

Acoustical Imaging for Underwater Inspection

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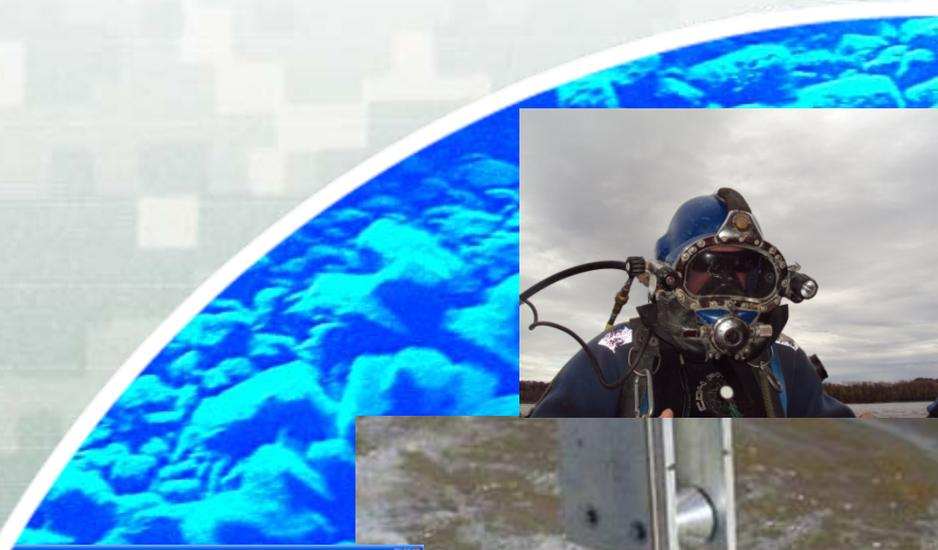
Electronics Engineer

ERDC Information Technology
Laboratory

29 February 2012



US Army Corps of Engineers
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The software interface displays a control panel with buttons for 'Scan ON', 'Scan OFF', 'Measure', 'Stop', 'Get Config', 'Test1', 'Test2', 'Squarred Areas', 'Start Angle, in degrees', 'End Angle, in degrees', and 'Rotate Speed, rpm'. It also shows a file path 'C:\Users\Dan\Documents\12-16_144761' and a 'Browse' button. A small graph in the top left shows a blue line on a grid. A central window shows a photograph of a rocky riverbank with a vertical red line overlaid. A bottom window shows a dark, narrow view of the riverbed.

