The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

The Center for Nanotechnology in Society at Arizona State University

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PI: David H. Guston, *Arizona State University*

Co-PIs: Elizabeth Corley, *Arizona State University*
Deirdre Meldrum, *Arizona State University*
Clark Miller, *Arizona State University*
Dietram Scheufele, *University of Wisconsin, Madison*
Jan Youtie, *Georgia Institute of Technology*

Annual Report for the Period
September 15, 2011 to September 14, 2012

This report includes work conducted at three collaborating universities of NSEC/CNS-ASU: Arizona State University, Georgia Institute of Technology, and the University of Wisconsin-Madison.

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3. Project Summary

The Nanoscale Science and Engineering Center/Center for Nanotechnology in Society at Arizona State University (NSEC/CNS-ASU) combines research, training, and engagement to develop a new approach to governing emerging nanotechnologies. CNS-ASU uses the research methods of "real-time technology assessment" to enable anticipatory governance through enhanced foresight capabilities, engagement with lay publics, and integration of social science and humanistic work with nanoscale science and engineering research and education.

CNS-ASU has two types of integrated research programs, as well as educational and outreach activities (themselves well-integrated with research). Its real-time technology assessment programs are: RTTA 1, Research and Innovation Systems Assessment, which uses bibliometric and patent analyses to understand the evolving dynamics of the NSE enterprise; RTTA 2, Public Opinion and Values, which uses surveys and quasi-experimental media studies to understand changing public and scientists' perspectives on NSE; RTTA 3, Anticipation and Deliberation, which uses scenario development and other techniques to foster deliberation on plausible NSE applications; and RTTA 4, Reflexivity and Integration, which uses participant-observation and other techniques to assess the Center's influence on reflexivity among NSE collaborators. Second, the thematic research clusters (TRCs), which pursue fundamental knowledge and create linkages across the RTTAs, are: TRC 1, Equity, Equality and Responsibility; and TRC 2, Urban Design, Materials, and the Built Environment ("Nano and the City").

The Center's major conceptual-level achievement has been validating anticipatory governance as a richly generative strategic vision. Its major operations-level achievements include: 1) demonstrating capacities for foresight, engagement, and integration that constitute anticipatory governance; 2) completing the "end-to-end" activities by linking multiple RTTA capacities for (the earlier) TRC 2 to create novel insights in a study of nanotechnology and the brain and for TRC 1 to create novel insights into equity and nanotechnology; 3) deepening the integration of NSE researchers into CNS-ASU; and 4) building collaborations for informal science education (ISE) on the societal aspects of NSE. Programmatic achievements in the reporting year include: revising an internationally adopted definition of nanotechnology and assembling a large study panel of nano firms; conducting polls of national public opinion poll and of leading nano-scientists; exploring material aspects of future-oriented deliberation; demonstrating that interactions between NSE researchers and social scientists can generate more reflexive decisions; conducting new field research on NSE and equity; and delineating some challenges and approaches to nanotechnology innovation in the context of urban sustainability.

The Center's principal **intellectual merit** derives from the large-scale, interdisciplinary ensemble that underpins it. The ability to generate creative scholarship, embrace and facilitate interactions among disparate approaches to understanding nanotechnologies, and build complementary capacities to tap that knowledge for governance, is the critical intellectual contribution to which CNS-ASU aspires. The Center's work has a substantial impact on scholarship, not only in terms of publications and citations but also through hosting international visitors. For **broader impact**, the Center has coupled research, education, and outreach activities exceptionally well by training significant numbers of new scholars from the social sciences and NSE, incorporating forefront research in new courses and ISE opportunities, and returning lessons learned and techniques developed for outreach back to the classroom. The Center has broadened the participation of under-represented groups by cultivating junior scholarship and raising issues of equity, gender, and disability as objects of programmatic study. The Center has enhanced the infrastructure for research and education by organizing community-defining conferences, producing community-defining sources of knowledge, serving as an international hub for dozens of scholars, sharing data and instruments widely, and disseminating its results aggressively to its academic peers as well as to public, scientific, industry, and policy audiences through traditional means and increasingly through new media.

4. List of Center Participants, Advisory Boards, and Participating Institutions

4. (a) LIST OF CENTER PARTICIPANTS

Participants receiving Center support:

ASU

Braden Allenby	**Professor**	**Civil & Environmental Engineering**
Moshe Apelas	**Associate Professor**	**Engineering Computer Science**
Andrew Askland	**Director**	**Center for Law, Science & Innovation**
Daniel Barben	Assistant Research Professor	Consort. for Science, Policy, & Outcomes
George Basile	**Executive Director**	**Decision Theatre for a Desert City**
Ira Bennett	**Assistant Research Professor**	**Consort. for Science, Policy & Outcomes**
Philip Bernick	Assistant Professor	English
Christopher Boone	**Professor**	**Human Evolution & Social Change**
Prasad Boradkar	**Associate Professor**	**Architecture & Landscape Architecture**
Katja Brundiers	**Community-Univ. Liaison**	**Global Institute of Sustainability**
Harvey Bryan	**Professor**	**Architecture & Landscape Architecture**
Marilyn P. Carlson	Professor	Mathematics & Statistics
Matthew Chew	**Faculty Associate**	**Sustainability**
Nalini Chhetri	**Lecturer**	**Global Institute of Sustainability**
Netra Chhetri	**Assistant Professor**	**Consort. for Science, Policy & Outcomes**
David Conz	**Lecturer**	**Letters & Sciences**
Elizabeth Corley	**Associate Professor**	**Public Affairs**
Kevin Corley	Assistant Professor	Management
Kurt Creager	**Executive Director**	**Stardust Center**
Peter Crozier	**Professor**	**Engineering of Matter, Transport & Energy**
Sandwip Dey	**Professor**	**Engineering**
Rodolfo Diaz	Professor	Electrical Engineering
Chris Diehnelt	Professor	Biodesign Institute
Gary Dirks	**Director**	**LightWorks**
Thomas Duening	Director	Entrepreneurial Programs
Terrie Lee Ekin	Director	CLAS Research Administration
Karin Ellison	**Associate Director**	**Biology & Society**
James Elser	**Regents' Professor**	**Life Sciences**
Scott Endsley	Vice President	System Design for Quality Improvement
Sandy Epstein	**Sr. Mgr. Strategic Bus. Dev.**	**Decision Theatre**
Timothy Eschrich	Process Engrg. Manager	Ctr. for Solid State Electronics Research
Mahmud Farooque	**Associate Director**	**Consort. for Science, Policy & Outcomes**
Tricia Farwell	Professor	Journalism & Mass Communication
Adelheid Fischer	**Staff**	**Innovation Space**
Erik Fisher	**Assistant Professor**	**Political Science**
Matthew Fraser	**Associate Professor**	**Sustainability**
Sylvain Gallais	**Clinical Professor**	**Languages & Cultures**
Joel Garreau	**Lincoln Professor of Law**	**Law**
David Gartner	**Professor**	**Law**
Alexandra Gino	**Research Faculty**	**Consort. for Science, Policy & Outcomes**
Jay Golden	Assistant Professor	Sustainability
Aaron Golub	**Assistant Professor**	**Geographical Sciences & Urban Planning**
Deborah Gonzalez	**Chief Academic Officer**	**University Public Schools**
Stephen Goodnick	**Professor**	**Electrical Engineering**

