Technology and Methods Development to Support Streamgaging

ACWI
Networks Review Team
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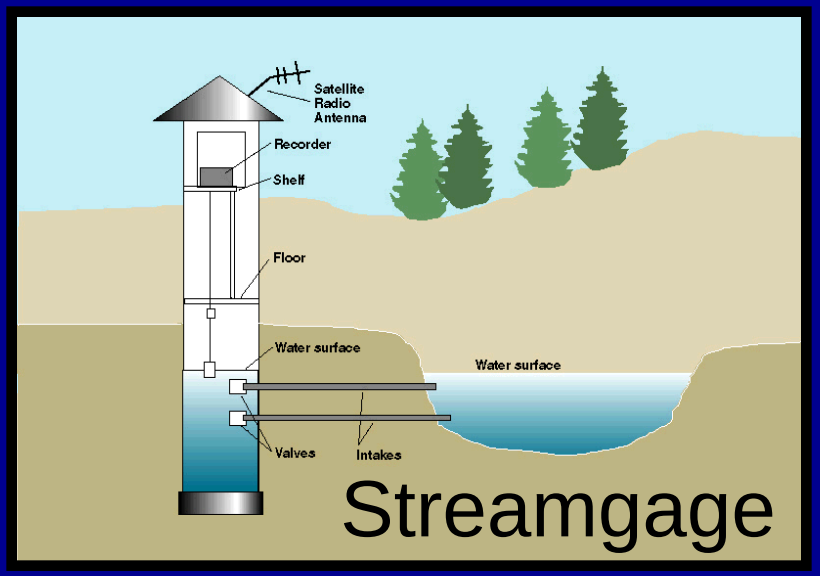
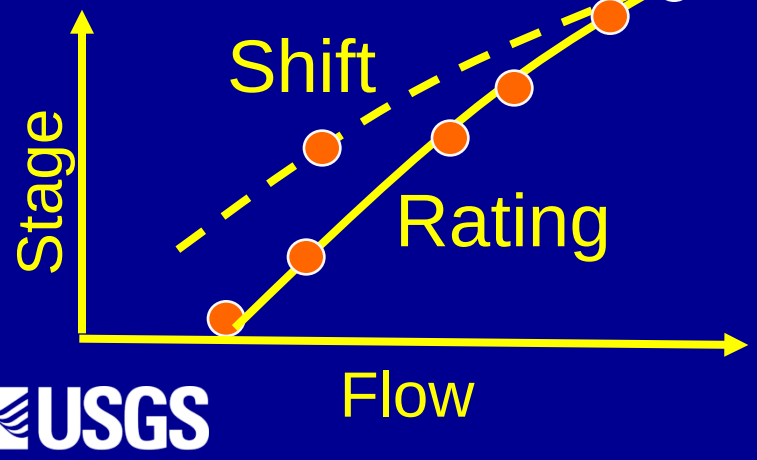
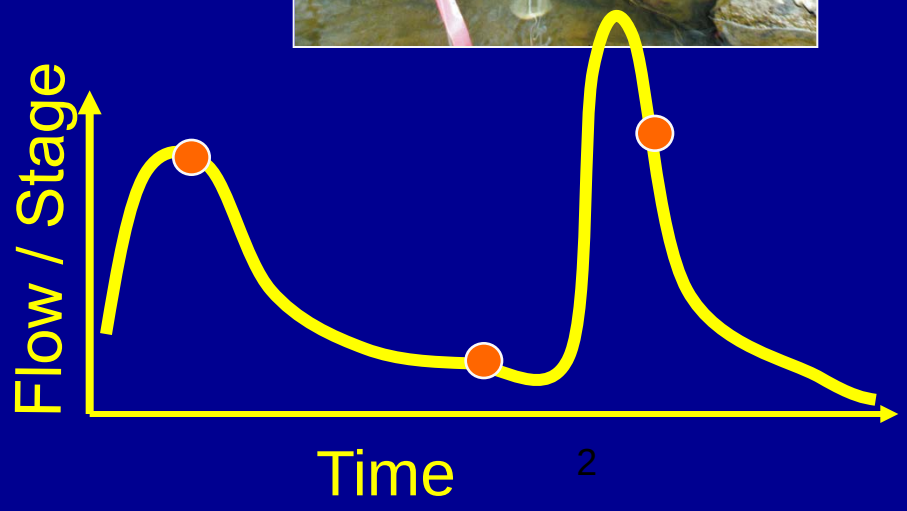
Robert Mason
USGS

