Status Report on Bottom-Tracking ADCPs & ADPs

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Topics for Presentation

- ADCP & ADP Usage
- Benefits
- Applications
- QA/QC Efforts
- New Developments

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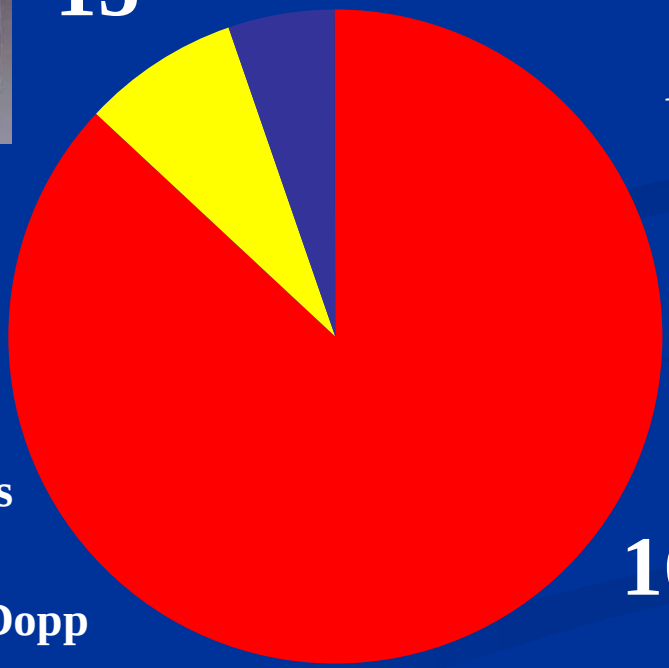
Profilers in the USGS



165 River Profilers =
$4,100,000

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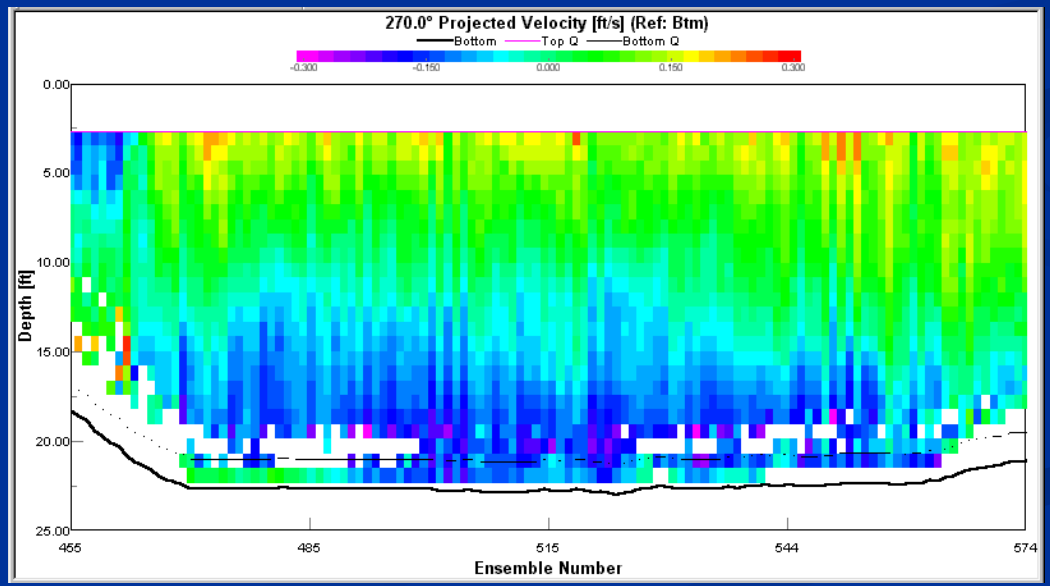
Benefits

- Measures Profiles in the whole cross section
- Doesn't assume log velocity profile
- Handles bidirectional flows



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Benefits

- Less time and equipment on bridges
- No lines in the water (debris risk reduced)
- Multiple deployment options

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Typical Deployment Methods

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Tethered from Cableway

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Maine's Bank Operated Cableway

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Alaska's Seaplane

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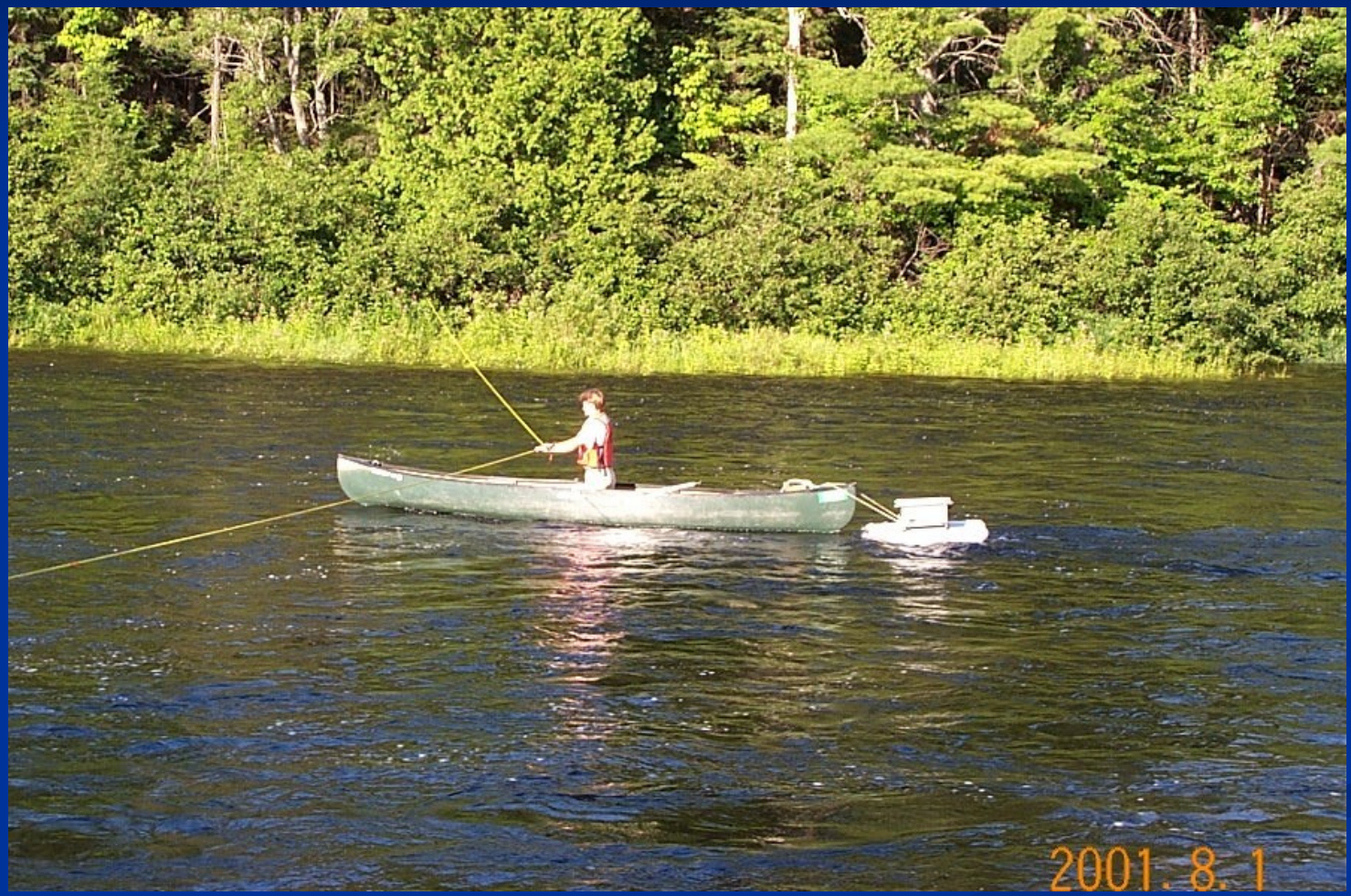
Maine's Canoe Deployment