Subhro Guhathakurta	**Professor**	**Geographical Sciences & Urban Planning**
Devens Gust	Professor	Chemistry & Biochemistry
David H. Guston	**Professor**	**Political Science**
Ed Hackett	**Professor**	**Human Evolution & Social Change**
Rolf Halden	**Associate Professor**	**Biodesign Institute**
Jiping He	Professor	Bioengineering
Renata Hejduk	**Associate Professor**	**Architecture & Landscape Architecture**
Stephen Helms Tillery	**Assistant Professor**	**Bioengineering**
Mark Henderson	Professor	Engineering
Kirsten Hendrickson	**Lecturer**	**Chemistry & Biochemistry**
Joseph Herkert	**Associate Professor**	**Humanities & Arts**
James Hershauer	Professor	Management
Lori Hidinger	**Managing Director**	**Consort. for Science, Policy & Outcomes**
Kirby Hoyt	**Faculty Associate**	**Architecture & Landscape Architecture**
Chong Ho Yu	**Systems Analysis**	**ALTI Research & Outreach**
Kiril Hristovski	**Assistant Professor**	**Technology & Innovation**
Ben Hurlbut	**Assistant Professor**	**Life Sciences**
Mary Ingram-Water	Lecturer	Barrett Honors College
Marco Janssen	**Associate Professor**	**Ctr. for Study of Institutional Diversity**
John Johnson	**Emeritus Professor**	**Social Transformation**
Paul Johnson	**Dean**	**Engineering**
Erik Johnston	**Assistant Professor**	**Public Affairs**
Stephen Johnston	Professor	Biodesign Institute
Kamil Kaloush	Associate Professor	Sustainable Engrg. & Built Environment
Sayfe Kiaie	Associate Dean	Engineering
Yushkim Kim	Assistant Professor	Public Affairs
William Kimbel	Virginia M. Ullman Professor	Human Evolution & Social Change
Gordon Knox	**Director**	**University Art Museum**
Anatoli Korkin	Director	Research & Economic Affairs
Michael Kozicki	**Professor and Director**	**Elect., Comp., & Energy Engin./Axon Tech.**
Joe Kullman	**Sr. Media Relations Officer**	**FSE Marketing & Public Affairs**
Timothy Lant	**Assistant Research Professor**	**Decision Theatre for a Desert City**
Karen Leong	**Associate Professor**	**Social Transformation**
Nancy Levinson	Director	College of Design
Rachel Levinson	**Indus. & Gov. Rel. Liaison**	**Research & Economic Affairs**
Merlyna Lim	**Assistant Professor**	**Consort. for Science, Policy & Outcomes**
Mary Laura Lind	**Assistant Professor**	**Engineering of Matter, Transport & Energy**
Stuart Lindsay	**Regents' Professor**	**Biodesign Institute**
Jose Lobo	**Associate Professor**	**Sustainability**
George Maracas	Research Professor	Electrical Engineering & Sustainability
Gary Marchant	**Lincoln Professor of Law**	**Law**
Joan McGregor	**Professor**	**Philosophy**
Chad McAllister	Staff	Chemistry & Biochemistry
Michael Mehaffy	**Faculty Associate**	**Geographical Sciences & Urban Planning**
Jeri Meeks	Bus. Operations Manager Sr.	OKED Finance
Kostalena Michelaki	**Associate Professor**	**Human Evolution & Social Change**
Clark A. Miller	**Associate Professor**	**Political Science**
Tom Moore	Professor	Chemistry & Biochemistry
Torin Monahan	Assistant Professor	Justice & Social Inquiry
Dan O'Neill	**Lecturer & Director**	**Technology & Innovation**
Robert Ott	**Associate Director**	**Occupational Health and Safety**

