

# Enhancing Access to the Radio Spectrum (EARS)

*Impacting the Wireless-Enabled Economy  
through NSF-Sponsored Research*

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## NSF-sponsored Research Benefits the Radio Spectrum and the Economy

- NSF funds a wide variety of engineering, scientific, and economics research directly related to wireless technology and policy
  - > Wireless networks, RF hardware, propagation, auction and market theory, antennas, security & encryption, policy and standards, etc.
- Approximate direct investment is \$64 million per year
  - > \$700 million over past 11 years
- The results of past research have been incorporated in a large number of highly successful applications:
  - > 802.11 and 802.16 (Wi-Fi and WiMAX), 911 cell phone location technology, explosives and biohazard detection, ground-penetrating radar, digital TV, adaptive antennas, SDR/CR...
- Research in spectrum access has critical economic impact
  - > goods and services enabled by the radio spectrum is estimated to be 5 – 10% of the U.S. economy, or approximately \$700 billion – \$1.4 trillion annually

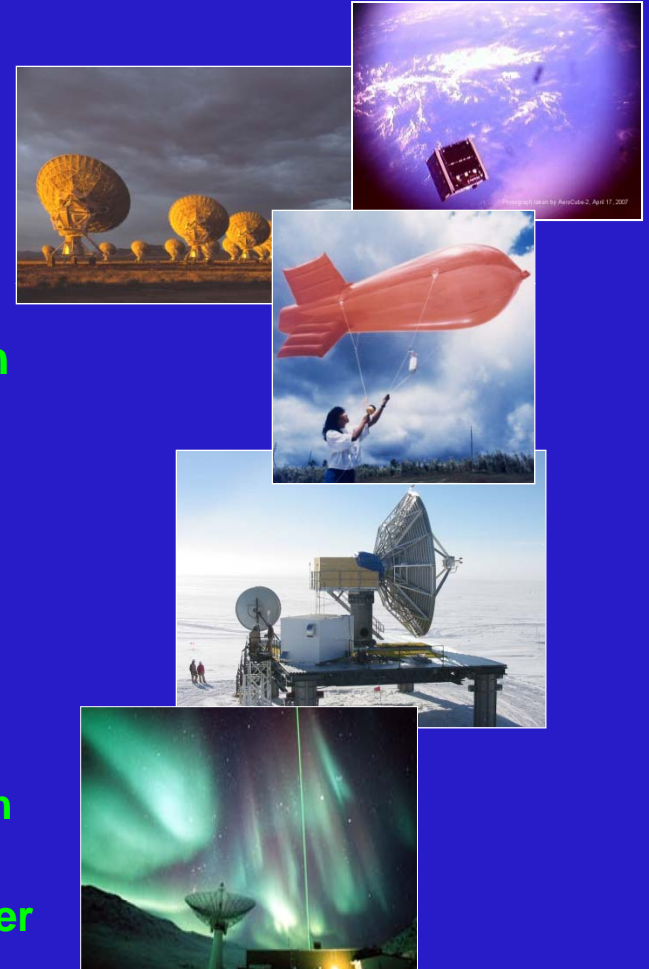




# Radio Spectrum

## Benefiting NSF-sponsored Research

- **NSF grantees and facilities rely on access to the radio spectrum for a large variety of scientific research**
  - > Radio & radar astronomy
  - > Remote sensing
  - > Meteorology
  - > Atmospheric science
  - > Ionospheric research
  - > Space weather modeling and prediction
  - > Oceanographic research
  - > Arctic/Antarctic science and logistics
  - > Cyber-networking
  - > Satellites
  - > Many others
- **Major spectrum-reliant NSF centers:**
  - > National Center for Atmospheric Research
  - > National Radio Astronomy Observatory
  - > National Astronomy and Ionosphere Center