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Remote Control Boat Demo

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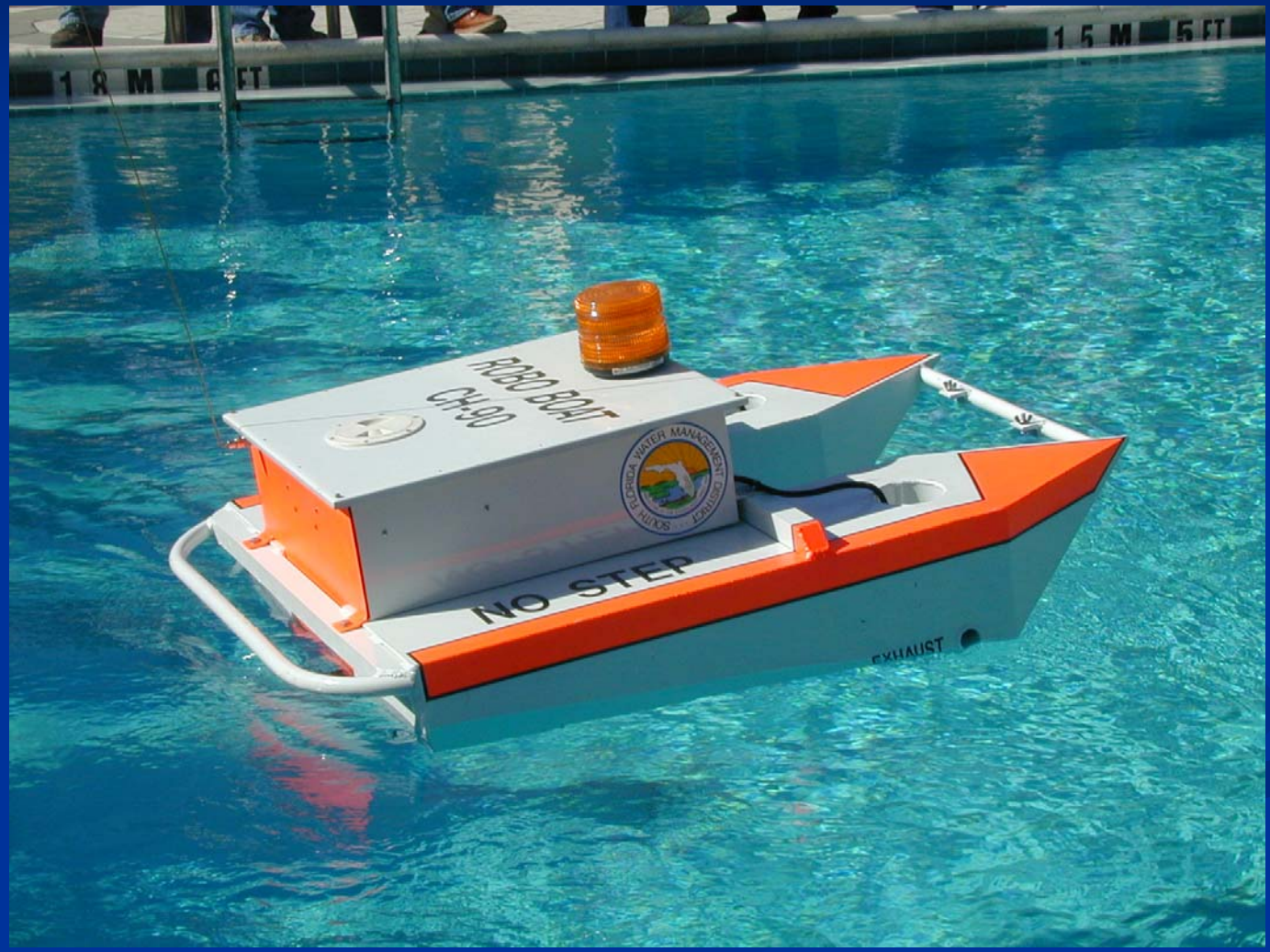
SFWMD Remote Boat



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OceanScience R/C Boat

Available Now
Max. Vel. 5.5 fps

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Applications

- Measure Flow Distribution
- Evaluate Aquatic Habitat
- Calibrate and Validate Numerical Models
- Visualize Flow Fields
- Qualitatively Assess Suspended Sediments

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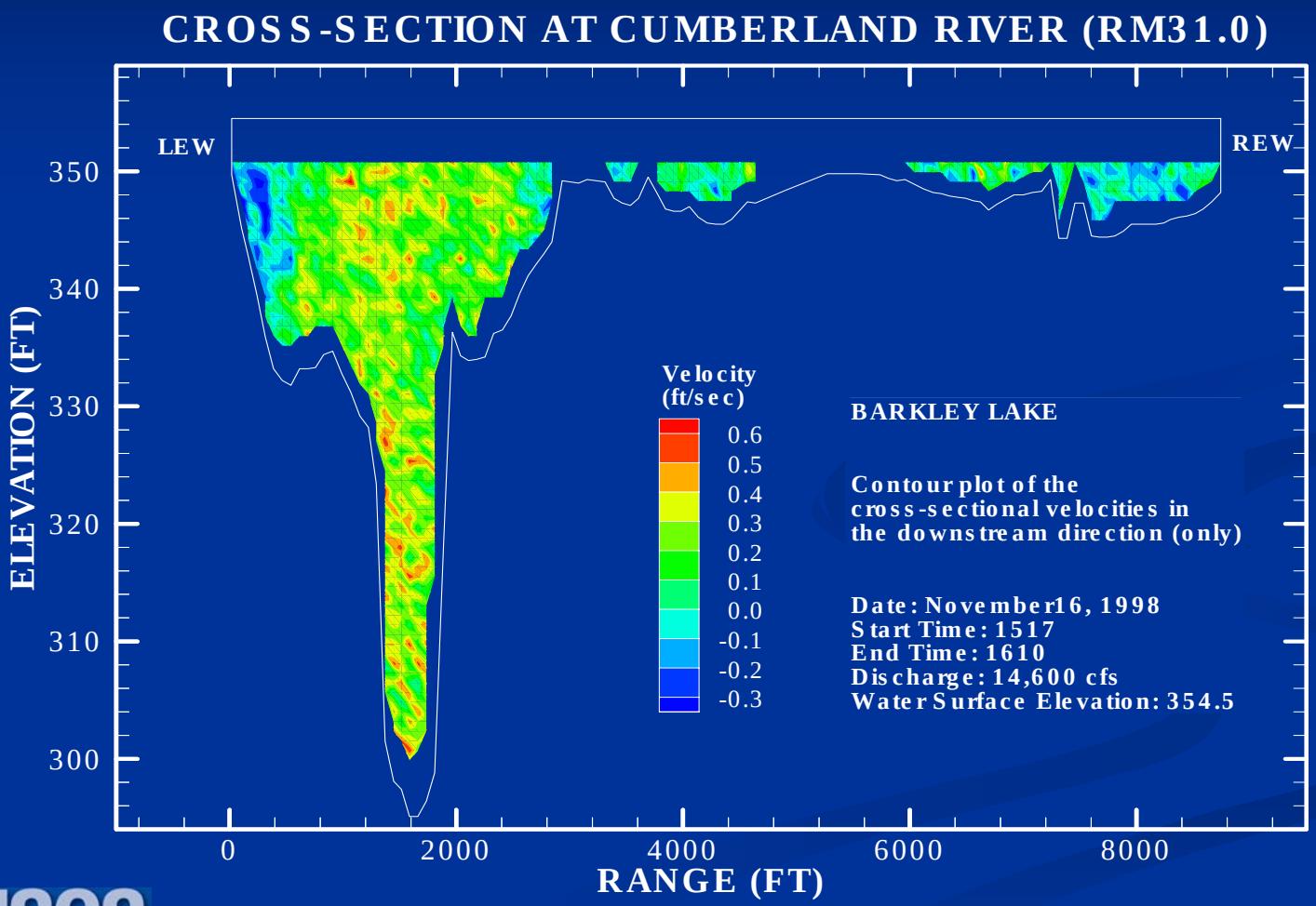
Flow Distribution