Robert Pahle	Assistant Research Professor	Decision Theatre for a Desert City
Mary Jane Parmentier	**Senior Lecturer**	**Letters & Sciences**
Darren Petrucci	**Director**	**Architecture & Landscape Architecture**
Patrick Phelan	**Professor**	**Engineering of Matter, Transport & Energy**
Rhonda Phillips	Professor	Community Resources/Development
S. Thomas Picraux	Professor	Materials Research
Kenneth Polasko	**Dep. Man. Dir./VP Bus. Dev.**	**Arizona Technology Enterprises**
Jonathan Posner	**Assistant Professor**	**Mechanical & Aerospace Engineering**
George Poste	Chief Scientist	Complex Adaptive Systems Initiative
Paul Privateer	Associate Professor	Film & Media Studies
B. Ramakrishna	Associate Professor	Materials
Charles Redman	Director	Sustainability
Barry Ritchie	Professor	Physics
Bruce Rittman	**Regents Professor**	**Biodesign Institute**
Jason S. Robert	Associate Professor	Life Sciences
Ariel Rodriguez	**Assistant Professor**	**Community Resources/Development**
Aaron Rothman	Specialist	Phoenix Urban Research Laboratory
Mark Ryan	Adjunct Professor	Design
Carlo Sammarco	**Professor**	**FabLab**
Hava Samuelson	**Professor**	**Jewish Studies**
Daniel R. Sarewitz	**Professor**	**Science & Society**
Anne Schneider	Professor	Justice & Social Inquiry
Dawn Schwenke	Research Professor	Health Management & Policy
Kimberly Scott	Associate Professor	Social Transformation
Thomas Seager	**Associate Professor**	**Sustainable Engrg. & Built Environment**
Cynthia Selin	**Assistant Professor**	**Sustainability**
Don Seo	Associate Professor	Chemistry & Biochemistry
RF (Rick) Shangraw	Vice President	Research & Economic Affairs
Emily Talen	Professor	Geographical Sciences & Urban Planning
Colin Tetreault	Faculty Associate	Sustainability
Trevor Thornton	**Professor**	**Electrical, Computer, & Energy Engineering**
Michael Tracy	Director	Center for Cancer Research
Sander van der Leeuw	**Dean and Professor**	**Sustainability/Human Evol. & Soc. Change**
Warren Van Egmond	**Adjunct Faculty**	**Mathematics**
Steven VanGinkel	Assistant Research Scientist	Environmental Biotechnology
Wim Vermass	**Professor**	**School of Life Sciences**
Myla Vicenti Carpio	**Assistant Professor**	**American Indian Studies**
Ajay Vinze	Professor	WPC Information Systems
Qiangbin Wang	Professor	Biodesign Institute
Xiao Wang	**Assistant Professor**	**Biomedical Engineering**
Karen Wellner	**Faculty Research Associate**	**Biology & Society**
Paul Westerhoff	**Professor**	**Sustainable Engrg. & Built Environment**
Jameson M. Wetmore	**Assistant Professor**	**Human Evolution & Social Change**
Roxanne Wheelock	**Web Administrator**	**International Languages & Cultures**
Philip White	Professor	Industrial Design
Arnim Wiek	**Assistant Professor**	**Sustainability**
Joann Williams	**Research Professor**	**Chemistry & Biochemistry**
Neal Woodbury	**Professor**	**Chemistry & Biochemistry**
Chong Yu	Systems Analyst Principle	ALTI Research & Outreach
Gregg Zachary	**Professor**	**Consort. for Science, Policy & Outcomes**
Frederick Zenhausern	Professor	Biodesign Institute

Collaborators

Jessica Adamick	**InterNano Project Mgr.**	**National Nanomanufacturing Networ**k
Greg Adamson	**Honorary Fellow**	**University of Melbourne**
Roger Angel	Univ. of AZ, Regents' Prof.	Astronomy
Richard Applebaum	**Univ. of California, Berkeley**	**Global & International Studies**
Simone Arnaldi	**University of Padua**	**CIGA**
Tom Arrison	**Senior Staff Officer**	**National Academy of Sciences**
Peter Asaro	Rutgers, Assistant Professor	Philosophy
Geri Augusto	**Brown University**	**Public Policy**
Davis Baird	**Clark University**	**Academic Affairs**
Shawn Barcelona	**Univ. of California, Berkeley**	**Center for Nanotechnology in Society**
Ardeth Barnhart	Univ. of AZ, Co-Director	AZ Research Institute for Solar Energy
Indrani Barpujari	**The Energy & Resources Inst.**	**Science and Technology**
Rob Barnett	**Dir. of Envir. Systems**	**PING Inc.**
Deborah Bassett	Univ. of WA, Dir Social Stud.	Workforce Development
Ottavia Bassetti	Board Member	The Bassetti Foundation
Rebecca Bates	**AAAS Sci. & Tech Pol Fellow**	**National Science Foundation**
Larry Bell	**Sr. V.P. Strategic Initiatives**	**Museum of Science**
Michael Bennett	**Professor, Law**	**Northeastern University**
Frazier Benya	**Natl. Acad. Engin.,Prog. Offc.**	**Engineering, Ethics, & Society**
Kavita Berger	**AAAS, Project Director**	**Science, Technology & Security Policy**
Robby Berloznik	Director	Flemish Institute Society & Technology
Roberta Berry	**Georgia Tech, Assoc Prof/Dir**	**Law, Science & Technology**
Andrew R. Binder	NC State Univ., Asst. Prof.	Communication
David Bjornstad	**UT Battelle**	**Environmental Sciences**
John Bobalek	**Dept. of Treasury, Prog. Mgr.**	**Bureau of Engraving & Printing**
Larry Bock	Chairman	Luxe Ventures
Jason Boehm	**Director, Prog. Coord. Offc.**	**Natl. Inst. of Standards & Technology**
Marianne Boenink	**Univ. of Twente, Lecturer**	**Philosophy**
Cathy Boggs	**Cal., Santa Barbara, Dir. Ed.**	**Center for Nanotechnology in Society**
Greg Book	**Georgia Tech, Asst. Dir.**	**Nanotechnology Research Center**
Valerie Bonham	**Executive Director**	**Pres. Comm. for Study of Bioethical Issues**
Line Bonneau	Said Bus. School, Res. Fellow	Science, Innovation and Society
Jason Borenstein	**Georgia Tech, Professor**	**Graduate Research Ethics Program**
Chris Bosso	**Northeastern University**	**Public Policy and Urban Affairs**
Ann Bostrom	**University of Washington**	**Public Affairs**
Daryl Boudreaux	**President**	**Boudreaux and Associates**
Robert Bowman	Queens Univ. Belfast, Dir.	Center for Nanostructured Media
Kevin Boyack	**President**	**SciTech Strategies, Inc.**
Barry Bozeman	**Georgia, Professor**	**Public Administration & Policy**
Suzanne Brainard	**Univ. of Washington, Ex. Dir.**	**Center for Workforce Development**
Donald Braman	George Washington, Prof.	Law
Philip Brey	**Univ. of Twente, Professor**	**Philosophy**
Susan Brienza	**Shareholder**	**Ryley, Carlock & Applewhite Attorneys**
Sage Briggs	**Cal.-Santa Barbara, Fin. An.**	**Physics**
Dominique Brossard	Wisconsin, Asst. Professor	Journalism & Mass Communication
Simone Browne	**Texas-Austin, Asst. Prof.**	**Sociology**
Will Bruder	**President**	**Will Bruder & Partners Ltd.**
Karl Bryant	**Cal., Santa Barbara, Asst. Pr.**	**Sociology and Women's Studies**
Jill Buschbacher	**City of Phoenix, Proj. Mgr.**	**Community & Economic Development**