The Streamgaging Process



Flow
Measurements





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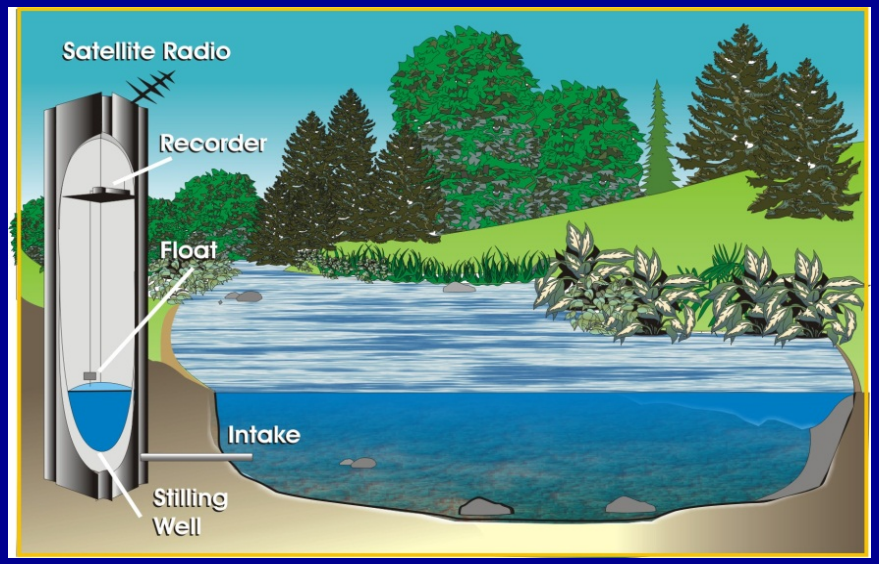