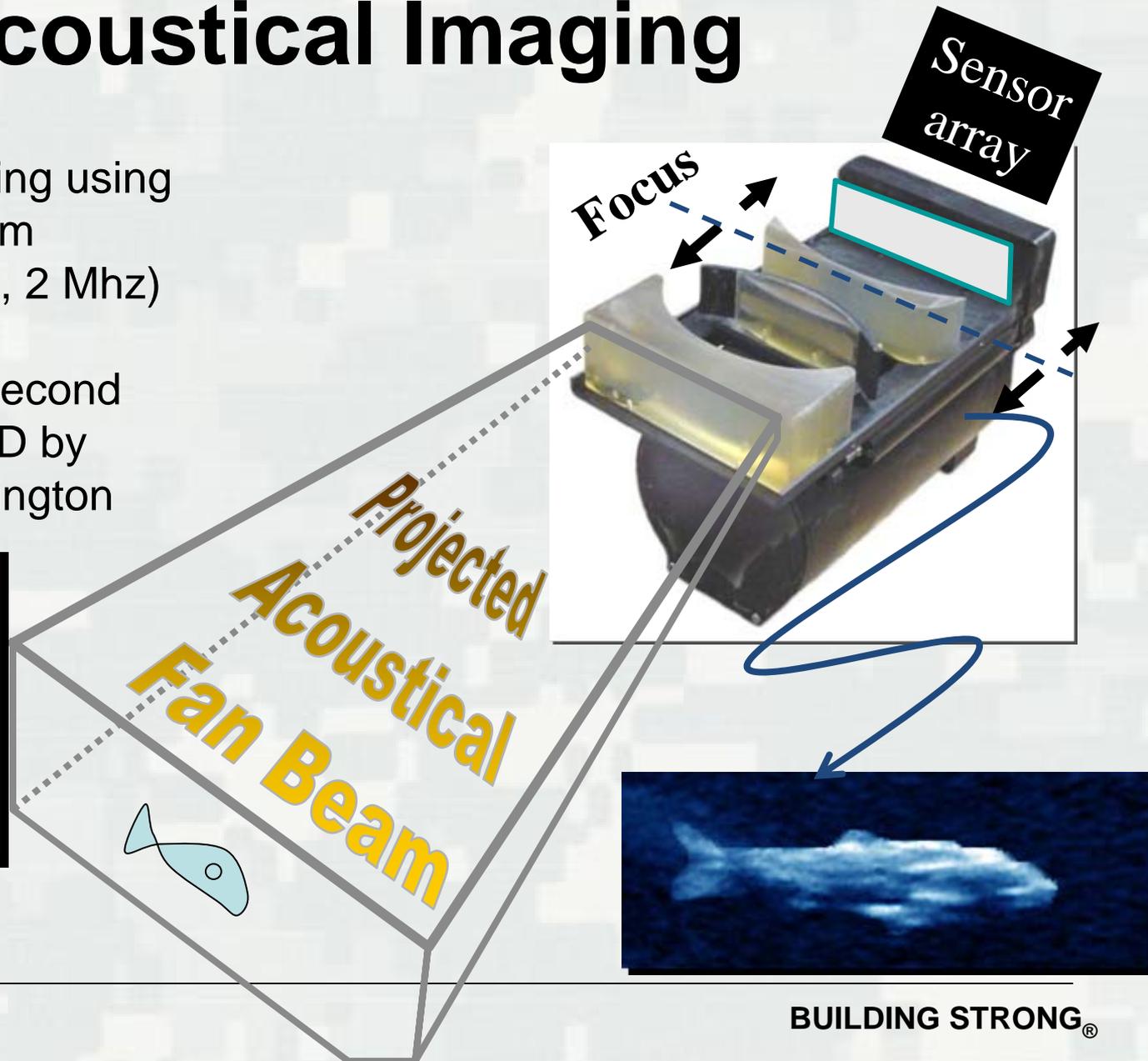


High Resolution Acoustical Imaging

Details:

- Mechanical focusing using complex lens system
- Dual frequency (1, 2 Mhz)
- 1-30M range
- Up to 12 frames/second
- Developed for DoD by University of Washington

The acoustic camera offers superior resolution and portability compared to Sidescan and Beam forming approaches



High Resolution Acoustical Imaging Vs. Conventional Dive Inspection

Diver only inspection

- Near zero visibility in turbid water
- Subjective verbal descriptions
- Potentially hazardous for diver
- Poor location referencing
- Limited to divers' perception

Acoustical Imaging

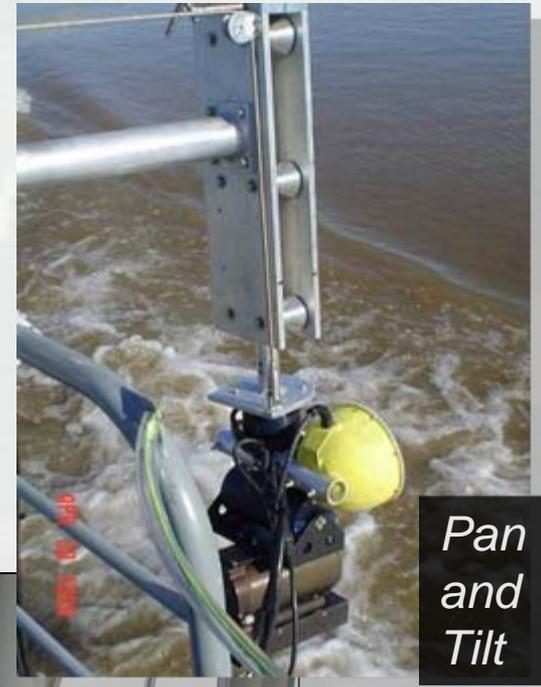
- Image unaffected by turbid water
- “Optical” digital record (2d -> 3d)
- Boat, ROV or diver deployed
- Data Tagging w/ Geo-referenced Position
- Real-time, noninvasive, and remote (3-90')



Acoustical Imaging System

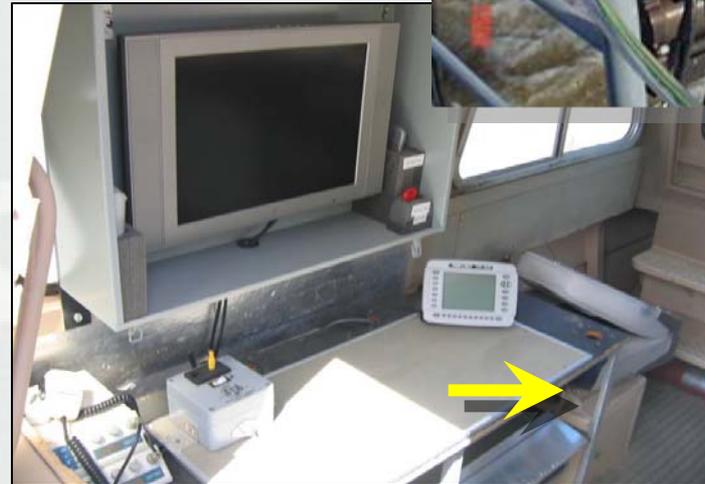


Camera pole
mount



*Pan
and
Tilt*

18 integrated sensors
provide geospatial
referencing



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High Resolution Acoustical Imaging Deployment (Continued)

