The Research Triangle Nanotechnology Network

Nanotechnology Hub in an Innovation Ecosystem

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

Duke UNIVERSITY

NC STATE UNIVERSITY

Executive Committee

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Nan Jokerst (Duke)

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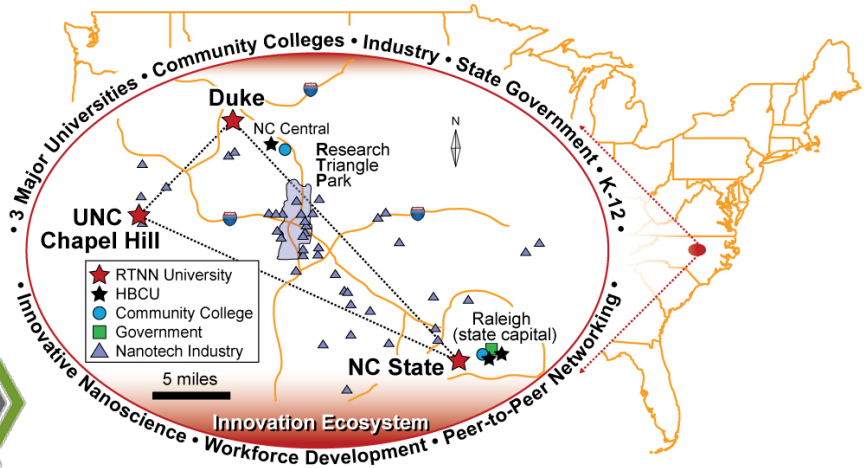
David Berube (NC State)

Mark Walters (Duke)

Phil Barletta (NC State)

Carrie Donley (UNC)

Maude Cuchiara (NC State)



NIH NIEHS

RTI INTERNATIONAL

IBM

GE Aviation

Triangle Women in STEM

phononic

DURHAM TECH

National Nanotechnology Coordinated Infrastructure

NSF

RTNN

North Carolina Central University Founded 1910

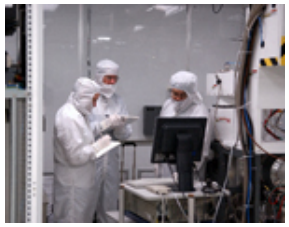
COIN The North Carolina Center of Innovation Network

RTNN Site Overview and Goals

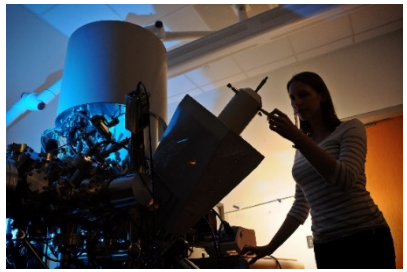
>200 Tools, >45 technical staff, and >100 principal faculty

SMiF

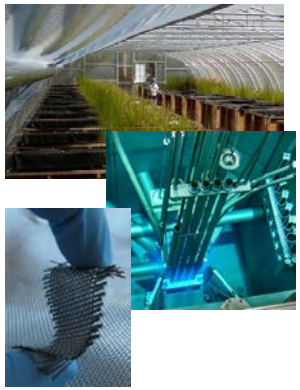
AIF analytical instrumentation facility



NNF



CHANL INSTRUMENTATION LABORATORY



RTNN RESEARCH TRIANGLE NANOTECHNOLOGY NETWORK

Distinguishing Goals of the RTNN:

1. ***Dramatically enhance access*** to nanotechnology facilities by lowering barriers e.g. **awareness, cost, and distance**
2. ***Develop innovative programs*** for building the user base, education, outreach, and workforce training
3. ***Conduct deep assessment*** of the user base and programs to institutionalize effective programs and drive change