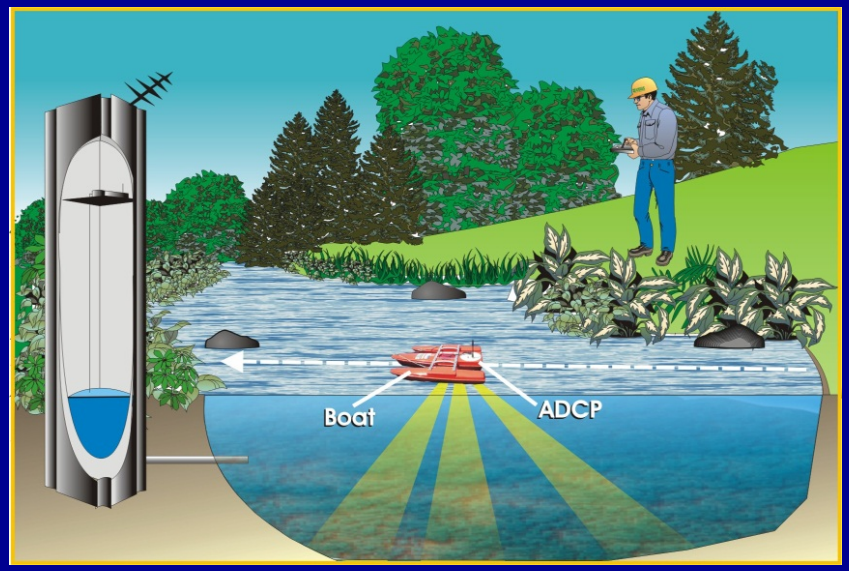
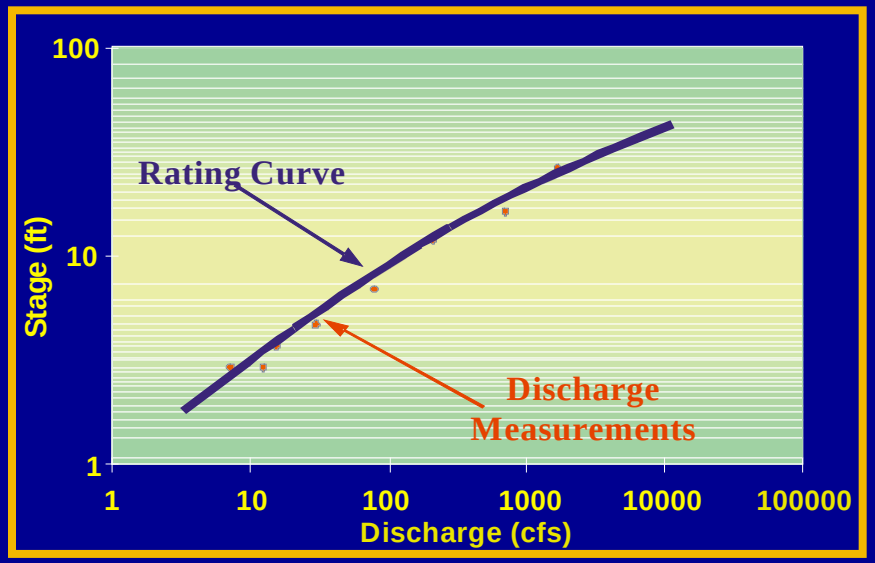
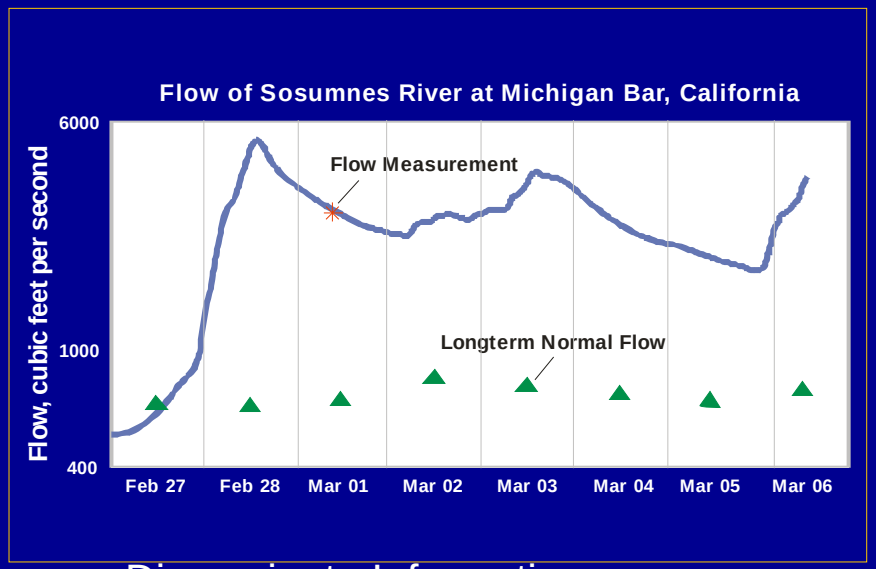
Current Streamgaging Process