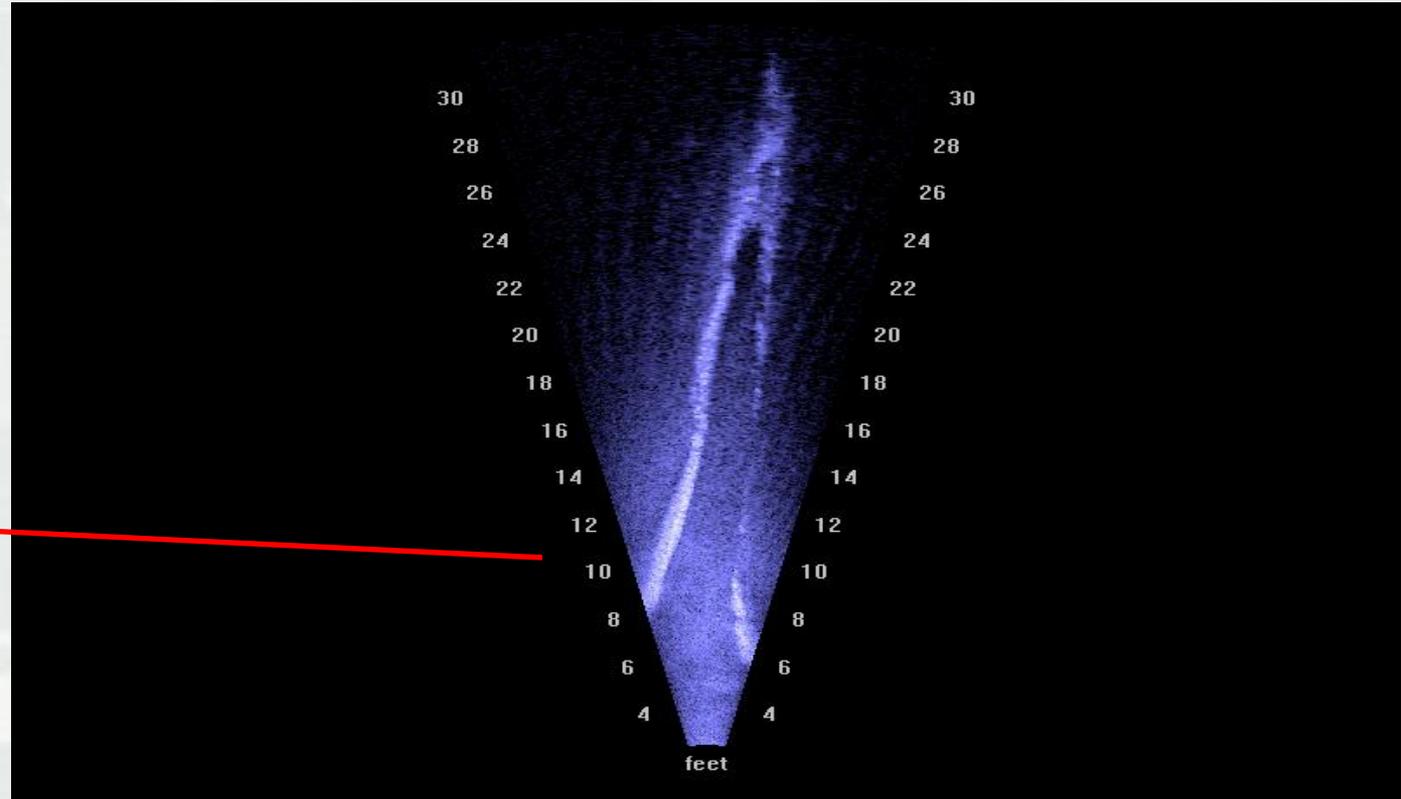
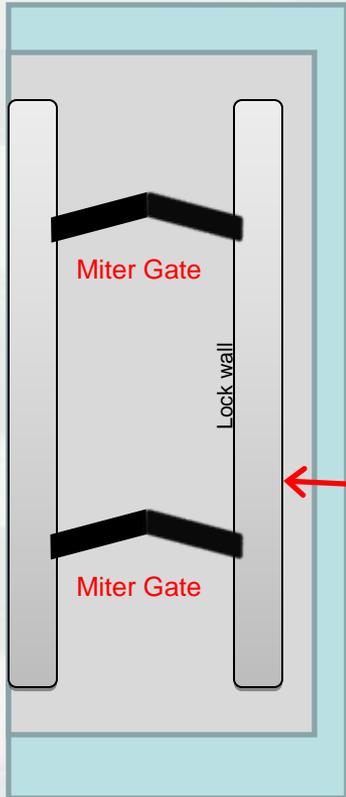
Integration of Video Monitor for Diver Use

- 1) Increases Diver's Involvement of Inspection Process.
- 2) Improves Diver Safety



