All accelerometer-based sensors met leak detection objectives
  - Hydrophone-based sensors did not meet leak detection objectives
  - Location accuracy varied
    - For accelerometers, leak location accuracy varied from 86% to 100%
    - For hydrophones, 50% leak location accuracy did not meet objectives
    - Accuracy impacted by pipe type, multiple leaks, filtering, etc.
  - Potential for false positives
    - Listening device needed to confirm predicted leak location

# Overall Recommendations

- Conservative estimates of water loss indicate high savings-to-investment ratio (SIR) for both technology types
- Intermittent inspection systems using accelerometers is feasible
  - Location accuracy
  - Minimal/no false positives
  - Highest predicted SIR

# Outlook for Continuous Leak Monitoring System

- Continuous monitoring offers SIR > 1.0 and highest potential for water savings for sustainable and efficient operations
- Barriers and issues still exist for implementation
  - Continuous monitoring may prove effective once data network and security issues can be addressed by DoD
- Follow-on use of ERDC test bed
  - Advanced Metering Infrastructure (AMI)
  - Pressure Management
  - District Metering Areas

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For additional information, please visit  
<https://www.serdp-estcp.org/Program-Areas/Energy-and-Water/Water-Conservation/EW-201339>

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# *SERDP and ESTCP Webinar Series*

## Q&A Session 2



## *SERDP and ESTCP Webinar Series*

The next webinar is on  
July 28, 2016

**“Geophysics 101: Realistic  
Expectations for Geophysics When  
Used for Site Characterization and  
Remediation Monitoring – Part 2”**



## Survey Reminder

*Please take a moment to complete the survey that will pop up on your screen when the webinar ends*