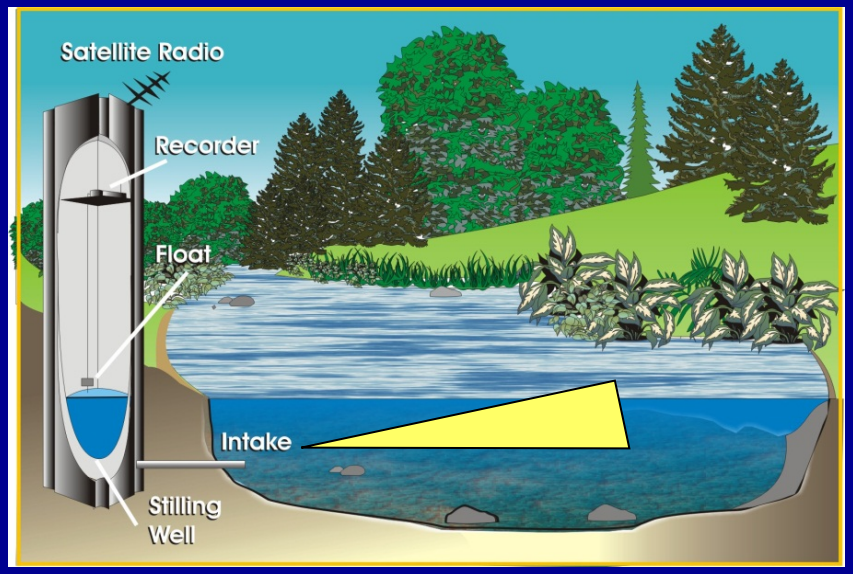


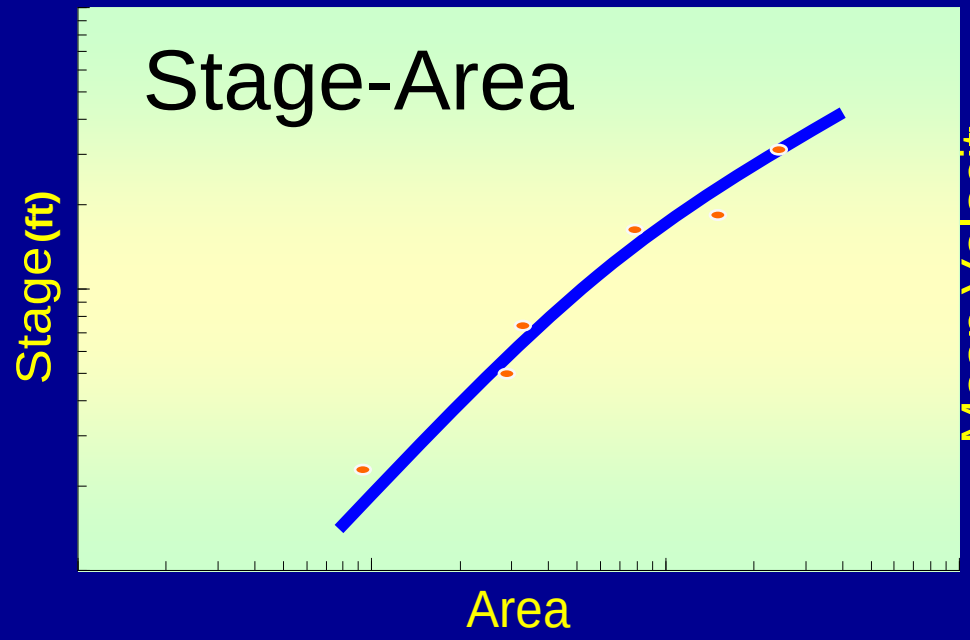
Relate Water Level to Flow

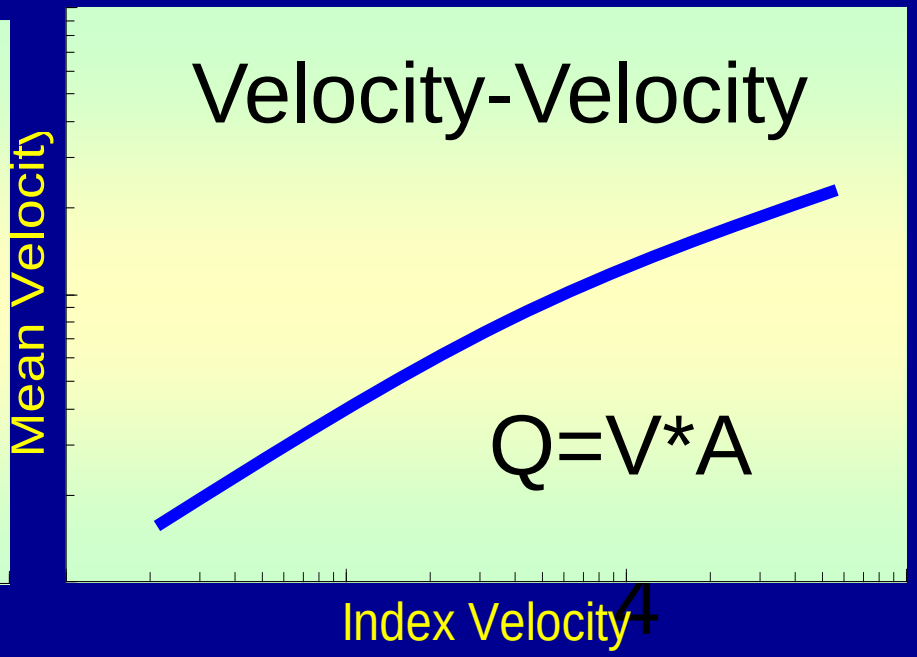


Disseminate Information

Index-Velocity Streamgaging

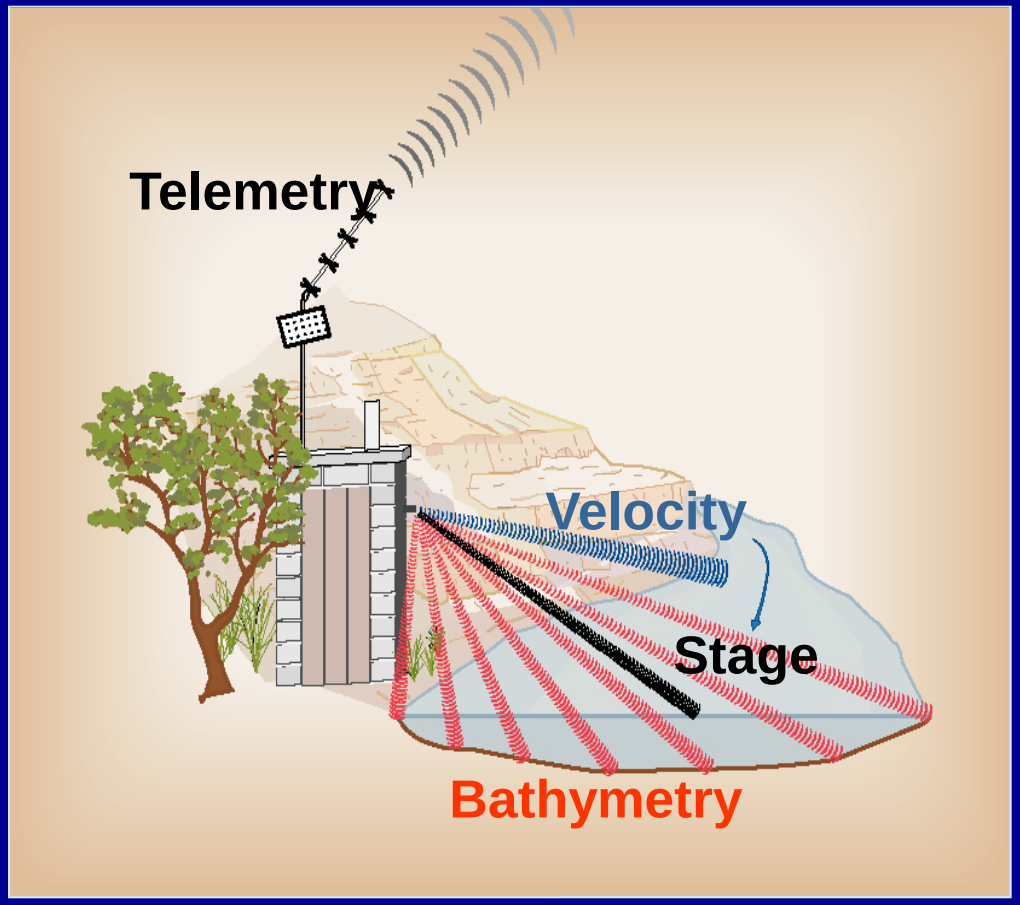






Measurement Method Improvements

Non-Contact Radar-Derived Discharge



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Remote Sensing