Acoustical Imaging of Lock and Dam #25

Nov 5 2012

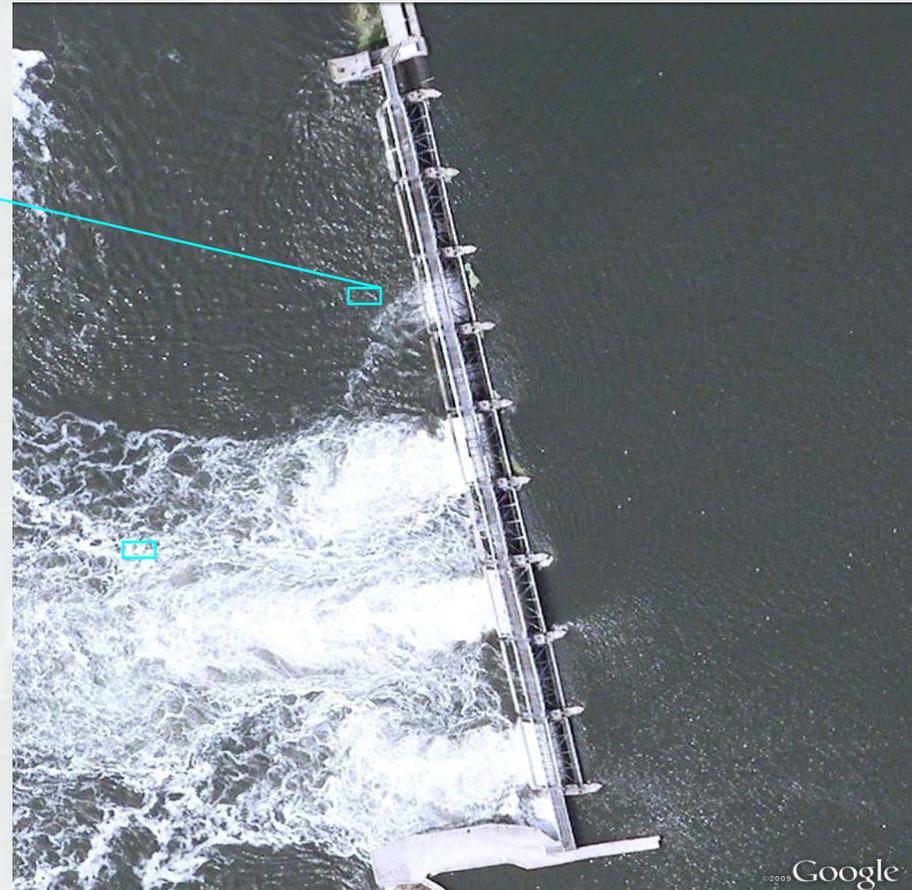
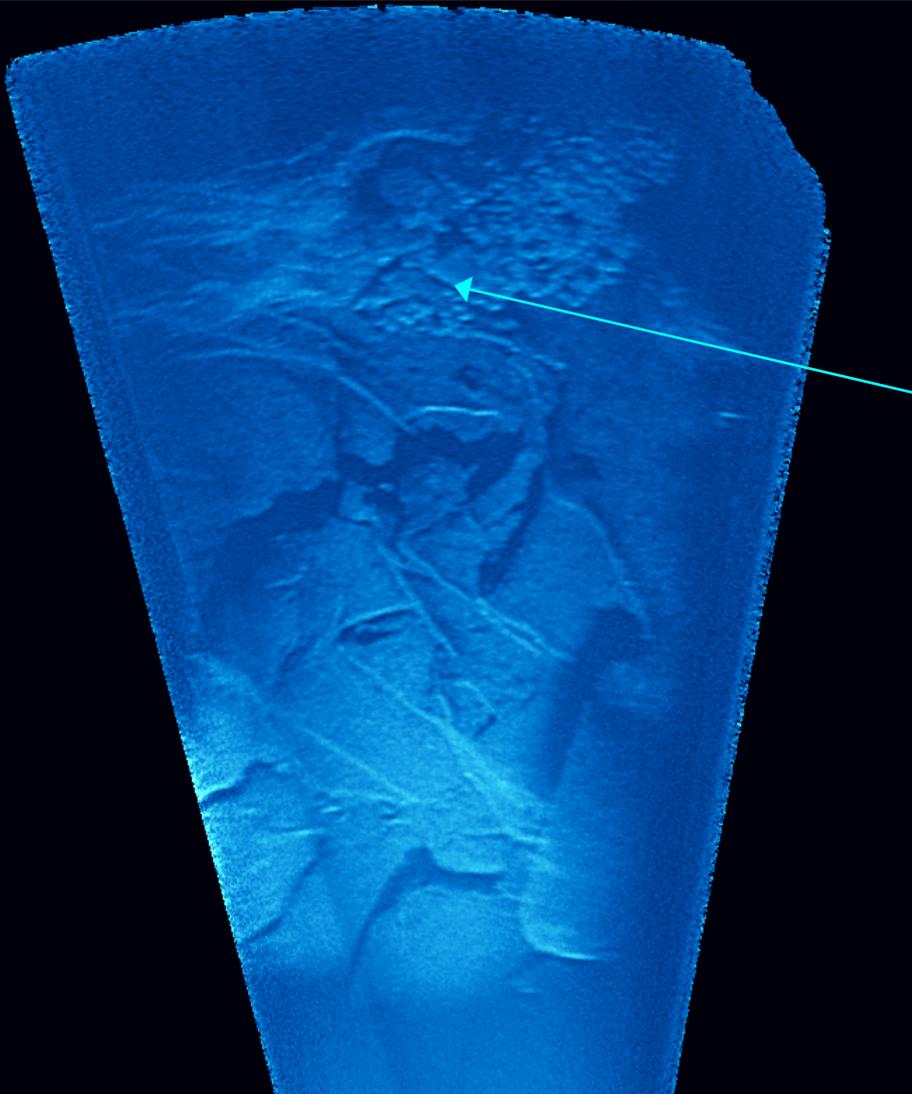


Scour Depth approximately 22 feet from edge of existing cracked concrete edge. Scour Depth estimated at 6 feet but could not be viewed directly as the diver was restricted in distance he could back from the target area. Arrow shows approximate location of this scoured area.