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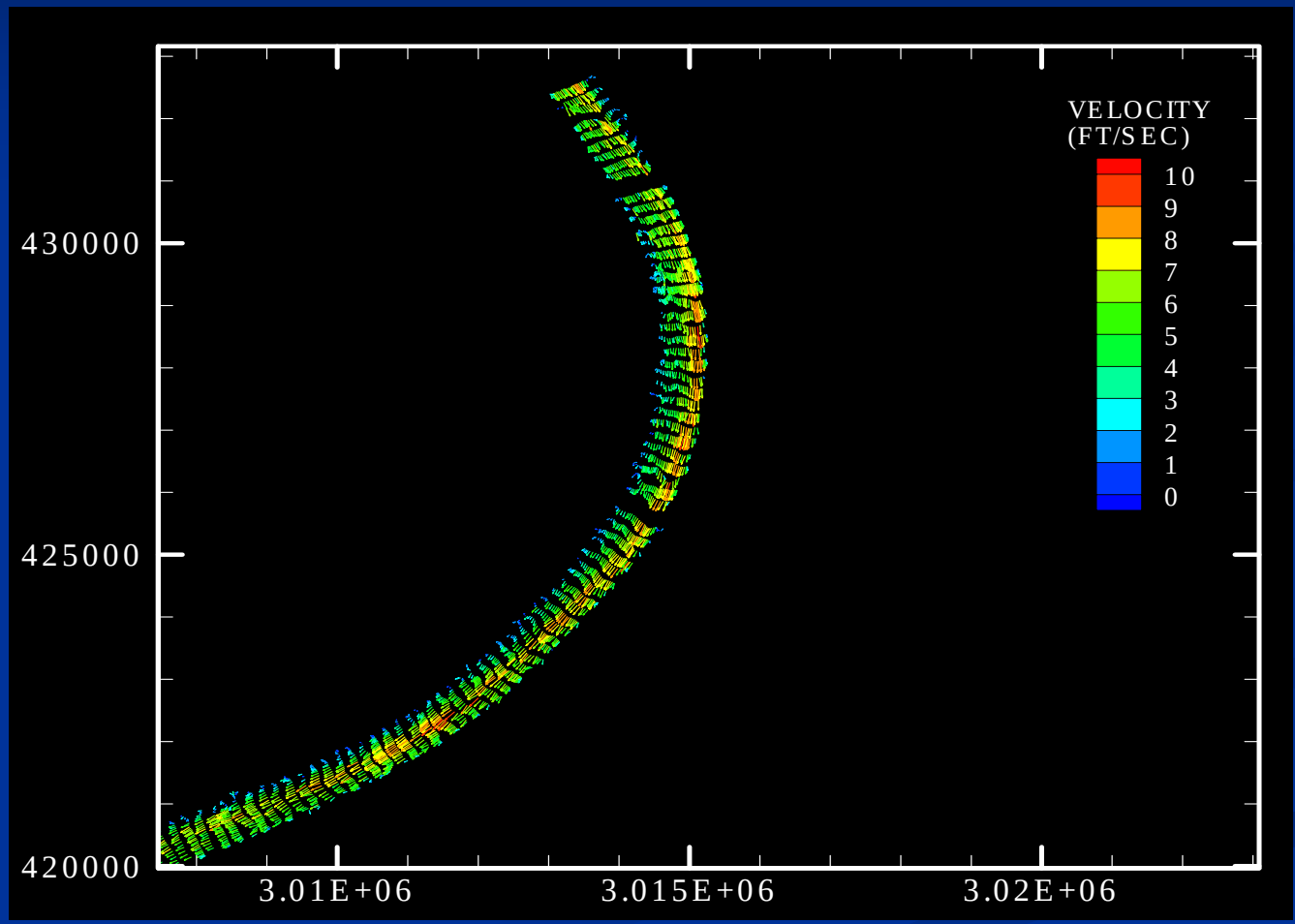
Flow Field Measurements



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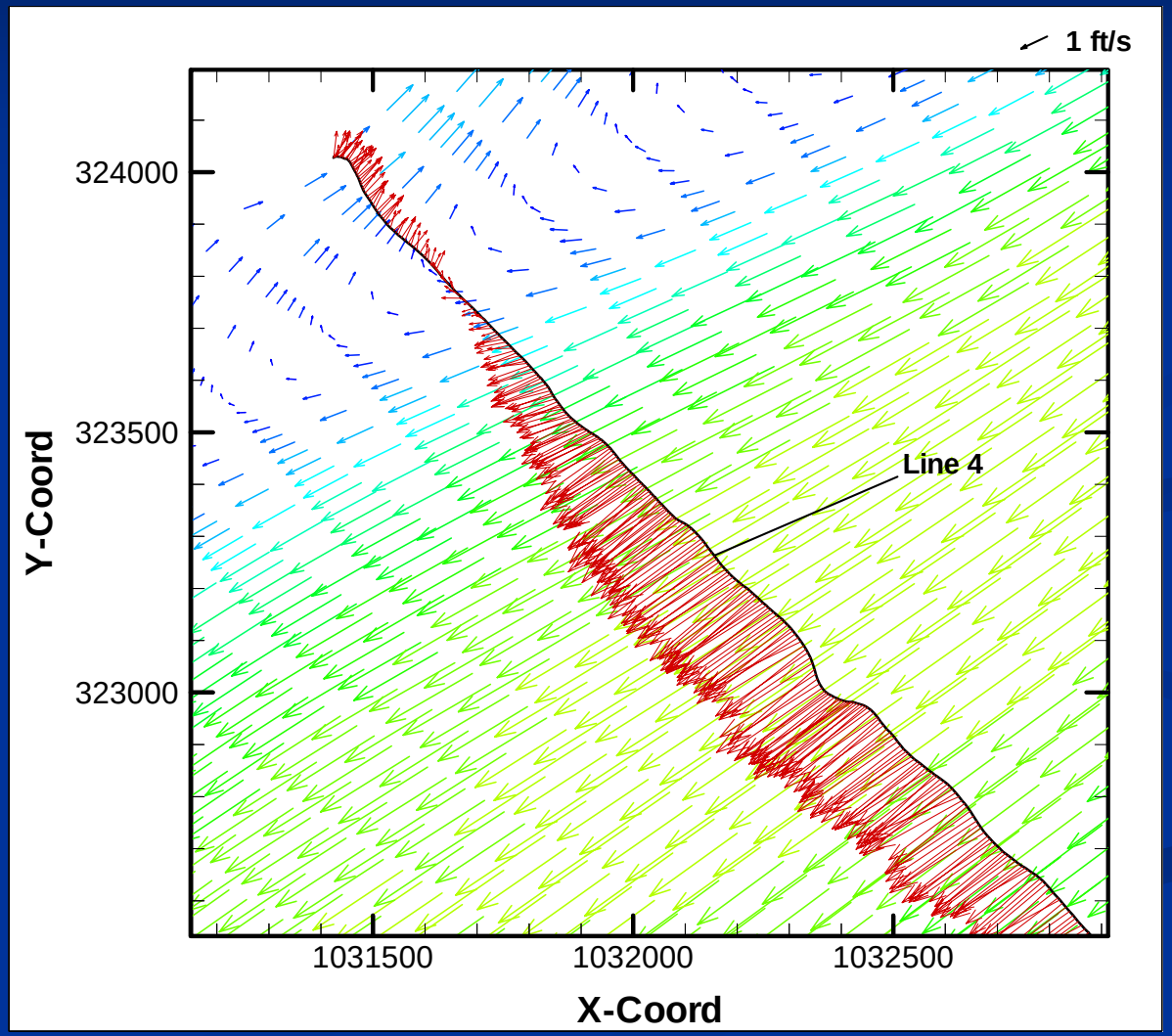
Numerical Model Validation