Francesco Calabrese	Advisory Research	MIT SENSEable City Lab
Jane Calvert	**Edinburgh, Academic Fellow**	**Social & Political Science**
Heather Canary	**University of Utah, Asst. Prof.**	**Communication**
Thomas Chermack	Colorado, Asst. Professor	Organizational Performance & Change
Parag Chitnis	**NSF, Deputy Div. Director**	**Molecular & Cellular Biosciences**
Michael Chorost	Author	
Jennifer Cleary	Rutgers, Sr. Project Mgr.	Planning & Public Policy
Michael D. Cobb	**NCSU, Associate Professor**	**Political Science**
Christopher Coenen	**Karlsruhe Ins. Tech, Res.**	**Inst. for Tech. Assess. & Systems Analysis**
Susan Coller-Monarez	**Sr. Sci. Adv., Sci. & Tech. Dir.**	**U.S. Dept. of Homeland Security**
Napier Collyns	Co-Founder	Global Business Network
Joseph Conti	**Wisconsin-Madison, Prof.**	**Sociology and Law**
Craig Cormick	**Australian Gov., Manger**	**Department of Innovation**
Kevin Costa	**Administrative Director**	**Synthetic Biology Engineering Research Ctr.**
Susan Cozzens	**Georgia Tech, Professor**	**Public Policy**
Wendy C. Crone	Wisconsin, Professor	Engineering Physics
Edward Cupoli	**Chief Economist**	**SEMATECH**
Michael Dahlstrom	**Iowa State Univ., Asst. Prof.**	**Greenlee School of Journalism & Comm.**
Dorothy Dankel	Bergen, Researcher	Center for Study of Sciences & Humanities
Marian Deblonde	Antwerp, Researcher	Environment & Sustainable Development
Bruna De Marchi	Mass Emergencies Programme	Inst. of International Sociology of Gorizia
Peter deLeon	**Colorado, Denver, Professor**	**Public Affairs**
Terry Devitt	Wisconsin, Science Writer	Science & Technology
Ricardo Dominguez	**Calif., San Diego, Assoc. Prof.**	**Visual Arts**
Robin Downey	**Genomics & Society Advisor**	**Genome British Columbia**
Fanie Duvenghuge	Manager	Microchip
Jake Dunagan	**Research Director**	**Institute for the Future**
Sharon Dunwoody	Wisconsin, Professor	Journalism & Mass Communication
Kevin Dwyer	Sundt Construction, Inc.	Senior Paralegal
Kathleen Eggleson	**Notre Dame, Res. Scientist**	**Science & Technology**
Ken Eklund	Serious Game Designer	Game Designer
Shirin Elahi	Scenario Architect	Complex Global Risks
Kirsten Ellenbogen	**Sr. Dir. Lifelong Learning**	**Science Museum of Minnesota**
Kevin Elliott	South Carolina, Assoc. Prof.	Philosophy
Jose Faria	**Unicamp, Professor**	**Medicine**
Elizabeth Farrell	New Hampshire, Coord.	Culture & Sustainability, Food & Society
James Faubion	Rice, Professor	Anthropology
Ulrike Felt	**Univ. of Vienna, Professor**	**Social Studies of Science**
Patrick Feng	**Assistant Professor**	**University of Calgary**
A. Fernandez-Ribas	Georgia Tech	Public Policy
Aaron Fichtner	Rutgers, Director	Research & Evaluation
Ulrich Fiedeler	Austrian Academy of Science	Institute of Technology Assessment
Guillermo Foladori	Universidad de Zacatecas	Nanotechnology
Torsten Fleischer	**Karlsruhe Ins. Tech, Head**	**Inst. for Tech. Assess. & Systems Analysis**
John Fortner	**Wash. Univ, Asst. Professor**	**Engineering**
Sharon Friedman	**Lehigh University, Professor**	**Journalism & Communication**
Emma Frow	Edinburgh, Res. Fellow ESRC	Genomics Forum
Teresa Fryberger	**NASA, Associate Director**	**Earth Science Division, Applied Science Prog.**
Silvio Funtowicz	European Commission	Protection & Security of the Citizen
Joan Fujimura	Wisconsin, Professor	Sociology
Wayne Fuqua	**Western Michigan, Professor**	**Psychology**

Jason Gallo	**Researcher**	**Science and Technology Institute**
Stefan Gammel	**Researcher**	**Technical University of Darmstadt**
Veronica Garcia Luis	**Research Associate**	**Exploratorium**
Hans Glimell	Gothenburg, Professor	Sociology
Jean Goodwin	**Iowa State Univ., Assoc. Prof.**	**English**
Lieve Goorden	Antwerpen, Professor	Millieu & Technologieman
Michael Gorman	**Virginia, Professor**	**Science, Technology and Society**
Melinda Gormley	**Notre Dame, Asst. Dir. Res.**	**Reilly Center**
Stuart Graham	Georgia Tech, Professor	Management
Peter Granda	**Univ. of Michigan, Asst. Dir.**	**Political & Social Research**
Gisela Grant	**Internship Coordinator**	**Politics & Global Studies**
David Grimshaw	Head of International Prog.	Practical Action
Alexei Grinbaum	**CEA-Saclay, Researcher**	**LARSIM Laboratory**
Laura Grossenbacher	**Wisconsin, Assoc. Professor**	**Engineering Professional Development**
Julia Guivant	**Fed. Santa Catarina, Prof.**	**Sociology & Political Science**
William Hallman	**Rutgers, Professor/Chair**	**Human Ecology**
Patrick Hamlett	NCSU, Associate Professor	Science, Technology & Society
Birgitte G. Hansen	Copenhagen Business School	Management, Politics and Philosophy
Anders Hanssen	Executive Officer	Research Council of Norway
Keishiro Hara	Osaka, Assoc. Professor	Research Inst. For Sustainability Science
Gary Harris	**Howard Univ., Professor**	**Electrical & Computer Engineering**
Jim Harris	**Vice President Bus. Develop.**	**Translational Genomics Research Institute**
Barbara Harthorn	**California, Santa Barbara**	**Director, CNS-UCSB**
David Hartmann	**Western Michigan, Professor**	**Sociology**
Brad Herring	**Mus. of Life Science, Director**	**Nanoscale Informal Science Education**
Diana Hicks	Georgia Tech, Professor	Public Policy
Stephen Hilgartner	Cornell University, Professor	Science & Technology Studies
Linda Hogle	Wisconsin, Associate Professor	Medical History & Bioethics
Michael Holland	**DOE, Sr. Advis. & Staff Dir.**	**Office of the Under Secretary for Science**
Rachelle Hollander	**Executive Director**	**National Academy of Engineering**
Maja Horst	**University of Copenhagen**	**Policy & Philosophy**
Leigha Horton	**Presenter**	**Science Museum of Minnesota**
Maurizio Iacopetta	Georgia Tech, Assistant Prof.	Economics
Helen Ingram	California-Irvine, Professor	Planning, Policy, and Design
Noela Invernizzi	**Federal University of Parana**	**Development Studies**
Jennifer Iriye	**Guest Exper. Prog. Interpret.**	**Arizona Science Center**
Alan Irwin	**Copenhagen Business School**	**Research**
Deborah Jackson	**Program Manager, ERC Prog.**	**National Science Foundation**
Sheila Jasanoff	**Harvard University, Professor**	**Science & Technologies Studies**
Mitchell Joachim	**Co-Founder**	**Planetary ONE**
Mikael Johansson	**Gothenburg Univ., Lecturer**	**Global Studies**
Deborah Johnson	**Virginia, Professor**	**Science, Technology & Society**
Marilyn Johnson	**Oregon Mus. Sci. & Industry**	**Science Director**
Travis Johnson	**Scientist**	**Agilent Technologies**
Michele Kadnar	**Research Fellow**	**National Institutes of Health**
Dan M. Kahan	Yale, Professor	Law
Seth Kahn	**Associate Professor, English**	**West Chester Pennsylvania**
Michael Kalichman	**Cal., San Diego, Director**	**Ethics & Science in Technology**
Amy Kaminski	**NASA, Senior Policy Advisor**	**Officer of the Chief Scientist**
Brad Keelor	**Sr. Sci. & Inn. Policy Advisor**	**British Embassy**
Thomas Kelly	New Hampshire, Professor	Office of Sustainability

