Title
Networked Infomechanical Systems (NIMS)

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Networked Infomechanical Systems (NIMS)

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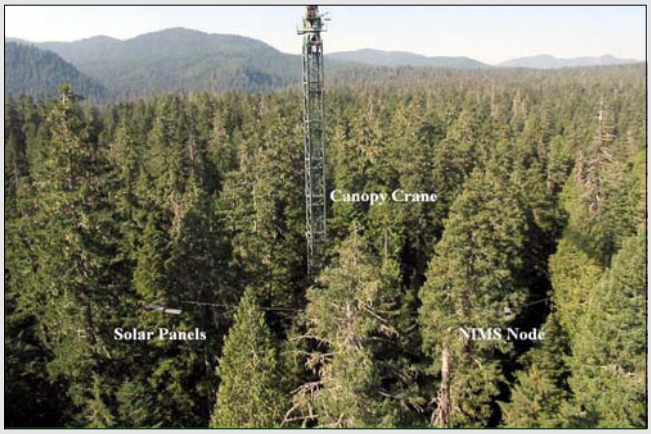
Introduction: Robotic Networked Wireless Sensing for Environmental Monitoring

- **New Requirements**
  - Measurement and detection in complex environments
  - Sampling of air, water, and soil.
  - Coverage of large spatial and temporal scales
- **Fundamental Challenges**
  - Unpredictable and large sensing uncertainty
  - Limited energy and operating lifetime
- **Research Goals**
  - Enable Sensor Diversity and Coordinated Mobility for *self-awareness* of sensing uncertainty and autonomous adaptation to maximize sensing fidelity.
- **Application Goals**
  - Distributed sensing in Natural and Civil Environments
- **Education Goals**
  - High School, Undergraduate, and Graduate programs

Solutions: NIMS Nodes and Infrastructure

Horizontal and Vertical Transport

Deployment at the Wind River Canopy Crane Research Facility



NIMS Prototype

Information Technology Research, Applications, and Education

Information Technology Research

- **Information Theory Foundations**
  - Hierarchical *System Ecology* of fixed and mobile nodes with infrastructure.
- **Sensor Diversity**
  - Diversity in sensor node location, orientation, and sensor type.
  - Enables distributed mapping of sensing uncertainty.
  - Enables distributed calibration of sensing channel
- **Coordinated Mobility**
  - Physical transport of nodes and modification of infrastructure.
  - Enables proactive methods for reducing sensing uncertainty through optimized diversity and sampling.
  - Enables reactive methods that bring optimized sensing resources to bear.
- **NIMS Tools**
  - NIMS System emulation
  - NIMS System Operation Authoring

Environmental Science And Public Health

- **Natural Environment**
  - Fundamental studies of ecosystems
  - Focus on meteorology, phenology, carbon budget, global change indicators
  - Sensing, imaging, and spectroscopy.
  - Sampling of atmosphere, water.
- **Public Health Environment**
  - Constantly vigilant monitoring and distributed detection of pathogens
  - Focus on coastal wetlands and urban water resources

Education Programs

- **Undergraduate and Graduate Courses**
  - Embedded Computing
  - Sensing and Imaging
  - Networked Robotic Systems
- **Undergraduate Research Programs**
  - Multidisciplinary undergraduate research teams
- **Grade 7-12 Education Programs**
  - Engage student and teacher communities in science and engineering
  - Real-time, remote Web access to active, controllable NIMS systems