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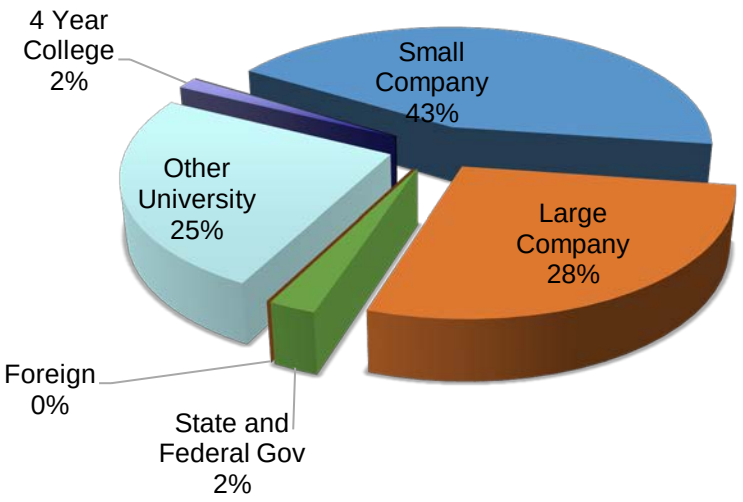
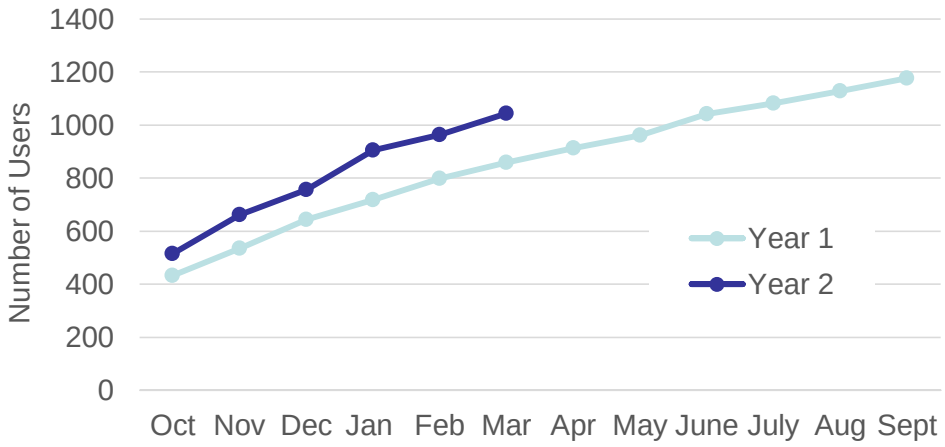
RTNN User Statistics

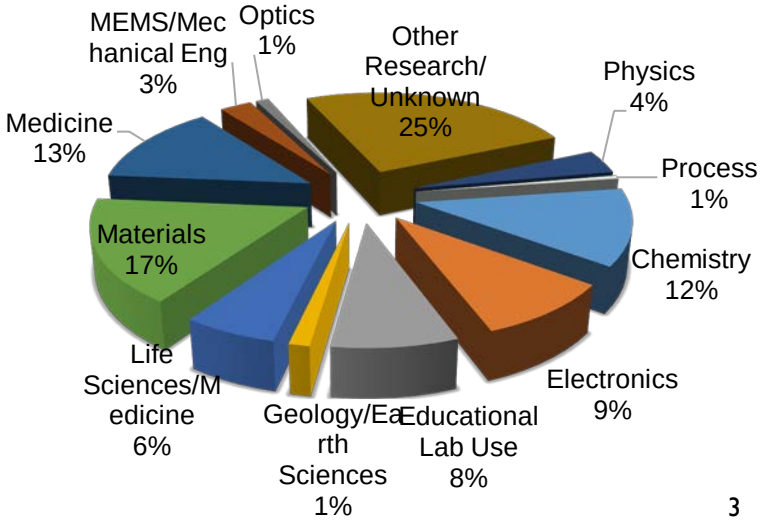
Yearly User Data Comparison		
	Year 1 (12 months)	**Year 2 (6 months)**
Total Users	1,177	1,043
Internal Users	975	838
External Users	202 (17%)	205 (20%)
Total Hours	53,044	24,944
Internal Hours	46,908	20,605
External Hours	6,136 (10%)	4,339 (20%)
Average Monthly Users	395	432
Average External Monthly Users	50 (13%)	64 (10%)
New Users	433	324
New External Users	71 (16%)	40 (12%)