Denisa Kera	**Research Institute Fellow**	**Natl. Univ. of Singapore & Asia**
George Khusf	**Univ. South Carolina, Dir.**	**Center for Bioethics**
Matt Kim	**Founder and President**	**QuantTera**
Tammy Kinsey	**Toledo, Associate Professor**	**Film**
Kamilla Kjolberg	Bergen, Research Fellow	Study of the Sciences and Humanity
Frederick Klaessig	**Manager**	**Pennsylvania Bio Nano Systems LLC.**
Richard Klavans	**President**	**SciTech Strategies Inc.**
Daniel Kleinman	Wisconsin, Professor	Rural Sociology
Mark Knell	Norwegian Institute	Chemistry
Joan Koerber-Walker	**Pres. & Chief Exec. Officer**	**Arizona Bioindustry Association**
Shinichi Kobayashi	**Assistant Professor**	**Nagoya University**
Kornelia Konrad	**Univ. of Twente, Asst. Prof.**	**Science, Technology, & Policy Studies**
Margaret Kosal	**GA Tech, Asst. Professor**	**International Strategy, Technology & Policy**
Fred Kronz	**Prog. Dir., Sci., Tech. & Soc.**	**National Science Foundation**
Sharon Ku	**Southern Indiana, Res. Fellow**	**Sociology**
Kristen Kulinowki	Rice University, Facul. Fellow	Chemistry
Elizabeth K. Kullman	**Sen. Res. & Eval. Associate**	**Museum of Science, Boston**
Ray Kurzweil	Author	
Frank Kusiak	**California-Berkeley**	**Science**
Jennifer Kuzma	**Minnesota, Assoc. Professor**	**Public Affairs**
Astrid Lagreid	**Norwegian Univ. Sci. & Tech.**	**Cancer Research & Molecular Medicine**
Frank Laird	Colorado, Professor	International Studies
Nancy LaPlaca	**Policy Advisor**	**Arizona Corporation Commission**
Lewis Laska	**Tenn. State Univ., Professor**	**Law**
Ruth Lee	**Director**	**Research Councils UK**
Christopher Lenhardt	**UT-Battelle, DAAC Sci. Lead**	**Oak Ridge National Laboratory**
Sam Lipson	**Director of Envir. Health**	**Cambridge Public Health Department**
Laurie Locascio	**Chief, Biochemical Sci. Div.**	**Natl. Inst. of Standards & Technology**
Stephanie Long	**Mgr., Public Prog. & Science**	**Science Museum of Minnesota**
Michael Loui	**Illinois, Urb.-Cham., Prof.**	**Electrical & Computer Engineering**
Brandon Lucas	**Mich., NNIN Ed Out. Coord.**	**Electrical Engineering & Computer Science**
Michael Lynch	Cornell, Professor	Science & Technology
Phil Macnaghten	**Durham University, Professor**	**Geography**
Roop Mahajan	Virginia Tech, Director Critical	Technology & Applied Science
Farzad Mahootian	**New York Univ., Professor**	**Global Liberal Studies**
Jim Malone	Physician	Private Practice
Mike Manasco	**Project Manager**	**Heliae**
William Mansfield	**Penn State, Dir. of Operations**	**NNIN Materials Research Institute**
Paul Martin	**Sr. V.P. Science Learning**	**Science Museum of Minnesota**
Christina Matta	**Wisconsin, Asst. Fac. Assoc.**	**Engineering Professional Development**
Heather Mayfield	**Deputy Director**	**London Science Museum**
Catherine McCarthy	Project Leader	Science Museum of Minnesota
Katherine McComas	**Cornell, Associate Professor**	**Communication**
David McConville	**Director, Noospheric Res.**	**The Elumenati, LLC.**
Robert McGinn	**Stanford, Professor**	**Science, Technology, & Society**
Alan McGowan	**Eugene Lang, Adjunct. Fac.**	**New School for Liberal Arts**
Sheila McNamee	New Hampshire, Professor	Communication
Celia Merzbacher	**Vice President**	**Semi-Conductor Research Corporation**
Pierre Meulien	President and CEO	Genome British Columbia
Evan Michelson	**Senior Research Associate**	**New York University**
Colin Milburn	**Cal.-Davis., Assoc. Professor**	**English and Science & Technology Studies**