Acoustical Imaging of Dresden Dam Chicago District

**Scour inspection
below the dam.**

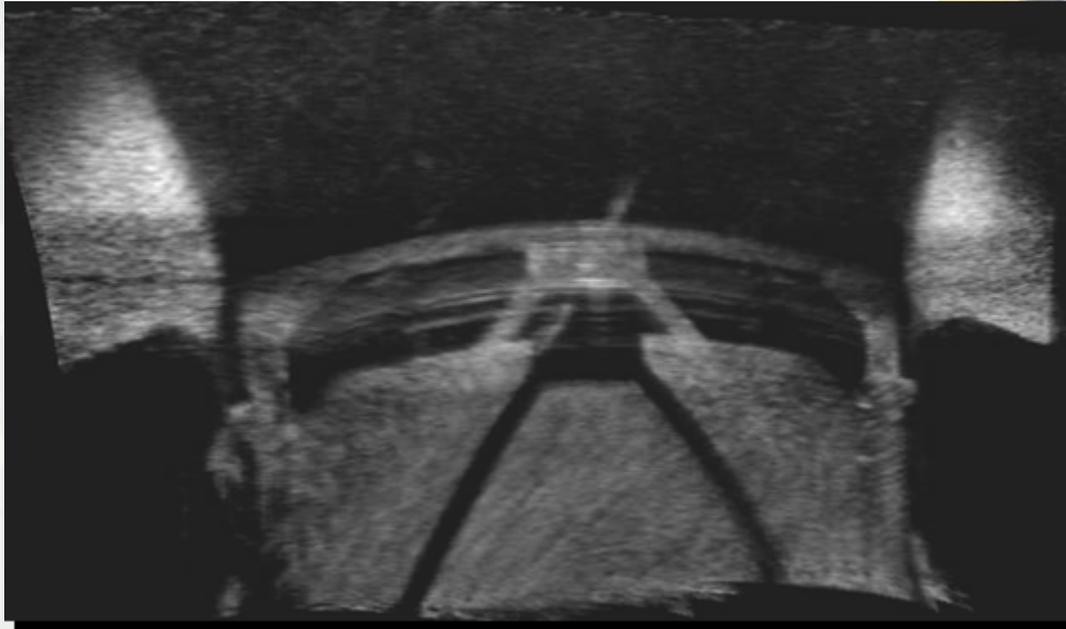


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Imaging Structural Elements

Acoustic Camera was used at Delaware Dam, Huntington District to look for obstructions in the gate slots.

- No slot problems were found.



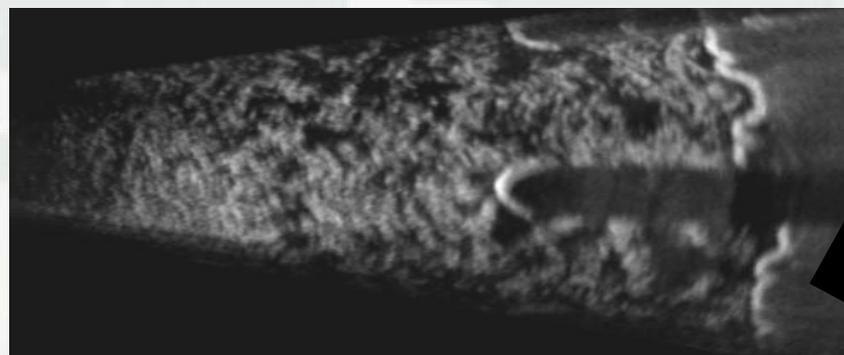
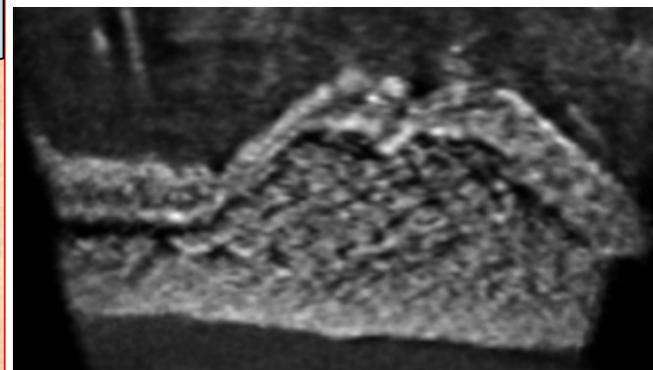
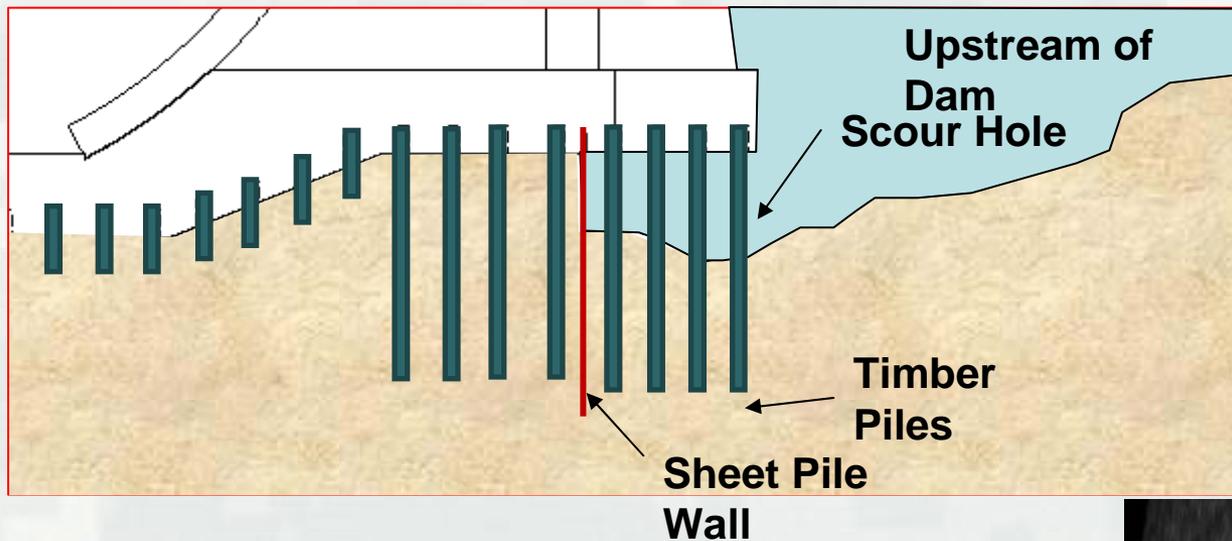
Maintenance gate being lowered

