

Enhancing Access to the Radio Spectrum (EARS)

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National Science Foundation

The National Science Foundation

- ▶ Independent Federal Government agency created in 1950 with a mission to:
 - ▶ Promote the progress of science
 - ▶ Advance the national health, prosperity, and welfare
 - ▶ Secure the national defense



NSF's headquarters in Arlington, Virginia

The National Science Foundation

- ▶ Annual budget of approximately \$7B
 - ▶ 95% goes to research funding (5% goes to operations)
 - ▶ Accounts for ~20% of all federally-supported basic research conducted by America's college and universities
- ▶ NSF-funded researchers have been awarded more than 180 Nobel prizes
- ▶ Approximately 10,000 new research grants are awarded each year, with an average duration of three years
 - ▶ Fields include math, physical sciences, engineering, computer science, economics, social sciences, biology, education
- ▶ NSF does not perform research itself or directly operate its own laboratories



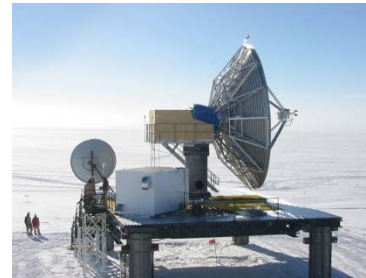
NSF as a Consumer of Radio Spectrum

- ▶ 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 & magnetospheric research
- ▶ Space weather modeling and prediction
- ▶ Oceanographic research
- ▶ Arctic/Antarctic science and logistics
- ▶ Cyber-networking
- ▶ Picosats

- ▶ Major spectrum-reliant NSF centers:

- ▶ National Center for Atmospheric Research (NCAR)
- ▶ National Radio Astronomy Observatory (NRAO)
- ▶ National Astronomy and Ionosphere Center (NAIC/Arecibo)
- ▶ National Ecological Observatory Network (NEON)



NSF as a Supplier of Spectrum Technology

- ▶ NSF funds a wide variety of research directly related to wireless technology and policies
 - ▶ Wireless networks, RF hardware, propagation, auction and market theory, antennas, security & encryption, public policy, interference mitigation, software-defined radios, dynamic spectrum access, cognitive radio systems...
- ▶ Approximate direct NSF investment in wireless research is \$700 million over the past 11 years (~\$65M per year)
 - ▶ Investments are across MPS, ENG, CISE, & SBE
- ▶ The results of NSF-funded research have been incorporated in a large number of highly successful applications
 - ▶ Wi-Fi, cell phones, E911 cell phone location technology, explosives and biohazard detection, ground-penetrating radar, GPS, digital TV, adaptive antennas, body scanners, UWB communications and imaging systems, WiMAX, the Internet...



Radio Spectrum & National Priorities

- ▶ Common themes in NBP, PM, Wi3, and pending legislation:
 - ▶ Get more people connected to broadband
 - ▶ Provide an interoperable nationwide public safety network
 - ▶ Fund spectrum-related R&D
- ▶ Radio spectrum plays a critical role in the nation's broadband goals and policies
- ▶ Broadband over the airwaves is a key driver for economic recovery and regaining America's technological leadership
- ▶ R&D that improves the way we use spectrum for all services can free up additional spectrum and have significant positive impact on the nation

Enhancing Access to the Radio Spectrum (EARS)

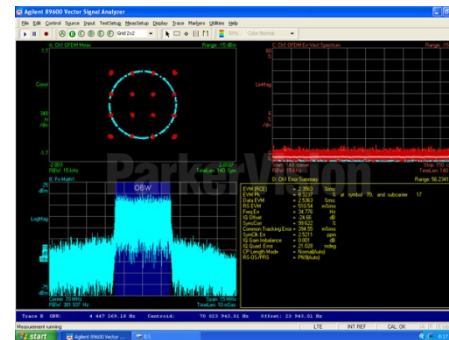
- ▶ A proposed new NSF initiative to invest in research that can improve the efficiency by which radio spectrum is used, or improve access to the radio spectrum for presently under-represented populations
- ▶ EARS will emphasize interdisciplinary research, recognizing the interplay among technology, public policy, economics, and social sciences in modern spectrum management
 - ▶ Perhaps the biggest innovation is not creating the technology of the future, but how we get there from where we are today