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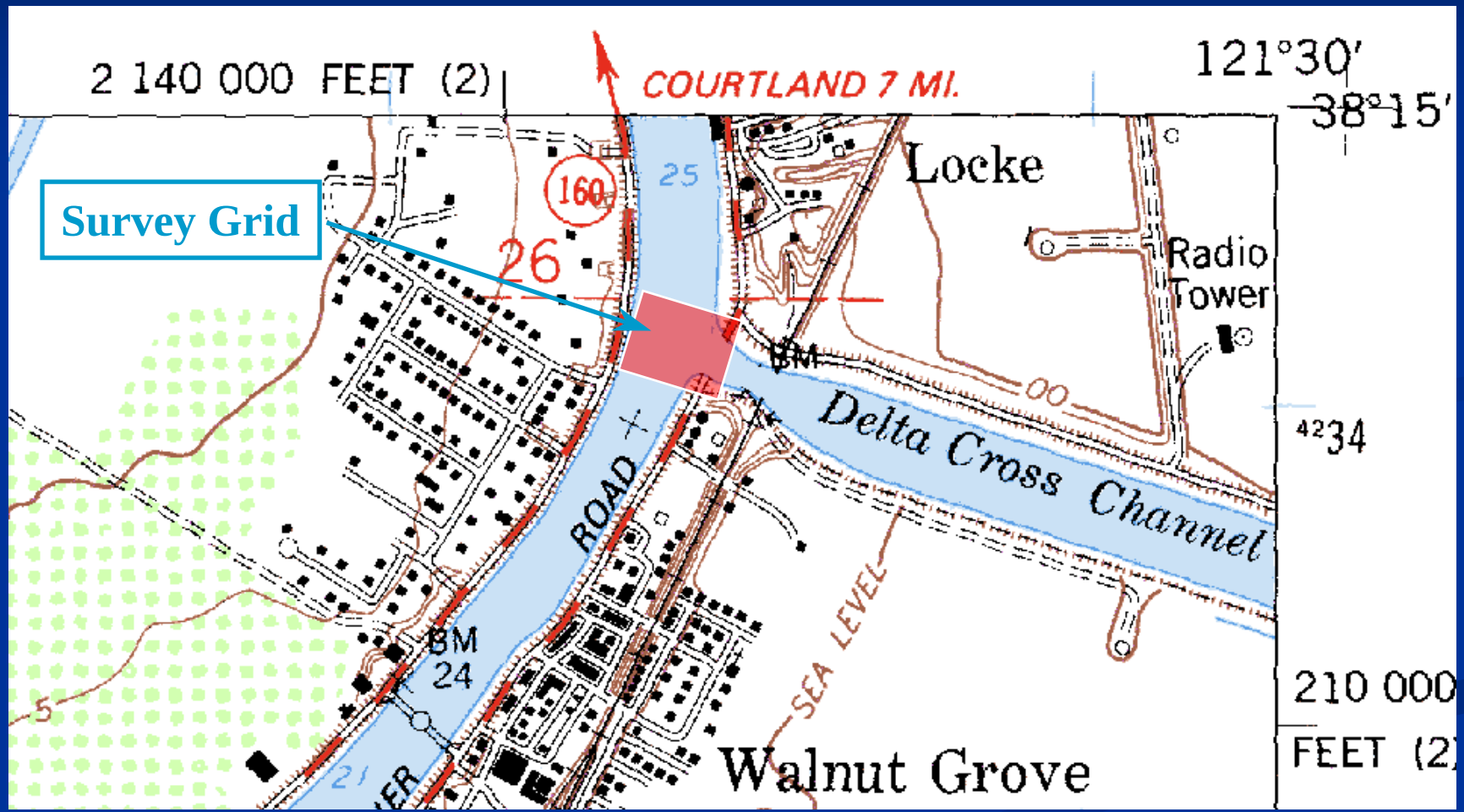
Sacramento River at Delta Cross Channel

Courtesy of Randal Dinehart, California District



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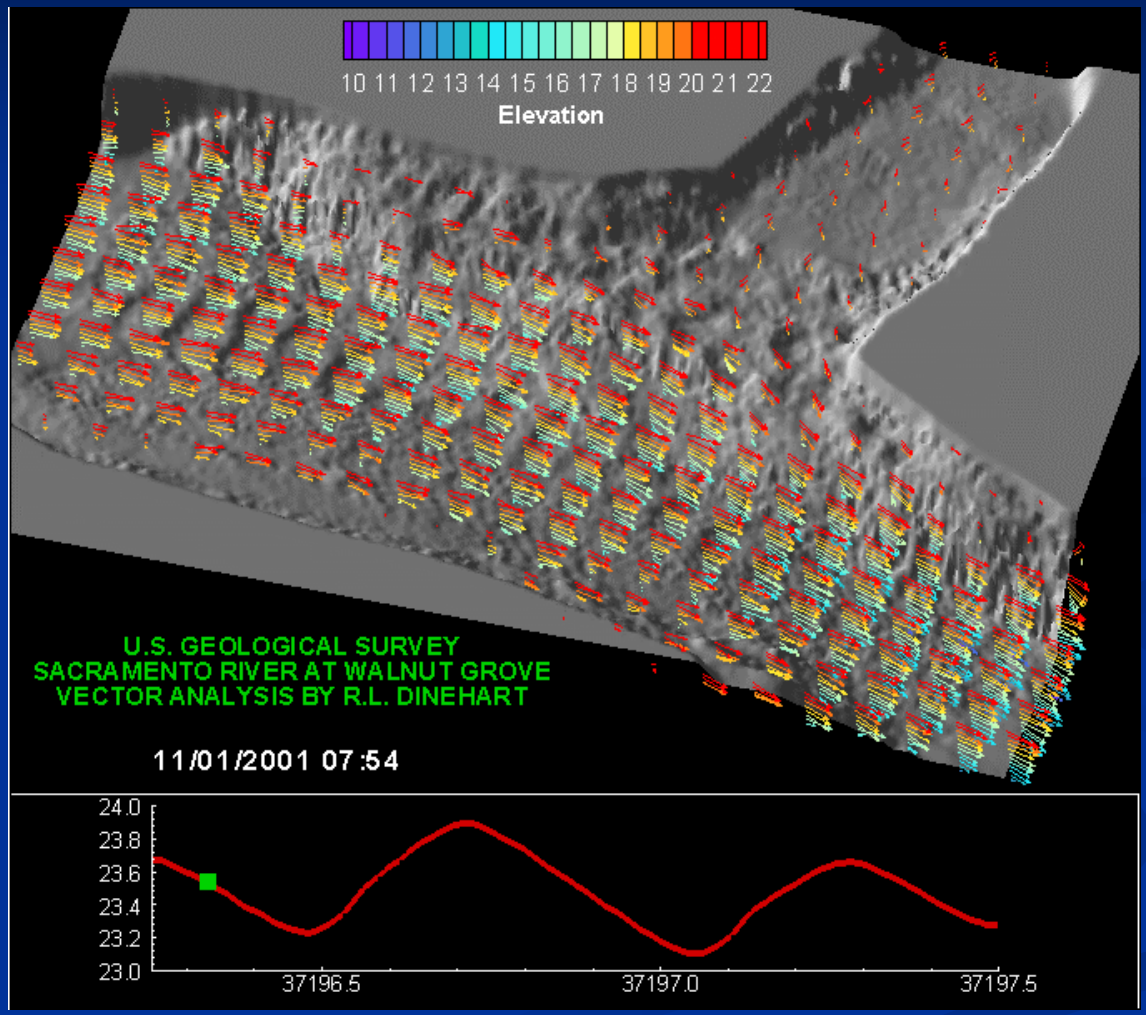
Flow Animation



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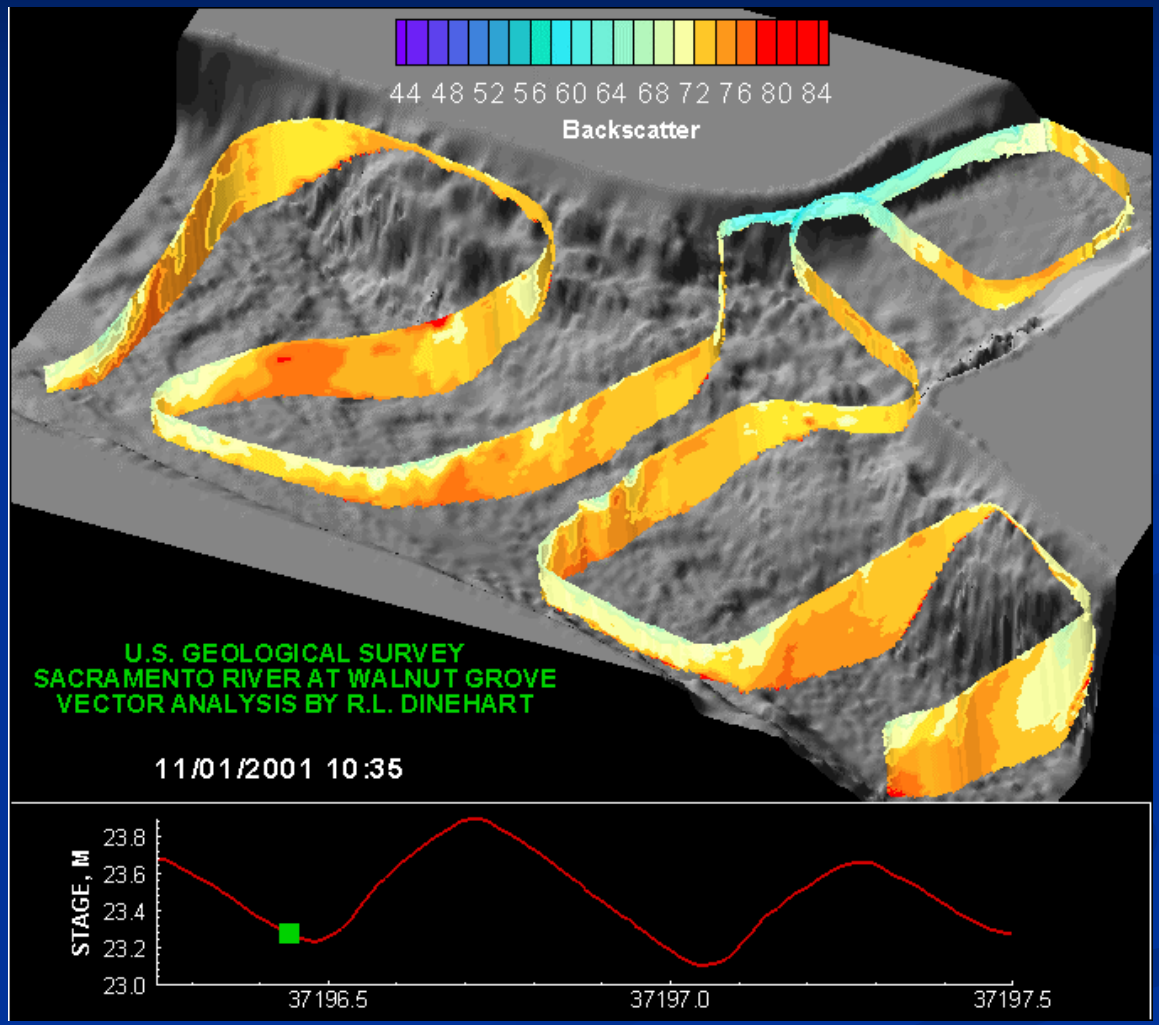
Animation of Backscatter Changes