Note water opacity

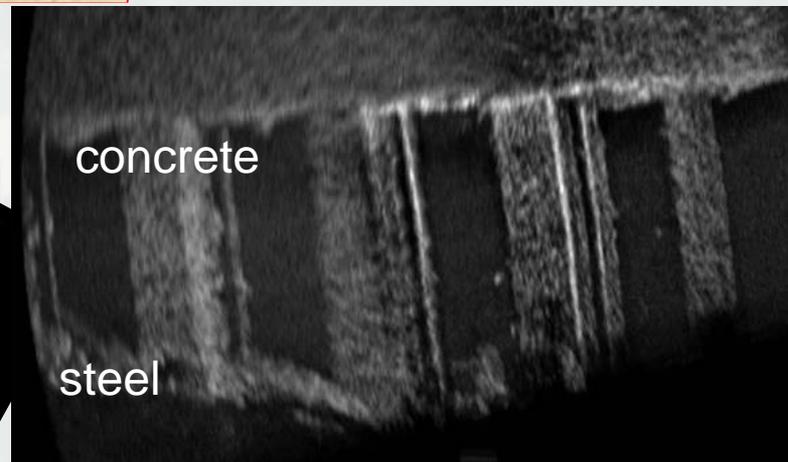
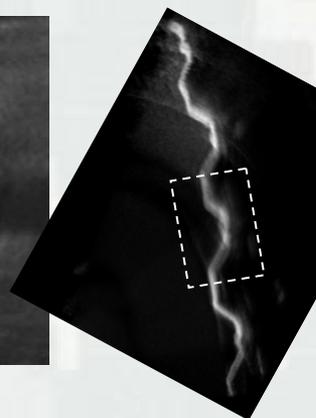


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Inspection of Scour-exposed Components Mel Price Lock and Dam



