Introduction

What is Acoustic Imaging

Example Projects

Conclusions
- Established 1979 in Chicago
- Predominantly an Asset Management & Structural Engineering Firm
- Provide Services to Clients Nationally and Internationally
- Responsive Service Including 24 Hour Emergency Hotline
Conducted FHWA Underwater Imaging Study TPF-5 (131)

Evaluated Usefulness of Various Acoustic Imaging Devices at Bridge Sites
Every site presents unique challenges...

...and we typically want to know what lies below the surface.
Inspection Risk can be Managed with Information

- Traditional information sources
  - Contract documents
  - Diver inspections
  - Single beam sonar survey data

- Modern information sources
  - Underwater acoustic imaging
    - 2-D images
    - 3-D point cloud models
Why is SONAR Useful to Underwater Inspectors

- **Common uses include:**
  - Volume calculations (riprap and dredge quantities)
  - Bridge scour monitoring (replace sounding plan)
  - Hydraulic analysis for design
  - Assessment of underwater conditions (structural investigation)
  - Underwater archeological documentation (shipwrecks)
  - Assist or direct divers (especially in hazardous conditions)
  - Assess existing or changed conditions
  - Detect and identify submerged objects
  - Verification documentation (quality, quantities, safety, etc.)
  - As-built documentation
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Key Advantages of Acoustic Imaging

- Ability to deploy from multiple points of view
- Easily adaptable to vertical and horizontal surfaces
- Compact for deployment in remote locations
- Not dependent on GPS
- Optimize resolution by reducing range from target
Most Useful When Standard Practices Have Shortcomings

- For divers/inspectors:
  - Low/No visibility (obtain big picture)
  - Difficult geometry (if a picture is worth 1,000 words – a 3-D model is worth much more)
  - Dangerous diving conditions
    - Extreme depth
    - Heavy pollution
    - Flooding (strong currents)
Most Useful When Standard Practices Have Shortcomings

- For hydrographic surveyors:
  - Obtain data under heavy canopy (within enclosed structures/caverns, under large shipping piers, even below the ice)
  - Reduce range/Enhance resolution at extreme depth
  - Provide data in shallow or heavily obstructed areas
  - Supplement to missing or low resolution traditional multi-beam data (cloud to cloud registration)
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Example 1A: Imaging During Flood Events

Iowa DOT: 2011 Floods at Hwy 175 near Onawa, IA

Riprap Embankment
Example 1B: Imaging During Flood Events

Iowa DOT: 2011 floods investigation of 4 bridges on I-29

Overlay of as-built and historic channel info for comparison
Example 1B: Imaging During Flood Events

NDDOT: 2009 Floods at Grand Forks, ND
Example 1C: Imaging During Flood Events

Northern Plains Railroad: 2011
Floods near Bottineau, ND
Example 2 – Diver Safety
Example 3– Obtain Data Over Shallow Obstructions
Example 5 – Archeological Documentation
Example 6 – Areas Inaccessible to Traditional Surveys
Example 7 – An Image is Worth a Thousand Words… And it might be worth even more in a claim.
"The BlueView data that Collins Provided was extremely useful to us. It reduced the risks for everyone involved." – Tom Hardinger, Bridge Maintenance Engineer for WisDOT
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Conclusions

Current Technology allows safe and cost effective underwater investigation during hazardous conditions, flood peak levels, and frozen surfaces.

- Acoustic imaging can:
  - provide useful information when traditional methods are difficult or unsafe.
  - increase equipment and diver safety.
  - increase quality.
  - decrease risk.
Questions

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