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QA/QC Efforts to Date

- Tow Tank Tests
  - Marginal success due to limits of tow tanks

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Efforts to Date -- continued

- Discharge Comparisons
  - Broadband tests: Morlock, 1996
  - Rio Grande and RiverSurveyor tests: Mueller, 2003

Parameter	Rio Grande				RiverSurveyor	
Frequency (kHz)	1,200		600		1,500	3,000
Water Mode	1	5	1	5	N/A	N/A
Bin Size (cm)	25	5	50	10	50	25
Blank (cm)	25		25		40	20
Bottom Mode	5		5		N/A	N/A
Averaging	1 ping per profile		1 ping per profile		5-second profiles	5-second profiles




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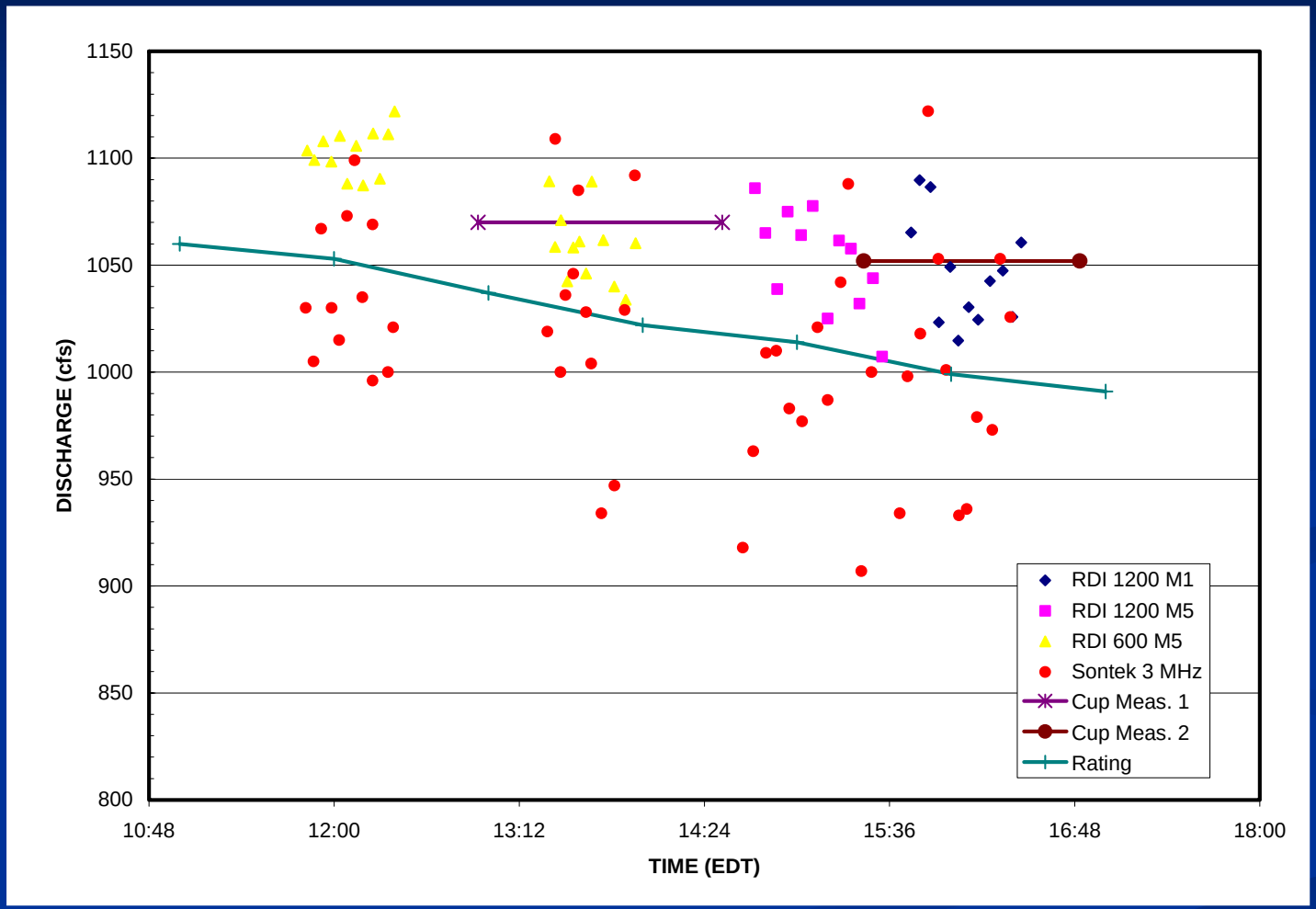
Sample Data



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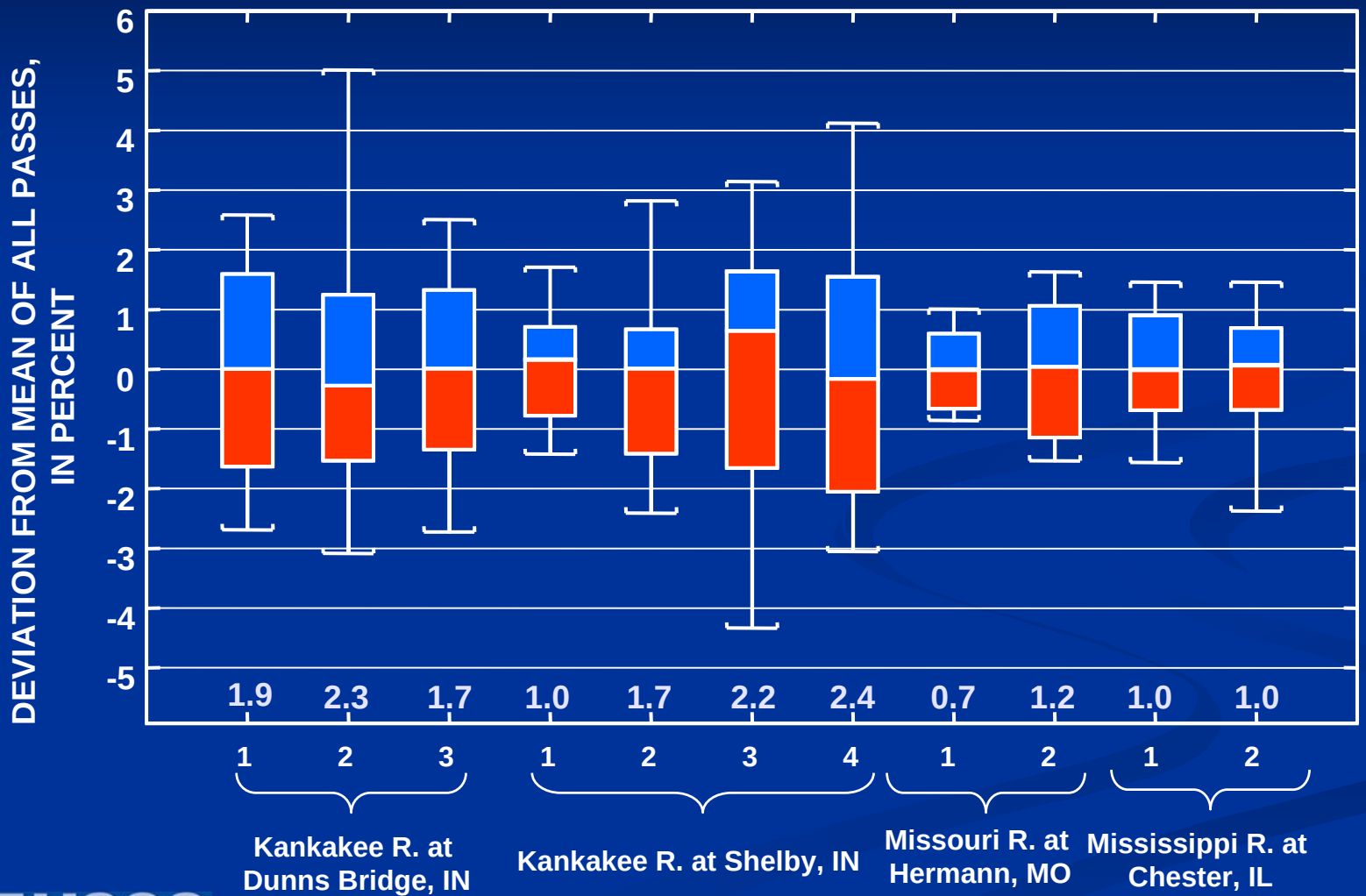
Variation in Rio Grande Meas.



