Contaminant Observation & Management

I. Matching the embedded sensing technology to the driving questions

II. 1 step forward, 1 step back, and sidesteps...

III. Surprises (good and bad)

IV. Where do we go from here?
Matching the embedded sensing technology to driving application questions

1. Relatively few technologies, but many potential questions: find a "sweet spot"

2. Recognize when you are wrong, and be poised to adapt as you learn the limits of the technology
Matching the embedded sensing technology to driving application questions

- Example: originally proposal versus final application

**Sweet spot?** – Highly uncertain distributed parameter models drive groundwater investigations…BUT few sensors ready AND groundwater operates on a large timescale…

**Adapt!** – Shallow soil domain is more dynamic, and agricultural and terrestrial ecology systems offer challenges well-suited to COTS embedded sensing technology development
1 Step forward, 1 step back, 1 step to the side  
(progress, corrective actions & new dimensions)

1. When things novel things are happening, you tend to believe they are real

2. Stay scientific, and objective to recognize the limitations of technologies and move forward (or move to the side!)

3. Also recognize that the scientific paradigm may be too immature to make good use of technology
1 Steps forward, 1 step back, 1 step to the side
(progress, corrective actions & new dimensions)

Great application sweet spot followed by early success in the lab with conducting polymers PVC (electrochemical)

In situ soil deployments difficult to manage and consistently ambiguous data output

Shift focus to river applications and sensor duty cycle management
1. We initially proposed sensors everywhere, all the time
2. Surprise: Mobility can put sensors everywhere some of the time, then put a few sensors in key locations all of the time (multiscale sensing)
Surprises happen

Beginning with novel javelin platform and traditional river monitoring station, enabling but sometimes failed to overcome heterogeneity issues.

Adding mobility to the mix led to multi-scale aquatic sensing systems – enabling reach scale habitat assessments with unsurpassed precision.
Where do we go from here?

1. How does the local view jibe with larger scales (those of interest to resource managers)?

2. Pixels and the life inside them: fusing imagery and embedded sensing
Managed wetland demo: linking hydrologic manipulations to moist-soil plant community structure

Key species seed production

May 2006

June 2007
Where do we go from here?

Moving to freshwater aquatic systems with high resolution remote sensing coupled to imagers and embedded sensors

Suspended solids in mixing zone
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- Matching the embedded sensing technology to the driving questions
  - Find a problem interesting to both sides
- \textit{I Steps forward, I step back, and don’t forget to sidestep!}
  - Successes and failures both reveal opportunities
- \textbf{Where do we go from here?}
  - Up-scaling to achieve “bigger picture” impact