External Users, Year 2





All Users,Year 2



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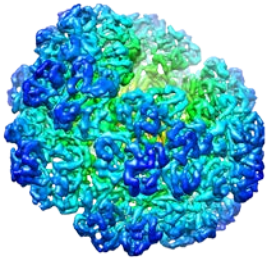
RTNN Upgrades and New Tool Capabilities

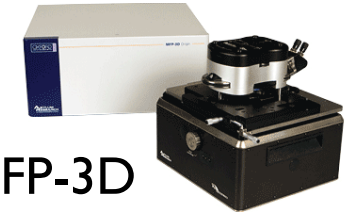
18 new tools since RTNN start – Year 2 highlights include:

Ultratech Fiji 200Gen 2 Plasma ALD system

FEI Titan Krios Cryo-TEM, for 2-D and 3-D molecular imaging



E-beam evaporator for low base pressures (~10^{-8} torr)



Asylum MFP-3D Classic Atomic Force Microscope

New MRI awarded ('17) for FEI Talos cryo-stage TEM

Horiba XploRA PLUS Micro-Raman Confocal Microscope

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RTNN Research Highlights

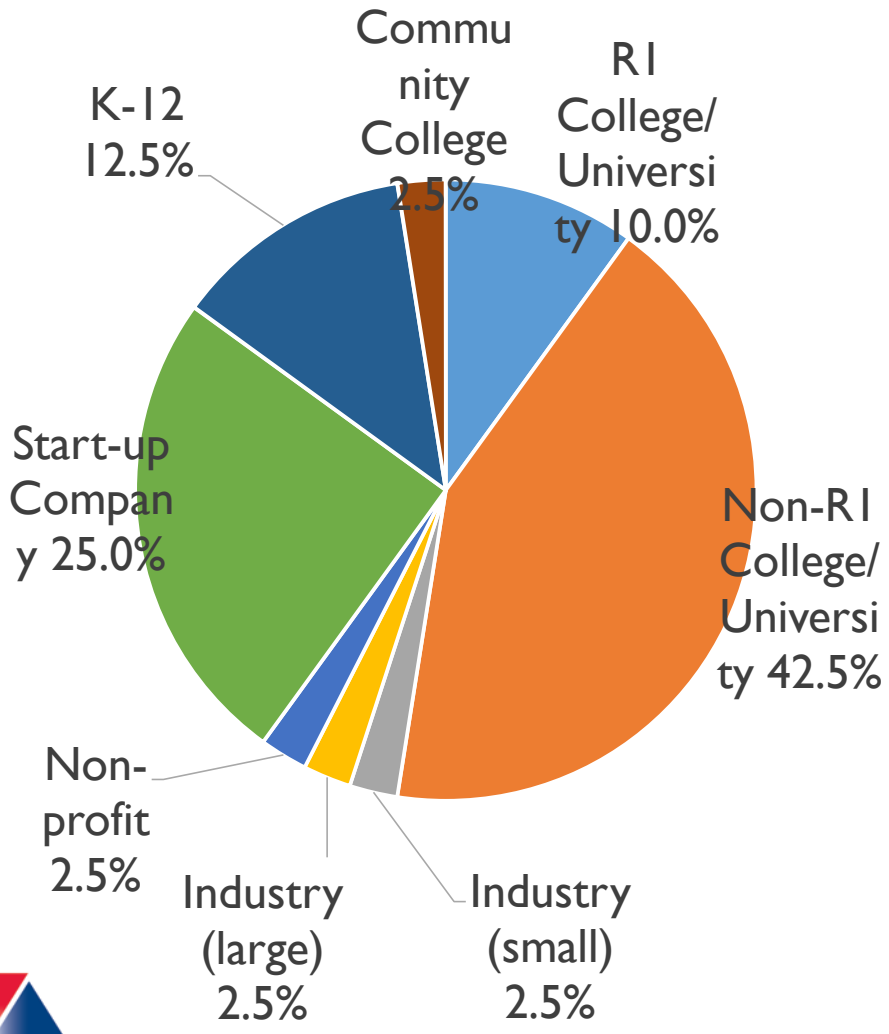
Research Enabled through the Kickstarter Program