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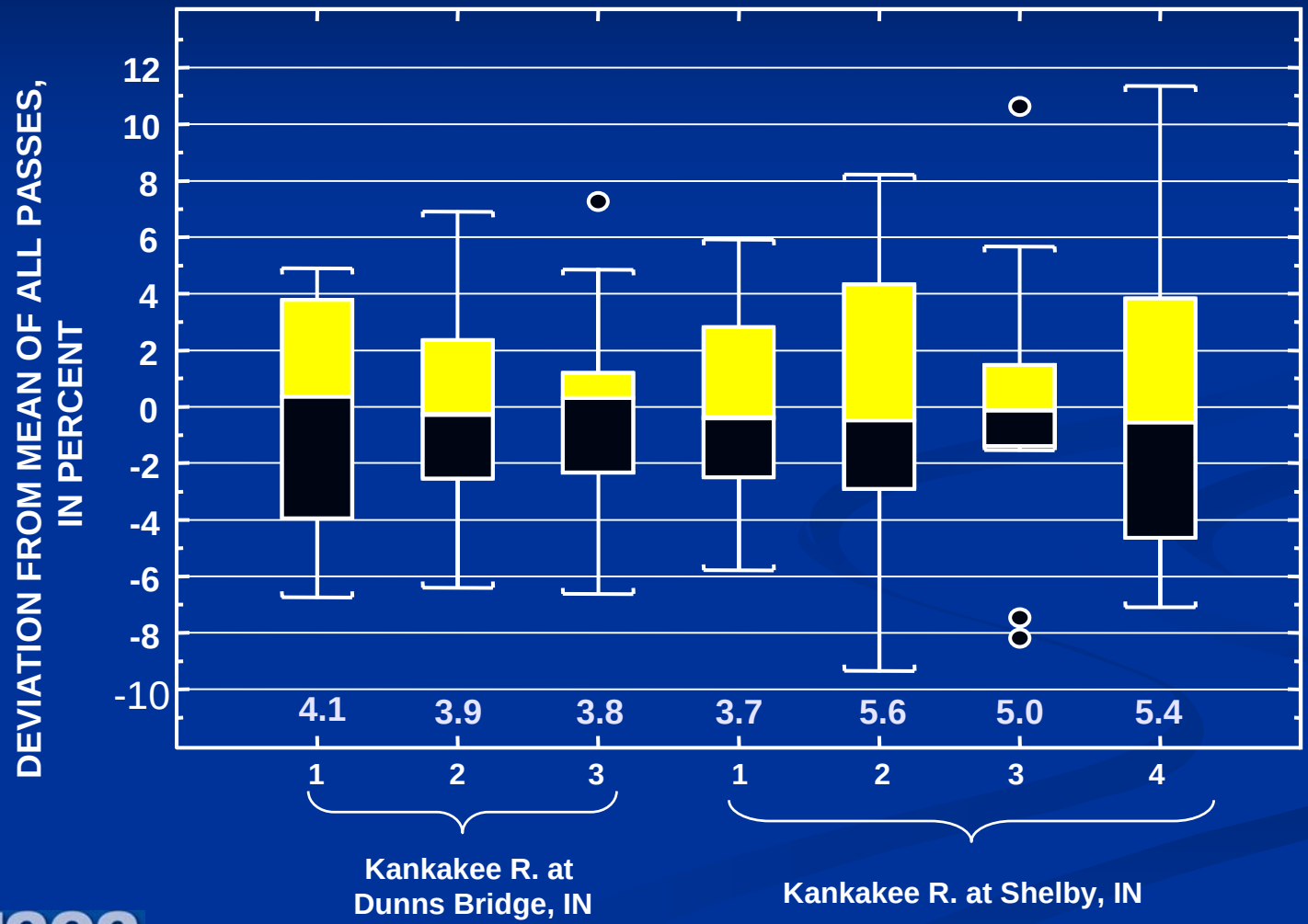
Variation in RiverSurveyor Meas.



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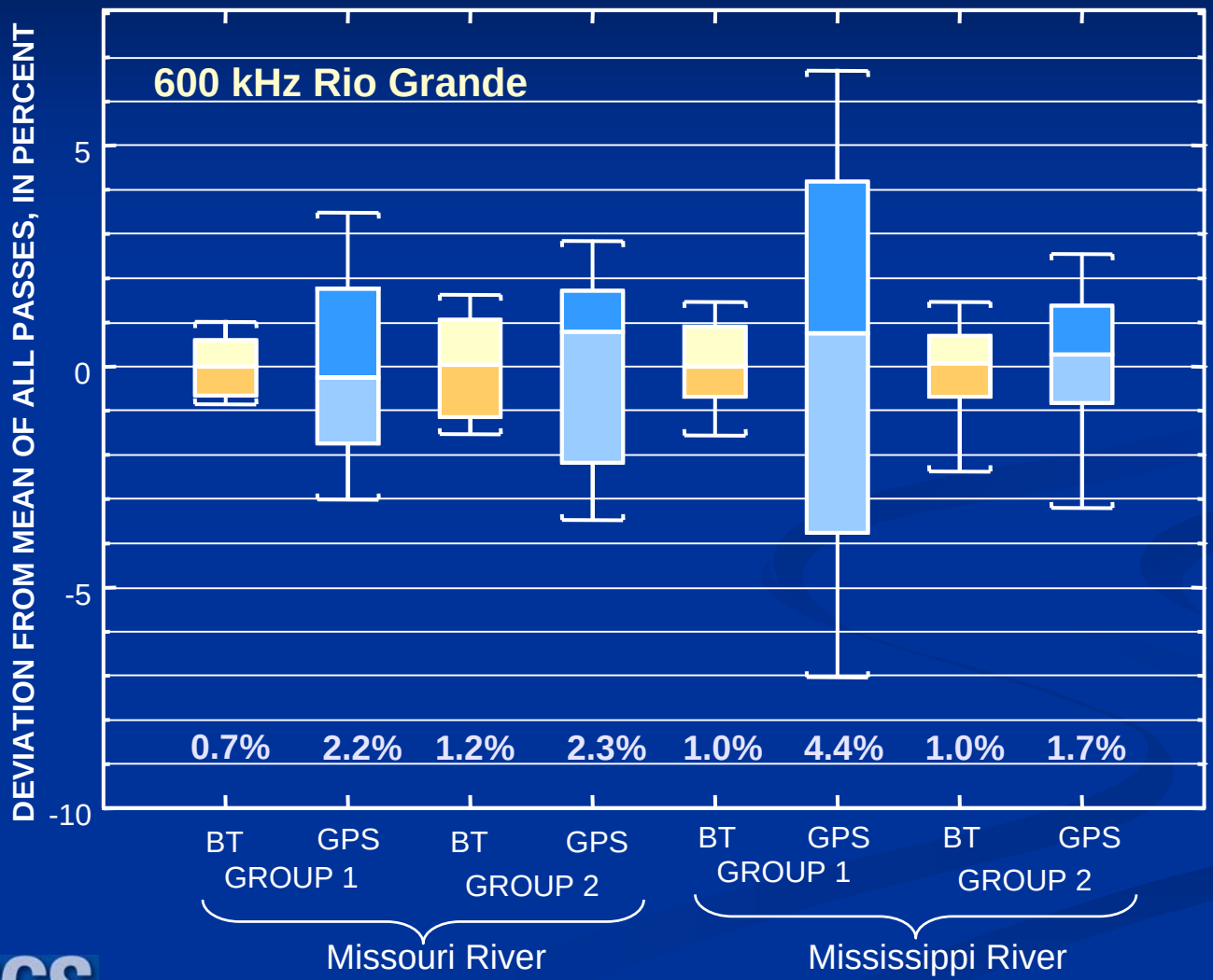
Variation in Bottom Track and GPS