Keith Miller	**Illinois, Springfield, Prof.**	**Computer Science**
Robert J. Milligan	Physician	Physician Services Group
Carl Mitcham	**CO School of Mines, Prof.**	**Liberal Arts & International Studies**
Cyrus Mody	**Rice University, Asst. Prof.**	**History**
Alison Mohr	Senior Research Fellow	University of Nottingham
Julia A. Moore	Deputy Director	Woodrow Wilson Center
Steven Moore	**Texas at Austin, Professor**	**Architecture & Planning**
Jeffery Morris	**EPA, Natl. Program Director**	**Nanotechnology Research Program**
Maj Munch-Andersen	**Technical Univ. of Denmark**	**Senior Scientist, Dept. of Management**
Webb Myers	STIP Associate	Intelligent Info. Services Group
Anne I. Myhr	**Genøk, Scientist**	**Center for Biosafety**
Kenneth Nealson	**Southern California, Prof.**	**Environmental Studies**
Alan Nelson	Director	Biodesign Institute
Richard Nelson	Columbia University, Professor	Economics
Chris Newfield	**Cal., Santa Barbara, Prof.**	**English**
Nils Newman	STIP Associate	Intelligent Info. Services Group
Dean Nieusma	**Rensselaer Poly. Inst., Prof.**	**Science & Technology Studies**
Ulrik Nissen	**Aarhus Univ., Prof. & Dir.**	**Bioethics & Nanoethics**
Alfred Nordmann	**Darmstadt Tech. Univ., Prof.**	**Philosophy**
Rune Nydal	**Norwegian Univ., Associate**	**Science & Technology**
Rosemary Ommer	Adjunct Professor	University of Victoria
Rae Ostman	**National Collab., Director**	**Sciencenter**
Richard Owen	**University of Exeter, Prof.**	**Business**
Krsto Pandza	Leeds Univ., Senior Lecturer	Business
Shobita Parthasarathy	Michigan, Assistant Professor	Public Policy
Tanuja Parulekar	**Professor**	**S.I.W.S. N.R. Swamy College**
Eleonore Pauwels	**Research Scholar**	**Woodrow Wilson Center**
Alice Pawley	Assistant Professor	Purdue University
Luigi Pellizzoni	**Univ. of Trieste, Assoc. Prof.**	**Political & Social Sciences**
Angela G. Pereira	**Eur. Comm., Scientific Offc.**	**Joint Research Centre**
Tim Person	**Chief Scientist**	**U.S. Gov. Accountability Office**
Sarah Pfatteicher	**Assistant Dean**	**Wisconsin, Madison**
Simon Pfersdorf	Researcher	Instit. Tech. Assessment & Sys. Analysis
Mark Philbrick	California-Berkeley	Public Policy
Nicholas Pidgeon	**Cardiff University, Professor**	**Psychology**
Matthew Pierlott	**West Chester, Assoc. Prof.**	**Philosophy**
Roger Pielke, Jr.	Colorado, Professor	Environmental Studies
Cynthia Pillote	**Partner**	**Snell & Wilmer Law**
Kenneth Pimple	**Indiana, Professor**	**Religious Studies**
Anne Plant	**Grp. Ldr., Biochem. Sci. Div.**	**Natl. Inst. for Standards & Technology**
Alan Porter	**Georgia Tech, Professor**	**ISYE & Public Policy**
Susanna Priest	**George Mason Univ., Prof.**	**Communication**
R. Queralto Moreno	Univ. of Seville, Professor	Ethics & Political Philosophy
Paul Rabinow	California, Berkeley, Prof.	Social Cultural Anthropology
Margaret Race	**Senior Research Scientist**	**SETI Institute**
Ismael Rafols	**Sr. Lecturer, Univ. of Sussex**	**Science & Technology Policy Research**
Khan Rahi	Loka Institute, Staff	Community Research Network
Rex Raimond	**Sr. Mediator & Prog. Mgr.**	**Meridian Institute**
Sally Randles	**Manchester, Sr. Res. Fellow**	**Manchester Business School**
Jerome Ravetz	Said Bus. Sch., Assoc. Fellow	Science, Innovation & Society
Steve Rayner	**Said Bus. Sch., Dir. & Prof.**	**Institute for Science, Innovation & Society**