Program provides "free" time on nanotech tools for ***new and non-traditional users***

Addresses **cost** and other barriers

40 projects selected to date (>800 hours of use)

Many participants have returned with own financial support



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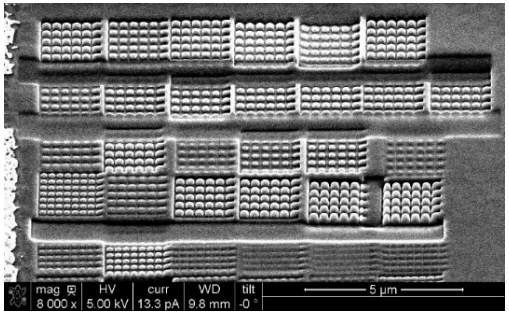
RTNN Research Highlights

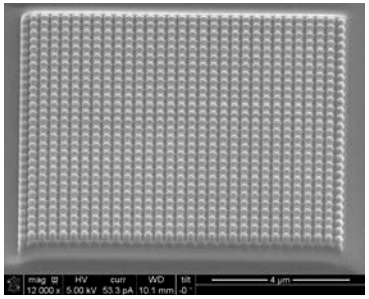
Research Enabled through the Kickstarter Program

Smart Material Solutions

- Developed technique called nanocoining
- Enables anti-reflective and self-cleaning surfaces
- Outcome: received Phase II SBIR funding



Test patterns cut into diamond stamp during optimization process



Final stamping die, 10 x 10 µm with 320 nm pitch

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Images courtesy of Dr. Stephen Furst, Founder and President

RTNN Research Highlights

Research Enabled through the Kickstarter Program

North Carolina Central University
Founded 1910

"Photocatalytic Hybrid Nanomaterials for Water Remediation"

Multiwall carbon nanotubes with titanium dioxide

Upon UV exposure hybrid materials remove 90-95% of model chemical

Dispersion and structure studied using SEM and TEM, critical to graduate student thesis

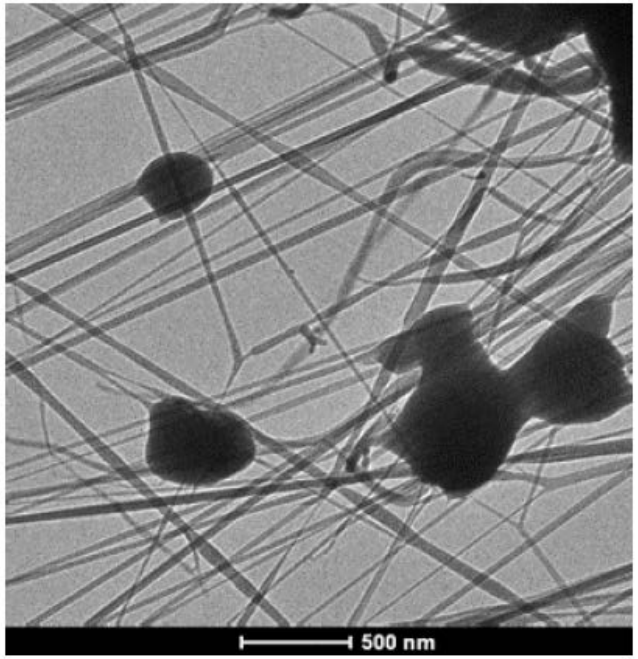

Image courtesy of Dr. John Bang, Professor of Environmental, Earth and Geospatial Sciences

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Building the User Base: Increasing Awareness

"Nanotechnology: A Maker's Course"

Easy-to-understand explanations and demos of nanofabrication and characterization tools and techniques, ***recorded in RTNN laboratories*** by ***diverse individuals***