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Summary of Results

- On average, all acoustic measurements were with 5% of Price AA or rating
- Higher frequency units will detect a moving bottom more often and will require use of DGPS more frequently
- COV was lower for RDI instruments
- COV was higher when using DGPS

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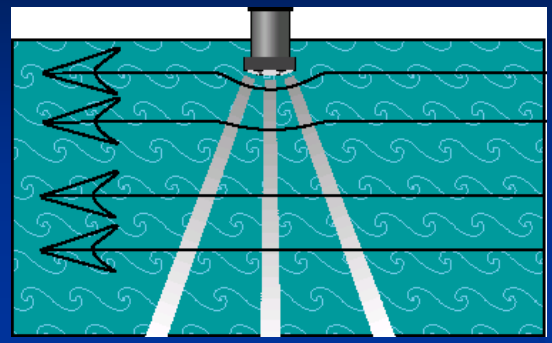
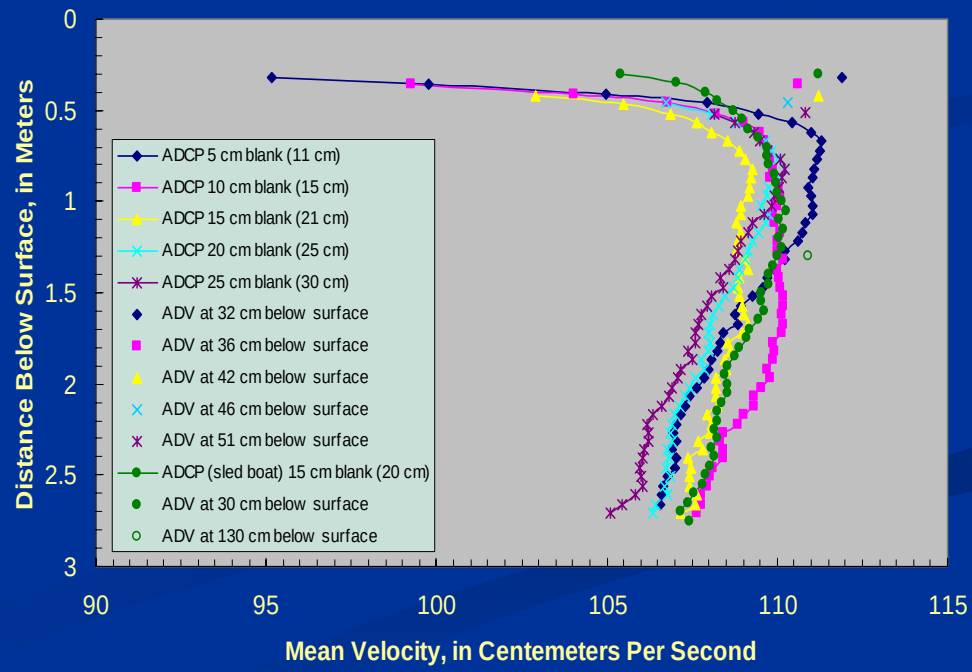
Efforts to Date -- continued

- Velocity Comparisons
  - Rio Grande: Gartner, 2002



MEAN VELOCITY PROFILES, DELTA MENDOTA CANAL, 1/24/02



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Current QA/QC Efforts

- Rio Grande Testing
  - Water Mode 11
  - Water Mode 12
  - Bottom Mode 7
- RiverSurveyor Testing
  - New Software
  - Shallow-Water Ping
  - Bottom-Track Algorithms

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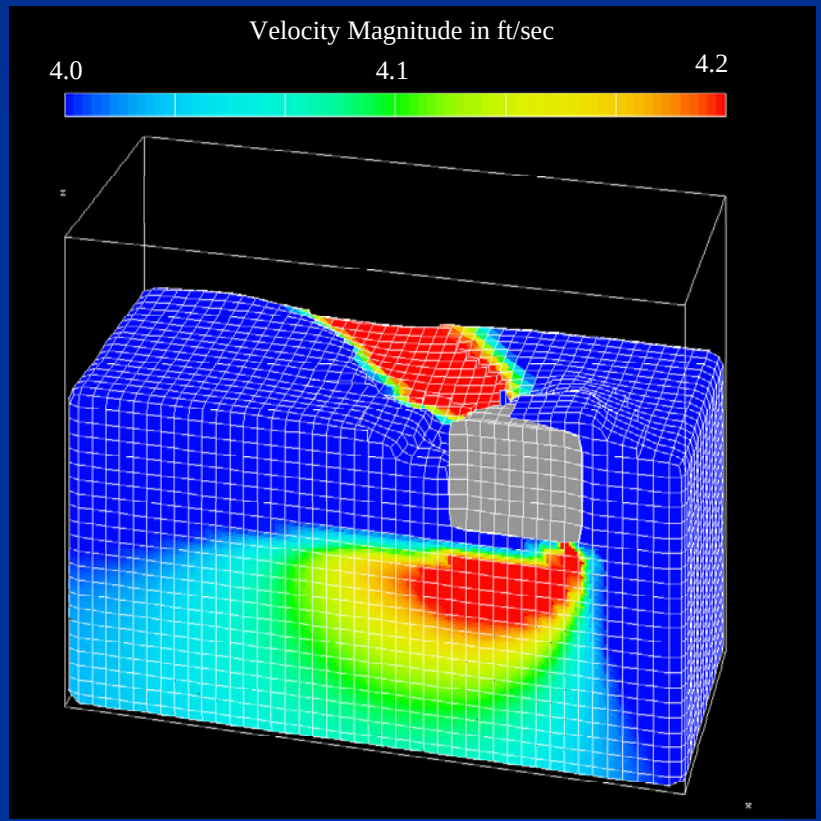
Current QA/QC Efforts

- Flow Disturbance



- Simple cylinder
- Fully-developed flow
- Approach velocity = 4 ft/s
- Flow is from right to left with a y-axis cutting plane at approximately the center of the cylinder.

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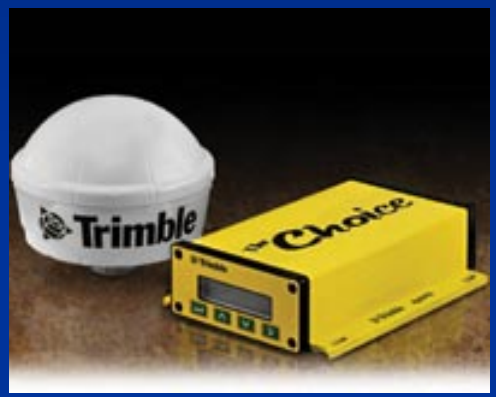
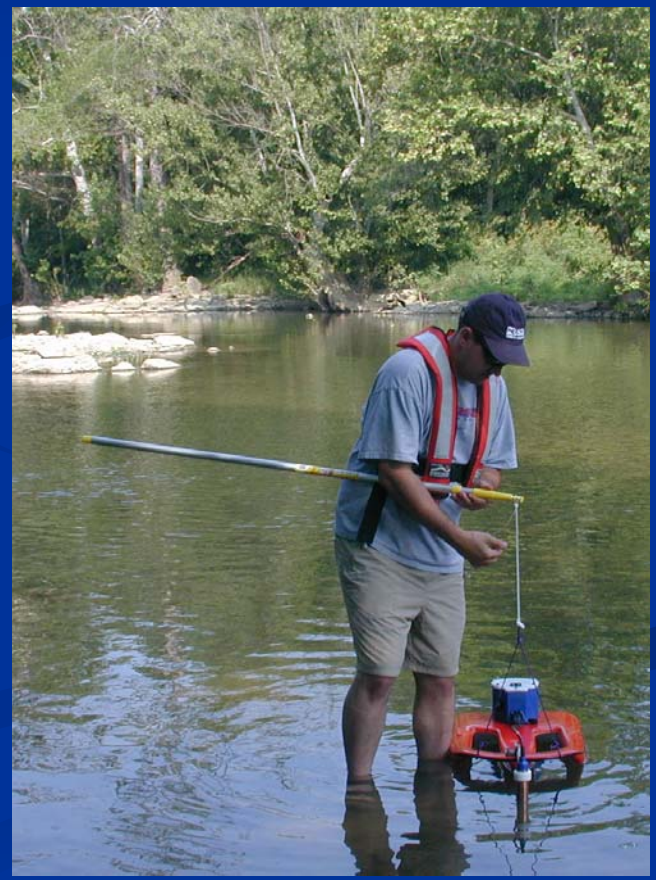
Current QA/QC Efforts