1. Evaluation of remote sensing technologies
   - Surface velocity from IR Imagery – Areté Associates' Airborne Remote Optical Spotlight System-Fixed (AROSS-F)
   - Example from the Colorado River, CO (Kinzel and others, 2012)
2. Computational modeling (inversion) for depth retrieval from remotely sensed data
   - Normally, we take bed elevation, discharge, roughness and solve for velocity and water-surface elevation.
   - Inverse method uses velocity and water-surface elevation to attempt to predict depth (+ Gives refined local information - Requires highly accurate data)
   - Example from the Kootenai River – (Nelson and others, 2012)

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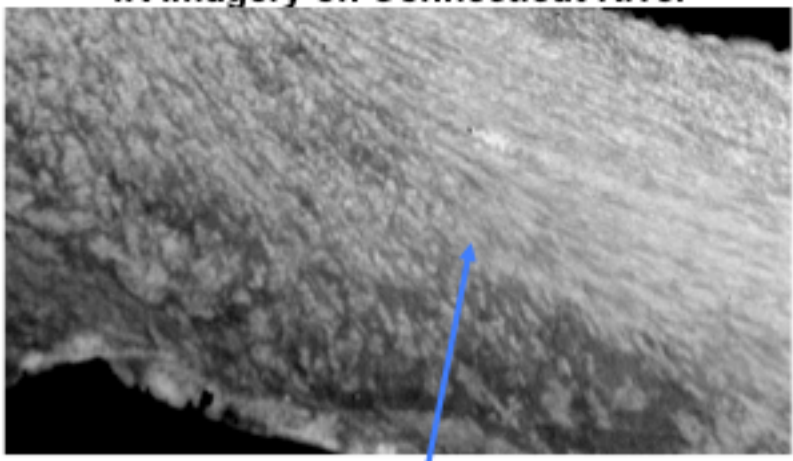
Inferring Flow Velocity and Depth from Imagery