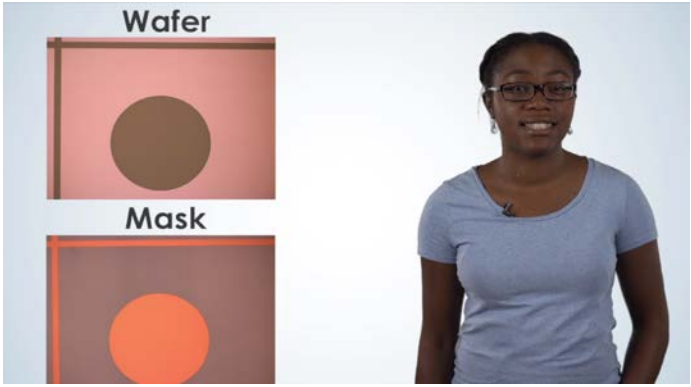
Launched Sept. 2017; within first month:

1,830 course views

626 enrolled learners (74% aged<35)

coursera

The leading online free education platform, reaching 24 million users

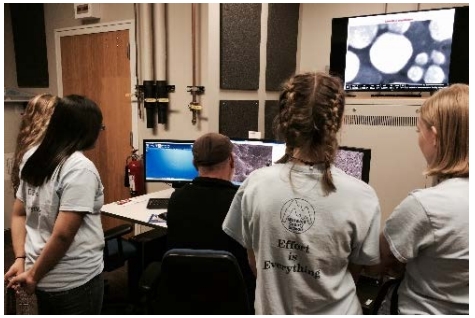


https://www.coursera.org/learn/nanotechnology

Science kits, lesson plans, desktop SEM into classrooms, lab demos and tours for education and outreach

> 3,313 people reached in Year 2

> 50% participation by underrepresented groups in STEM



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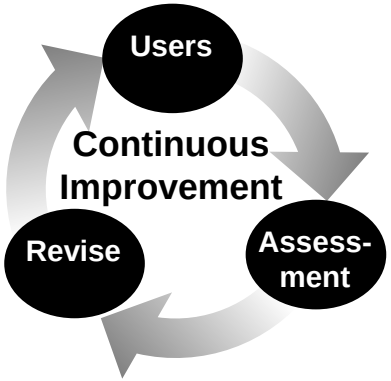
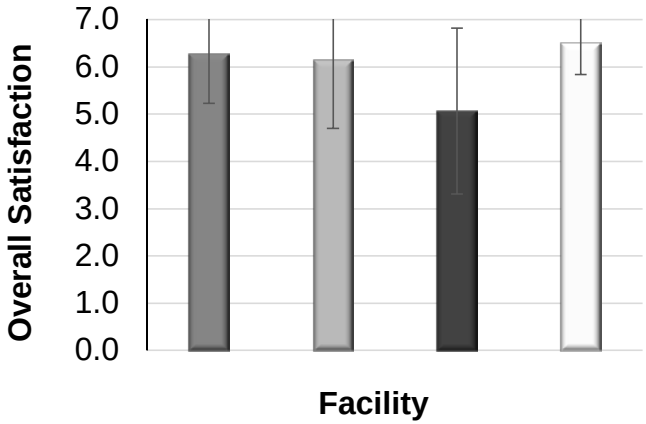
RTNN SEI Activities

"Deep assessment" of the user experience and new programs (e.g. Kickstarter, Coursera) to ***determine real issues and drive change*** – unique opportunity in a multi-site node with numerous stakeholders



Year 2 example: Satisfaction ratings at one facility not comparable to peers. Data used to implement a change in leadership and restructuring of facility.



Raise ***public awareness*** of nanotechnology through online resources and social media campaign

Team science activities – behavioral assessment in cross-disciplinary and multi-site collaborations

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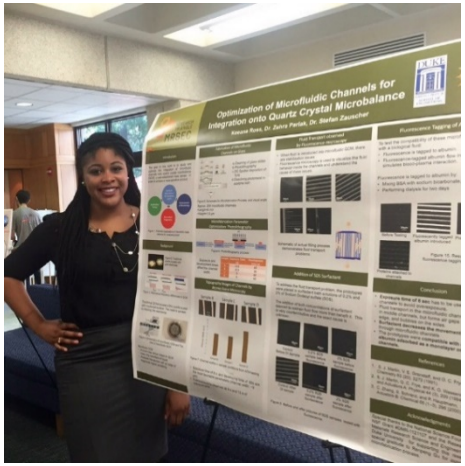
LinkedIn