- GPS Evaluation



- StreamPro Evaluation



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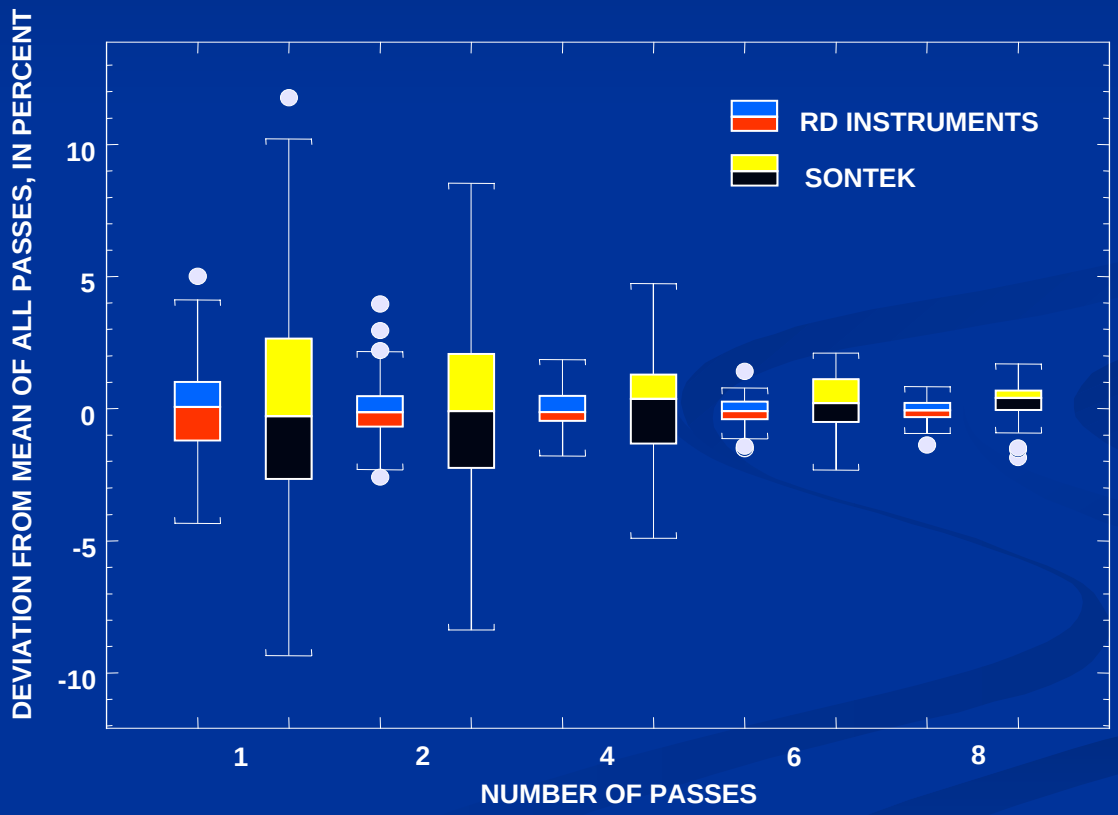
Current QA/QC Efforts

- Number of Passes



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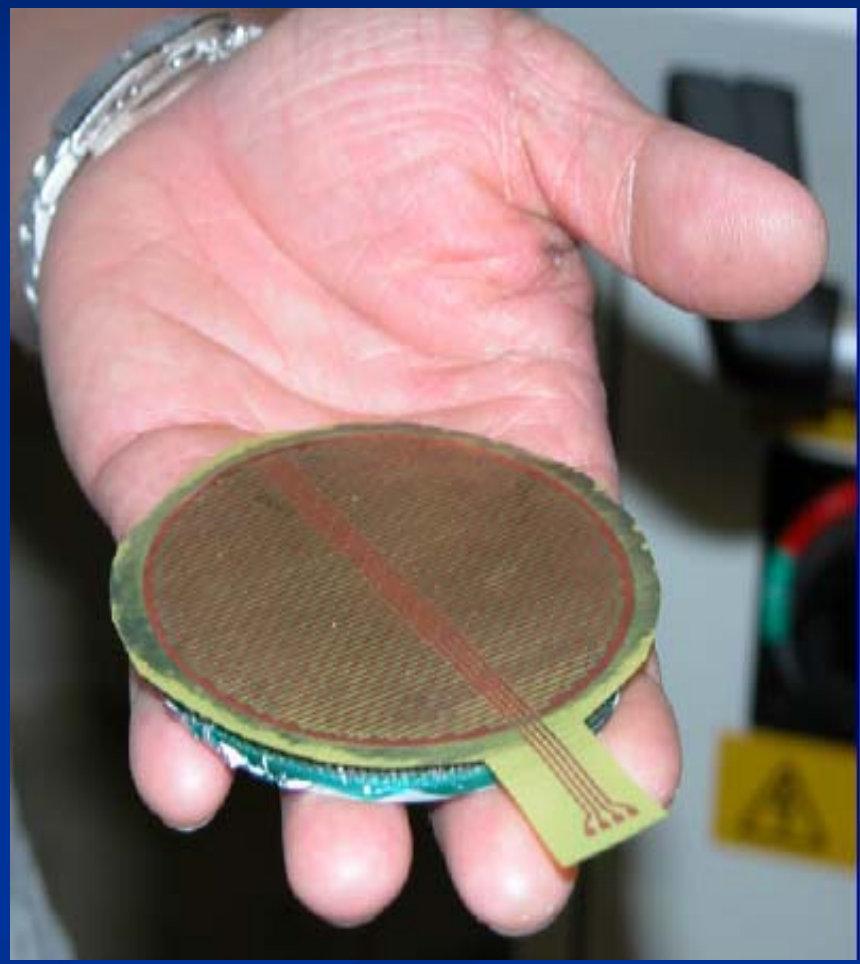
Future Developments

- Phased Array Technology
  - 2.8 inches in diameter
  - 58 x 58 elements
  - Replaces 4 individual ceramics
  - Still in development



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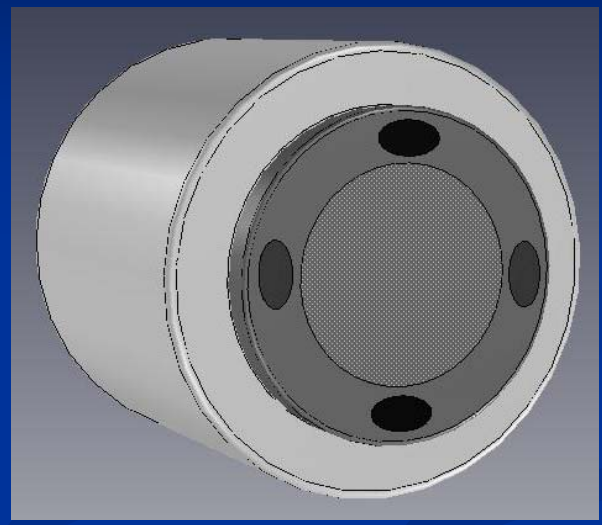
Next Generation ADCP

- Dual Frequency Operation – For shallow & deep rivers:
  - 600 kHz for accurate bottom tracking & deep water profiling
  - 2400 kHz for high resolution shallow water profiling
- Flat face for minimum flow disturbance
- 5” X 5” cylinder



Depth	Bin size	Frequency
0.3–0.6 m	5 cm	2.4 MHz
0.6–2 m	10 cm	2.4 MHz
2–50 m	10 cm (? 2 m) 40 cm (> 2 m)	Interleave 2.4 MHz & 600 kHz

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Next Generation Field Vehicle

- Great morale builder
- Great recruiting tool
- No need to maintain boats
- Built-in ADCP and computer

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