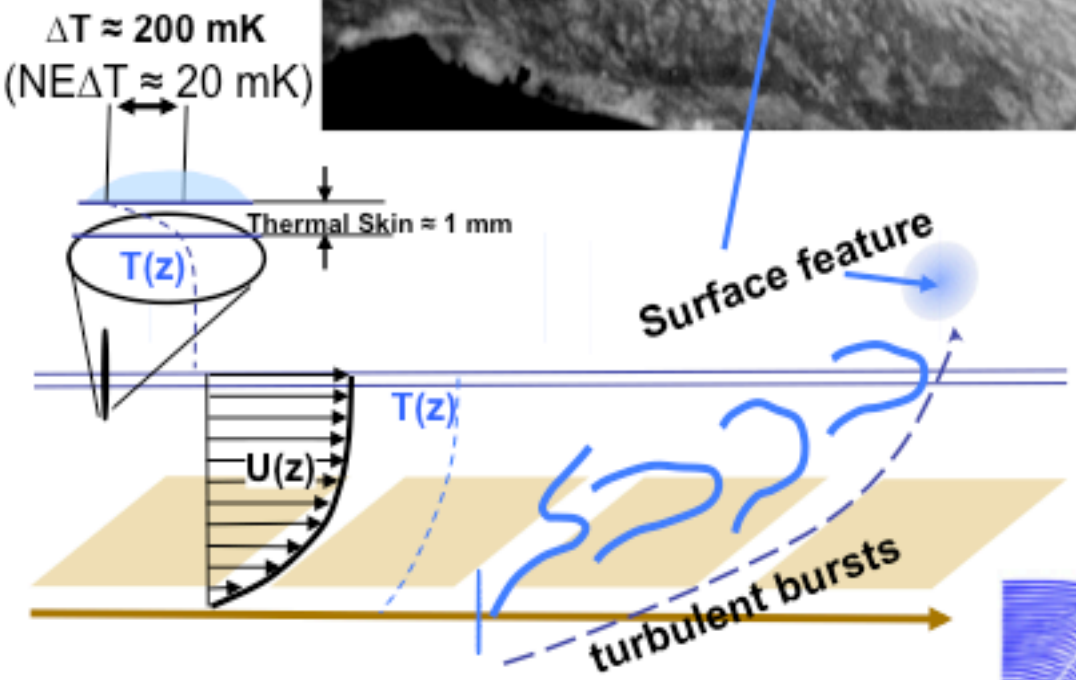
IR Imagery allows for day-night capability and higher resolution than EO

- Turbulence in river generates a surface expression that is advected along with the mean flow of the river (Taylor's hypothesis)
- Surface feature is tracked using a cross-correlation algorithm to measure current
- Requires heat flux at the thermal skin on the order of $\Delta T \sim 200$ mK
- Typical MWIR camera sensitivities (noise equivalent delta temperature, **NEΔT)** are on the order of 20 mK

See Garbe et al (2004), Zappa and Jessup (2005), Veron and Melville (2010), Chickadel et al (2011),…

IR Imagery on Connecticut River





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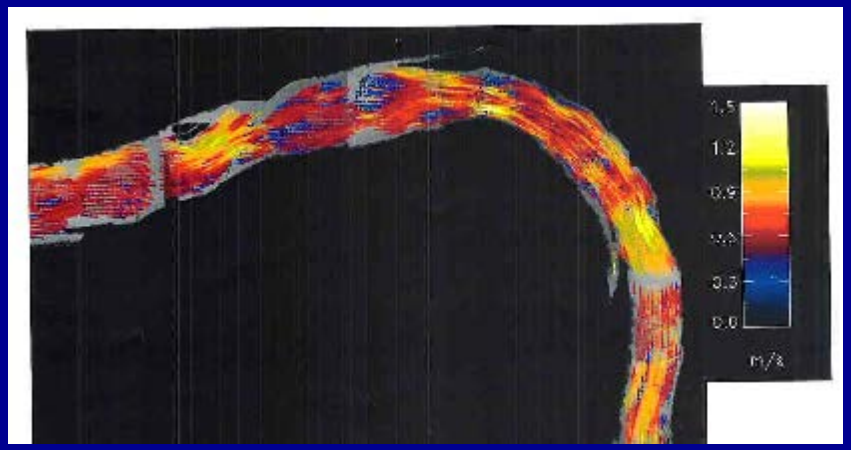
Areté Associates

Airborne Remote Optical Spotlight System (AROSS)

Figure 1. Configuration of AROSS-IR. Shown are the positioner with camera systems and the Twin Otter collection platform.



Source: Steven Anderson, Cindy Piotrowski, John Duganr, Robert DiMarcor and Seth Zuckerma, 2011, “Airborne Passive Remote Sensing of Surface Currents in Rivers and Estuaries”

References

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- Steven Anderson, Cindy Piotrowski, John Duganr, Robert DiMarcor and Seth Zuckerma, 2011, “Airborne Passive Remote Sensing of Surface Currents in Rivers and Estuaries”

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