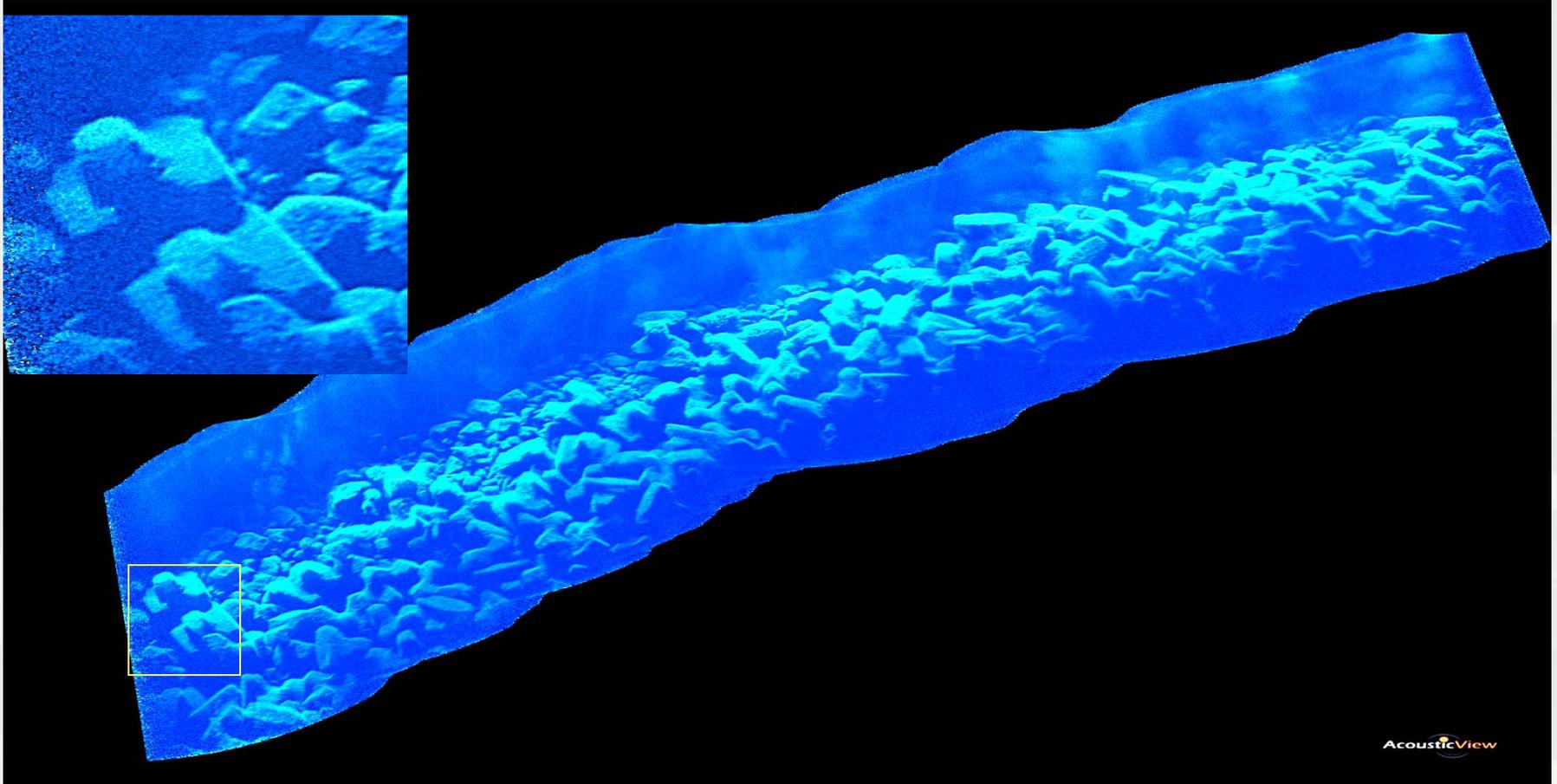
Scour-exposed Timbers



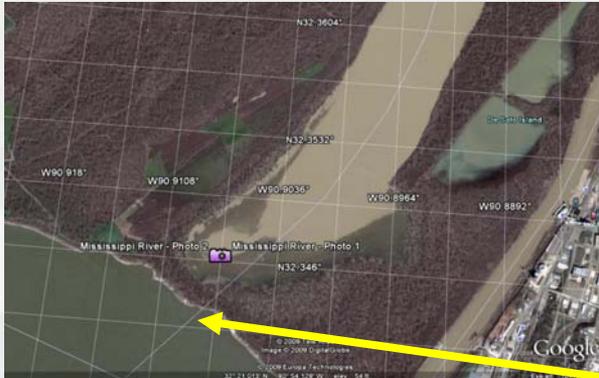
Scour-exposed
Sheet Piles



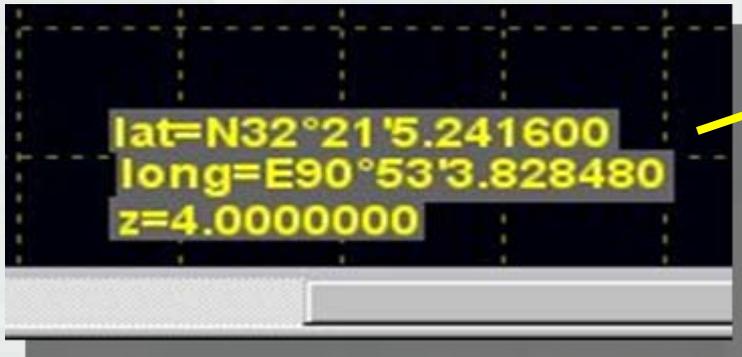
New Image Mosaicking Capability in Near Real-time