EARS Investment Interests

- ▶ **Several broad areas of investment interest include (but are not limited to):**
 - ▶ New interdisciplinary technology solutions that enable spectrum efficiency and enhanced spectrum access, including hardware and materials innovations, new spectrum access methods and protocols, spectrum security, and interference mitigation.
 - ▶ Innovative technologies that expand the use of the radio spectrum including millimeter-wave and THz communication systems and free-space optical communication networks.
 - ▶ Interdisciplinary research on spectrum allocation and assignment including market- and nonmarket-based methods for spectrum access and usage, economics of radio spectrum access including auctions and secondary markets.
 - ▶ Green spectrum technologies that enable energy efficient communications and radio systems with low environmental impact in fabrication and disposal.
 - ▶ Research on the social, behavioral and economic impact of wireless, including new (and potentially disruptive) technologies; physical and social networks; the adoption and use of wireless and related technologies; implications for access to educational, health and other resources; the impact of wireless and continuous monitoring on social and economic interactions of individuals, groups and organizations; the creation and impact of public policies and regulations around wireless allocation and use.
 - ▶ Transitional support for legacy systems and policies

EARS Benefits to Research Community

- ▶ Provide significant new funding for spectrum-related research
- ▶ Help facilitate and fund unique research collaborations
- ▶ Fund academic/small business technology transfer
- ▶ Sponsor workshops and challenges
- ▶ Provide testbed opportunities to validate proofs of concept, interoperability, and compatibility



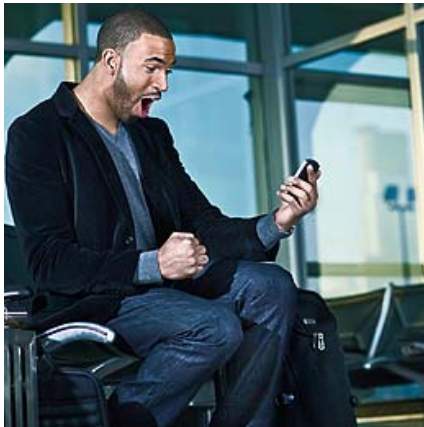
EARS Benefits to the Wireless Industry

- ▶ Invest in high-risk/high-reward research
- ▶ Invest in research that can benefit multiple sectors of the wireless industry
- ▶ Encourage practical research perspectives that take into account realistic economic and regulatory scenarios
- ▶ Provide funding for collaborative small business/academic research
- ▶ Provide funding for graduate students and postdocs who will become the technology leaders of tomorrow



EARS Benefits to the Public

- ▶ Find ways to free up spectrum for new and innovative wireless services
- ▶ Improve access to the radio spectrum for traditionally under-represented groups (for example, rural areas)
- ▶ Improve public safety, homeland security, and national defense



EARS Funding

- ▶ All future Federal Government funding is very uncertain, but there are three possible EARS funding sources:
 - ▶ EARS under pending legislation
 - ▶ EARS in NSF appropriated budget
 - ▶ Relatively small investment (\$15M)
 - ▶ Could be used to fund exploratory and seed research
 - ▶ Subject to Congressional appropriations process
 - ▶ **EARS Small Business Technology Transfer competition**
 - ▶ **Proposal deadline in 16 days**

EARS Small Business Technology Transfer (STTR) Competition

- ▶ NSF has issued an STTR solicitation that parallels the goals of the EARS initiative
 - ▶ STTR funds cutting-edge, high risk, high quality scientific, engineering, or science and engineering education research that would have a high potential economic payoff if the research is successful.
- ▶ Solicitation available now (NSF 11-561)
 - ▶ Deadline **December 16, 2011**
 - ▶ Phase I: Up to \$150K for one year for provide evidence of a commercially viable product, process, device, or system
 - ▶ Phase II: Follow-on to Phase I, provides up to \$500K for up to two years
- ▶ http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503661
 - ▶ Or just search for “EARS STTR” from the NSF home page



How to Take Advantage of EARS Funding Opportunities

- ▶ One or more solicitations for the EARS program will be issued in FY12
 - ▶ Solicitations will provide details of topic areas, as well as lots of administrative detail on how and when to apply
- ▶ A separate solicitation for the EARS Small Business Technology Transfer (STTR) competition is available now, with a deadline of **December 16, 2011**
- ▶ Please monitor the EARS Web page (tinyurl.com/nsfears)

Summary

- ▶ Radio spectrum and the perceived lack thereof has become a national priority as a facilitator of broadband and public safety services
- ▶ NSF is in a unique position to play a role in meeting national goals and objectives
- ▶ The EARS program will provide opportunities to academic and small business researchers to create innovative new spectrum technologies and policies
- ▶ Results from EARS research will benefit all spectrum users
- ▶ Your feedback on the EARS program is always welcome



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