## Enhancing Access to the Radio Spectrum (EARS): A potential NSF initiative

- NSF is uniquely poised to develop a coordinated, cross-cutting, and focused research initiative on topics that will improve the future of radio spectrum access and management
  - > Historically, funding for spectrum-related research has been spread across multiple directorates, with no unified goals or objectives beyond those of the individual programs
- Enhancing spectrum efficiency will allow more applications to co-exist within a fixed amount of radio spectrum
  - > With wireless becoming bigger than the automobile and agriculture industries, the potential economic impact is akin to finding ways to substantially increase average gas mileage or to significantly increase crop yield
- Enhancing spectrum efficiency is a major common objective across all sectors of the wireless telecom industry, including commercial, government, private, and scientific sectors





# EARS Background & Status

- **Workshop goals:**
  - > Develop a vision for future spectrum access that accommodates anticipated uses and demand
  - > Establish a prioritized and time-ordered list of research priorities that can help achieve that vision
- EARS concept has been under consideration since 2007
- Cross-directorate funding has been obtained to sponsor an invitational workshop bringing together the nation's leaders in spectrum-related science, engineering, and economics research
- The workshop will include observers from significant government and private-sector stakeholders
  - > NTIA, FCC, DoD, OSTP, NIST, NASA, DHS, FAA, DOJ, others
  - > IEEE, TIA, ANSI, CTIA, PCIA, other trade and standards bodies

# EARS Workshop Personnel

- **PIs & Co-PI:**
  - > Prof. Jennifer Bernhard, University of Illinois, PI
  - > Prof. Jeff Reed, Virginia Tech, PI
  - > Prof. Jerry Park, Virginia Tech, co-PI
- **Steering committee**
  - > Prof. Charles Clancy, U. Maryland
  - > Prof. Michelle Connolly, Duke University (former FCC chief economist)
  - > Prof. Rhonda Franklin, U. Minnesota
  - > Prof. Al Gasiewski, U. Colorado
  - > Mr. Bill Hayes, president, IEEE Broadcast Technology Society
  - > Prof. Ali Niknejad, Berkeley Wireless Research Center
  - > Prof. Jon Peha, Carnegie Mellon (former FCC chief technologist)
- **NSF EARS program director**
  - > Dr. Andrew Clegg



# The National Broadband Plan

- **The Plan includes recommendations to help accommodate new ways to deliver wireless services to all Americans**
  - > **Spectrum allocation and utilization reform**
  - > **Expanded economic incentives for efficient spectrum use**
  - > **Make more spectrum available for broadband**
  - > **Expand opportunities for innovative spectrum access models**
- **Through its sponsored research and its ongoing participation in regulatory bodies, NSF will play a significant role in these recommendations**





# The National Broadband Plan

## *Expanding Opportunities for Innovative Spectrum Access Models*

### *Recommendation 5.14*

- **The FCC should initiate proceedings to enhance research and development that will advance the science of spectrum access. A robust research and development pipeline is essential to ensuring that spectrum access technologies continue to evolve and improve. As described in Chapter 7, the FCC should start a rule-making proceeding to establish more flexible experimental licensing rules. Additionally, the National Science Foundation, in consultation with the FCC and NTIA, should fund wireless research and development that will advance the science of spectrum access. (emphasis added)**



# Presidential Memorandum: Unleashing the Wireless Broadband Revolution

- Released June 28, 2010
- EARS is responsive to section 3:
  - > “The Secretary of Commerce, working through NTIA, in consultation with the National Institute of Standards and Technology, National Science Foundation (NSF), the Department of Defense, the Department of Justice, NASA, and other agencies as appropriate, shall create and implement a plan to facilitate research, development, experimentation, and testing by researchers to explore innovative spectrum-sharing technologies, including those that are secure and resilient.”
- Accompanying fact sheet:
  - > “EARS ... [is] working on advanced sharing technologies for both national security and commercial applications.”



# Summary

- NSF is presently investing in spectrum-related research with a proven track record of creating economic value
- Exponentially growing demand for radio spectrum access calls for increasingly vigorous investments in research that facilitates improved spectrum efficiency and access
- NSF has been identified as the natural home to sponsor spectrum research
- The EARS concept is ideally suited to fill this role.
  - > First step is a workshop to identify key research opportunities and challenges
- Given the value of the radio spectrum, positive results from the initiative would significantly advance American competitiveness across multiple arenas and provide significant positive impact to the nation's economy



# Contact Information

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