Christine Reich	Assistant Director	Museum of Science
David Rejeski	**Director, Sci. & Tech. Inn.**	**Woodrow Wilson Center**
Bob Reuss	**Independent Consultant**	
Tracy Rexroat	**State Sup. Engin./Manufact.**	**AZ Department of Education**
Arie Rip	**Univ. of Twente, Professor**	**Science & Technology Studies**
Jody Roberts	**Chem. Her. Found., Asso. Dir.**	**Center for Contemporary History & Policy**
Melanie Roberts	**Director**	**Emerging Leaders in Science & Society**
H. Rodriguez Zabaleta	Univ. del Pais Vasco	Automatic Control & Systems Engineering
David Roessner	**Associate Director**	**SRI International**
Juan Rogers	**Georgia Tech, Assoc. Prof.**	**Public Policy**
J. Rogers-Brown	**Long Island Univ., Asst. Prof.**	**Sociology & Anthropology**
Louise Roman	**Assistant to President**	**Will Bruder & Partners Ltd.**
Kjetil Rommetveit	**Univ. of Bergen, Researcher**	**Centre for Science**
Dale Rothman	Denver, Assoc. Prof.	International Futures
Alan Rubel	Greenwall Fellow	Georgetown Univ. Law Ctr.
Daniele Ruggiu	**Univ. of Padua, Res. Fellow**	**CIGA**
Chuck Runyan	**Head, Patent Prosecution**	**Gallagher & Kennedy**
Dietram Scheufele	**Wisconsin, Professor**	**Life Sciences Communication**
Erich Schienke	**Penn State, Asst. Professor**	**Science, Technology & Society**
Jennifer Schneider	CO Schl. of Mines, Asst. Prof.	Liberal Arts & International Studies
Gerd Scholl	**Economist**	**Inst. for Ecological Economy Research**
Ronald J. Schott	**Executive Emeritus**	**Arizona Technology Council**
Daan Schuurbiers	Radboud Univ., Project Mgr.	Center for Society & Genomics
Astrid Schwarz	**Univ. of Basel, Assoc. Res.**	**Science Research**
Claudia Schwarz	**Univ. of Vienna, Researcher**	**Social Studies of Science**
Dane Scott	**Montana, Director**	**Ethics & Public Affairs**
Franz Seifert	**Univ. of Vienna, Professor**	**Anthropology**
John Selsky	Univ. South Fl., Assoc. Prof.	Management
Meena Selvakumar	**Director**	**Pacific Science Center**
Chris Sequeira	**FAA, Envir. Program Mgr.**	**Environment & Energy**
Philip Shapira	**Georgia Tech, Professor**	**Public Policy**
Mark Shapiro	Ctr for Investigative Journalism	
Gwyneth Shaw	**Writer**	**New Haven Independent**
Bret Shaw	UW-Madison, Asst. Prof.	Life Sciences Communication
Brian Sherman	**Managing Dir./VP Bus. Dev.**	**Arizona Commerce Authority**
Tania Shibata	**Product Application Manager**	**BrasEq**
Katherine Shilton	**Maryland, Assistant Professor**	**Information Studies**
Elena Simakova	**University of Exeter, Lecturer**	**Innovation**
David Sittenfeld	**Program Manager, Forum**	**Museum of Science**
Rasmus Slaatelid	**Univ. of Bergen, Assoc. Prof.**	**Sciences and Humanities**
Mitchell Small	Carnegie Mellon, Professor	Public Policy
Alex Smith	**City of Tempe, Tech. Dev. Sp.**	**Economic Development**
Laurel Smith-Doerr	Program Director	National Science Foundation
James Soudriette	**Cert. Mgmt. Consul./Partner**	**The Galaxy Organization**
Ahmad Soueid	**Principal & Sr. Vice Pres.**	**HDR Architecture**
Kayte Spector-Bagdady	**Associate Director**	**Pres. Comm. Study Bioethical Issues**
Joe Spencer	Production Manager	ALD NanoSolutions
Tina Stanford	**SRI Intl, Educ. Researcher**	**Center for Learning & Technology**
Nicholas Steneck	**Michigan, Professor**	**Research Ethics Program**
Karl Stephan	**Texas State, Assoc. Professor**	**Engineering**
Jack Stilgoe	**Univ. Exeter, Sr. Res. Fellow**	**Business**

Roger Strand	Bergen, Professor	Science Theory
Deborah Strumsky	**Assistant Professor**	**UNC Charlotte**
Michael Sullivan	Director	Hispanic Research Center
Steve Suppan	**Senior Policy Analyst**	**Inst. Agriculture & Trade Policy**
John Sweeney	**Envir. Health & Safety Offc.**	**Harvard**
Tsjalling Swiersta	Twente, Professor	Philosophy
Albert Teich	**AAAS, Director**	**Science & Policy Programs**
Frank Theys	Visual Artist and Filmmaker	Savage Film
Brian Thibeault	**Project Scientist**	**California, Santa Barbara**
Paul Thompson	**Michigan State Univ., Prof.**	**Philosophy**
Joanna Tornow	**Office of the Director**	**National Science Foundation**
Elizabeth Tran	**Associate Program Officer**	**National Science Foundation**
Julia Trosman	Director	Center for Business Models
Paul Turgeon	**Georgia Tech, Proj. Coord.**	**Nanotechnology Research Center**
Jeff Ubois	Archivist	The Bassetti Foundation
Simone Van der Burg	**Radboud Univ. Med., Sr. Res.**	**Scientific Inst. Quality Healthcare**
Rinie van Est	Coordinator	Rathenau Institute
Carl Van Horn	Rutgers, Professor	Planning & Public Policy
Harro Van Lente	**Utrecht Univ., Assoc. Prof.**	**Emerging Technologies**
Thomas Val Valey	**Professor Emeritus**	**Western Michigan University**
Rene Von Schomberg	**Directorate General Research**	**European Commission**
Catherine Vrentas	**Mol. Biologist/Sci. Out. Spec.**	**U.S. Department of Agriculture**
Stephanie Wang	**UT-Battelle, Behavioral Res.**	**Oak Ridge National Laboratory**
Jue Wang	Florida Intl., Asst. Prof.	Religious Studies
Vivian Weil	**Illinois Inst. Tech., Prof./Dir.**	**Ethics / CSEP**
Peter Weingart	**University of Bielefeld, Prof.**	**Institute for Science & Technology Studies**
Jianying Wen	**Professor**	**University of Jiangsu, China**
Kyle Whyte	**Michigan St. Univ., Asst. Prof.**	**Philosophy**
Fern Wickson	**GenØk, Associate Professor**	**Center for Biosafety**
Matthias Wienroth	**Edinburgh, Acad. Res. Fellow**	**Genomics Forum**
Terence Wilkins	University of Leeds, Professor	Inst. of Particle Science & Engineering
James Wilsdon	Director	The Royal Society
David Winickoff	California, Berkeley, Prof.	Bioethics & Society
Gregor Wolbring	**Univ. of Calgary, Asst. Prof.**	**Bioethics, Culture, and Disabilities**
Amy Wolfe	**UT-Battelle, Group Leader**	**Environmental Sciences**
Edward Woodhouse	Rensselaer Poly. Inst., Prof.	Science & Technology Studies
John Wooding	Massachusetts, Lowell, Prof.	Economic & Social Development
Joan Woolfrey	**West Chester, Assoc. Prof.**	**Philosophy**
Charyl Yarbrough	Rutgers, Project Director	Workforce Development
Go Yashizawa	Tokyo University	Project Lecturer
Peter Yeadon	**RISD/Decker Yeadon LLC**	**Associate Professor/Architect**
Edward You	**Supv. Special Agent**	**FBI Weapons of Mass Destruction**
Paul Youngman	**UNC-Charlotte, Assoc. Prof.**	**Humanities, Technology & Science**
Jan Youtie	**Georgia Tech, Sr. Research.**	**Enterprise Innovation Institute**
G. Zenner Petersen	Wisconsin-Madison, Dir. Ed.	Materials Research Science & Engineering
Lee Zwanziger	**Designated Federal Official**	**Food & Drug Administration**
Steven Zylstra	**Pres. & Chief Exec. Officer**	**Arizona Technology Council**