RTNN-NNCI Network Activity

National Nanotechnology Day: "**Small Talk**," a NanoMaker live, online Q&A event – faculty and staff expert panel on nanofabrication and characterization

Building the User Base subcommittee and active in NNCI **committees** and **working groups**

Hosted Japanese student from the Institute of Materials Science (NIMS) in Japan through Cornell's program



RTNN REU students participate in **REU Convocation** in Atlanta

Staffing booths with Coordinating Office at SERMACS (Charlotte) and TechConnect Expo (DC)

Participate in all NNCI annual conferences and all NNCI-wide electronic conferences

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New Education and Outreach Concepts

Leveraging successful platforms to reach the masses – e.g. massive online education such as Coursera, edX – podcasts e.g. BlogTalkRadio

Reaching ***rural communities*** using (augmented) virtual reality, 4-H programs, and portable tools on the road (e.g., EM, AFM)

Thinking beyond "education and outreach" - ***Training "kids" as users?*** – How many science projects use nanotechnology in our facilities?

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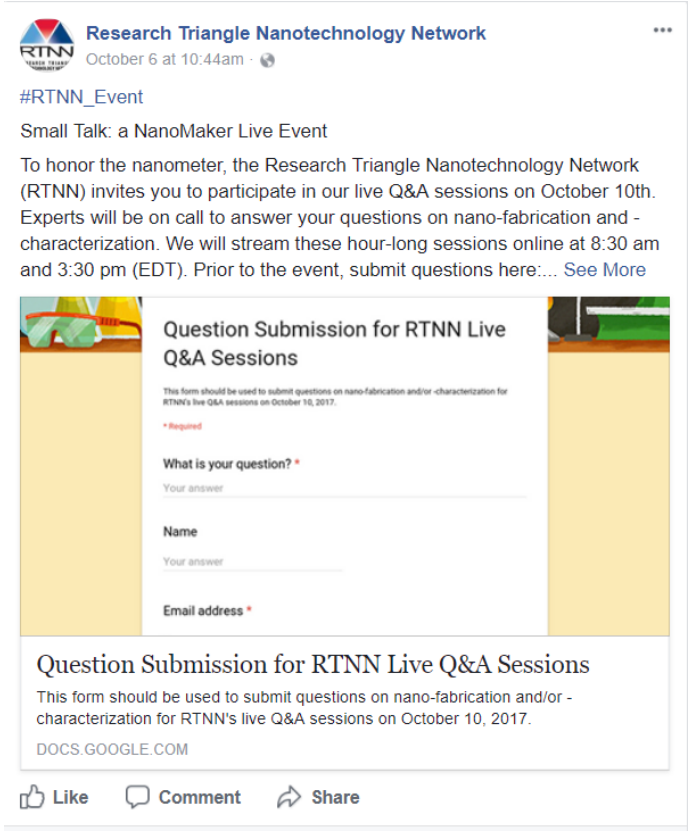

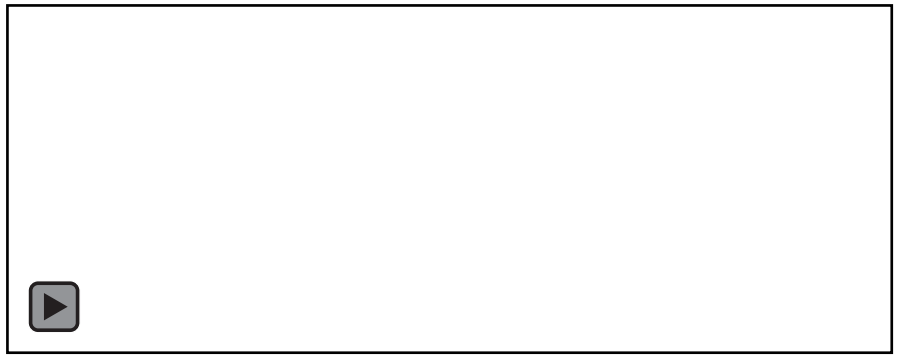

blogtalkradio℠

The largest online talk radio network, enabling individuals and businesses to host their own live radio talk shows and reach millions of listeners that visit the site each month

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