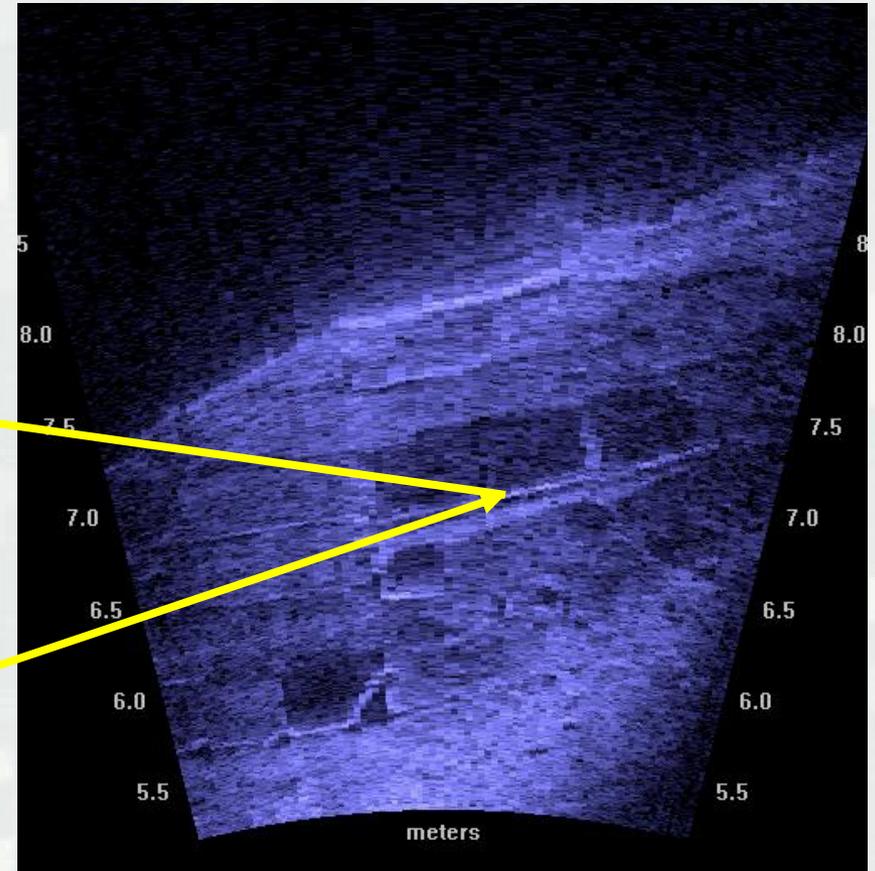
GIS Referencing of Each Data Pixel



Adding Acoustical Camera Images to CorpsMap 3D



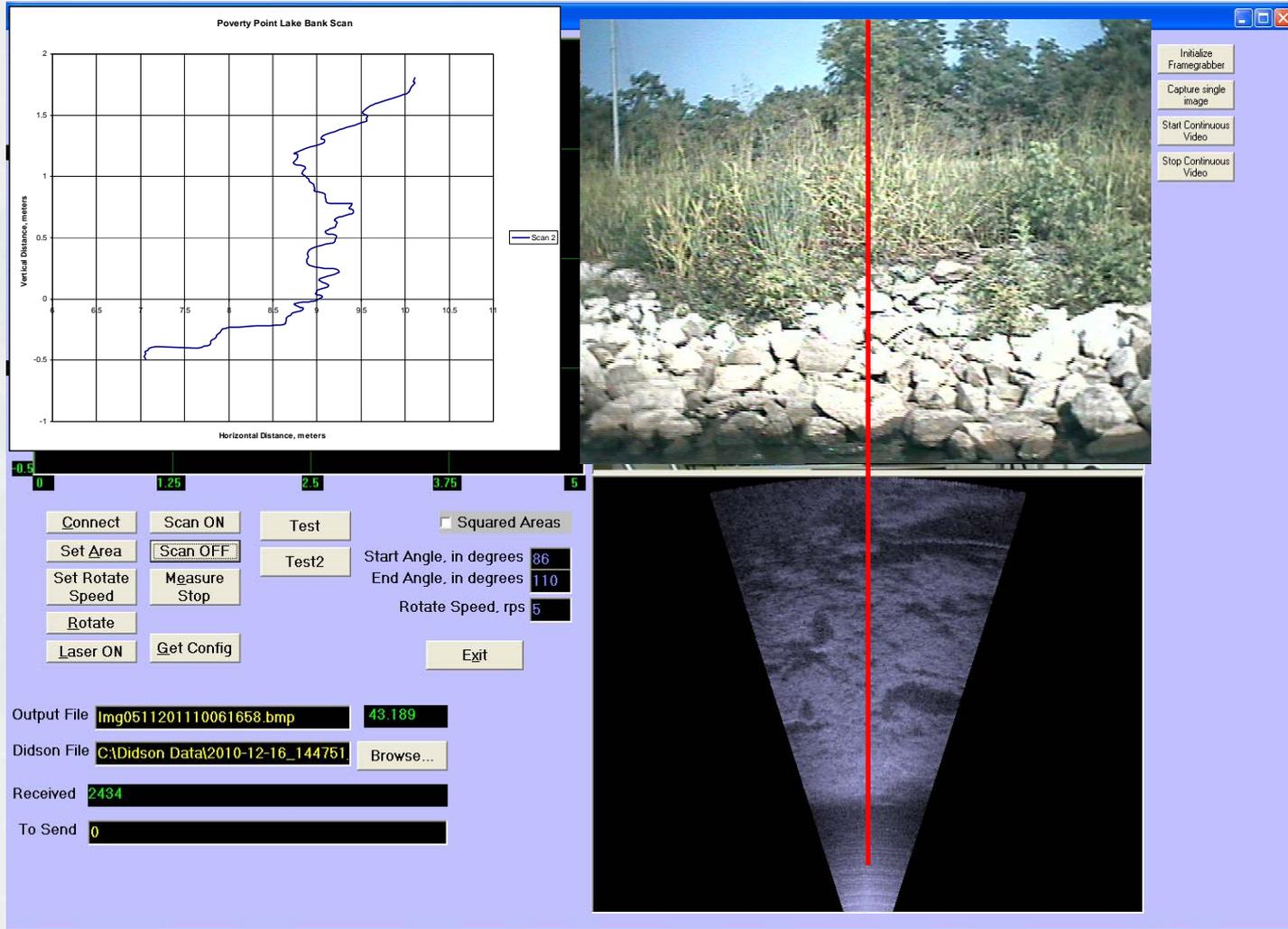
GIS Positional Data



Matting Along Mississippi River Bank



New Capability Under Development - 3D Imaging of Structures Above and Below Water Level.



Acoustical Imaging

Summary:

Underwater Acoustical Imaging using High Resolution acoustical cameras provides near photographic quality images, reduces the risk of diver injury and provides a permanent record of inspections.

High Resolution Acoustical Cameras and Two Dimensional Laser Scanners are being combined for inspection of navigational structures and navigable river bank conditions. Both above water and below water lines are mapped in 3 dimensions.

This integrated system provides a tool for capturing high resolution three dimensional images of structures which can be exported via the DXF format to commercial software packages such as Right Hemisphere, AutoCAD, MicroStation, etc..