Post-Doctoral Scholars

Troy Benn	Post-doctoral Fellow	Civil & Environmental Engineering
Doe Daughtrey	Post-doctoral Fellow	Religious Studies
Sarah Davies	**Pod-doctoral Fellow**	**Center for Nanotechnology in Society**
Matthew Harsh	**Post-doctoral Fellow**	**Center for Nanotechnology in Society**
Sean Hays	**Post-doctoral Fellow**	**Consort. for Science, Policy & Outcomes**
Daniel Higgins	**Post-dcotral Fellow**	**Center for Nanotechnology in Society**
Punarvasu Joshi	**Post-doctoral Fellow**	**Elect. Comptr. & Energy Engineering**
Anastasios Panaretos	Post-doctoral Fellow	Electrical Engineering
Cathy Slade	Post-doctoral Fellow	Public Policy
Walter Valdivia	**Post-doctoral Fellow**	**Public Administration**
Berea Williams	Post-doctoral Fellow	Chemistry & Biochemistry

ASU

Graduate Researchers

Dulce Perez Aguilera	**Social Justice**
Parul Agrawal	Materials Science & Engineering
Rebecca Allen	**Biodesign Institute**
Carlo Altamirano-Allende	**Human and Social Dimensions of S & T**
Judd Anderman	Science & Technology Policy
Caroline Appleton	**Biology & Society**
Ebraheem Azhar	**Electrical Engineering**
Marci Baranski	Biology & Society
Ceyhan Beckham	Electrical Engineering
Monamie Bhadra	Human & Social Dimensions of S & T
Shreya Bhattacharyya	Chemistry & Biochemistry
Bradley Brennan	Chemistry & Biochemistry
Jennifer Brian	**Biology & Society**
Michael Burnam-Fink	**Human & Social Dimensions of S & T**
Santhosh Chenna	Engineering of Matter, Transport & Energy
Shannon Conley	**Political Science**
Jessica Corman	**Biology**
William Curran	**Electrical Engineering**
Robert Davis	**Political Science**
Natalie DeGraaf	**Science & Technology Policy**
Shannon DiNapoli	Life Sciences
Ajit Dhamdhere	Nanoscience
Justin Flory	Chemistry & Biochemistry
Rider Foley	**Sustainability**
Ariana Fox	Biology
Jinglin Fu	Chemistry & Biochemistry
Gretchen Gano	**Human & Social Dimensions of S & T**
Manuel Garay Valenzuela	Education Leadership & Policy Studies
Aixa Garcia-Mont	Education
Meredith Gartin	Global Health
Sandeep Kaur Gill	Nanoscience
Cecilia Gonzalez	**Life Sciences**
Cesar Gonzalez Esquer	SOLS Graduate Programs
Kelly Hale	Anthropology
Dongran Han	Chemistry
Keivon Hobeheidar	Biological Sciences

Qian Hu	Public Affairs
Nate Hisamura	Mathematics
Douglas Huron	**Global Technology Development**
Christoforos Ioannidis	**Philosophy**
Daniela Ivan	English
Taylor Jackson	Biology & Society
Lijing Jiang	Chemistry & Biochemistry
Valerie Johnson	**Design**
Craig Jolley	Biophysics
Tomasz Kalinowski	**Biological Design**
Risto Karinen	Political Science
Julia Kerran	**Urban & Environmental Planning**
Ashley Kibel	Physics
Youngjae Kim	**Public Administration**
Phani K. Kondapani	Nanoscience
Tim Kostyk	**Human & Social Dimensions of S & T**
Jason Lappe	Chemistry and Biochemistry
Jonathan Lappen	Geography
William Lepkowski	Chemistry & Biochemistry
Shannon Lidberg	**Human & Social Dimensions of S & T**
Jewel Loree	Science & Technology Policy
Yi Lai Christine Luk	**Human & Social Dimensions of S & T**
Christopher Madden	Chemistry & Biochemistry
Kevin Margeson	Science & Technology Policy
John C. McKnight	**Human & Social Dimensions of S & T**
Chris Mercer	Sustainability
Emily Molfino	Political Science
Chad Monfreda	**Human & Social Dimensions of S & T**
Sharlissa Moore	**Human & Social Dimensions of S & T**
Vicki Moore	Chemistry & Biochemistry
Romarie Morales	Applied Mathematics
Jeffrey Moran	**Mechanical Engineering**
Rebecca Murans	Design
Israel Murguia	Public Administration
Tanya Musgrave	Public Policy
Tracy Niday	**Chemistry & Biochemistry**
Christina Nulle	Global Technology Development
Jason O'Leary	**Science & Technology Policy**
Azra Panjwani	Mathematics
John Parsi	Political Science
David Proffitt	Urban & Environmental Planning
Caroline Reid	Urban & Environmental Planning
Kiera Reifschneider	**Biochemistry**
Alicia Rodgers	Science & Technology Policy
Laura Rodriguez	Technology & Innovation
Kehinde Salau	**Mathematics & Statistics**
Cyndy Schwartz	Human & Social Dimensions of S & T
Jaswinder Scharma	Biomedicine
Lee Seabrooke	**Human & Social Dimensions of S & T**
Nisha Sherma	Chemistry
Quinn Spadola	Physics

Lucia Stavig		**Justice Studies**
Yuri Sylvester		**Political Science**
Trista Taylor		Public Administration
Justin Tosi		Political Science
Brenda Trinidad		**Human & Social Dimensions of S & T**
Yusuf Tufail		SOLS Graduate Programs
Oriol Vidal Aparicio		Political Science
Jennifer Watkins		**Chemistry & Biochemistry**
Benjamin Wender		**Civil, Envir., & Sust. Engineering**
Jinglei Zhang		Chemistry & Biochemistry

Affiliated
Post-Doctoral Scholars

Jason Delborne	Wisconsin	Rural Sociology
Pierre Delvenne	**University of Liege**	**Political Science**
Matthew Eisler	**Calfornia, Santa Barbara**	**Center for Nanotechnology in Society**
Arianna Ferrari	**Karlsruhe Inst. Technology**	**Technology Assessment & Systems Analysis**
Domingo Ferrer	**University of Texas**	**Microelectronics Research Center**
Sonia Gatchair	Georgia Tech	Public Policy
Luciano Kay	**Georgia Tech**	**Public Policy**
Padraig Murphy	Dublin City University	Communication
Megan Palmer	**Stanford**	**Synthetic Biology**
Debasmita Patra	**Cornell**	**Communication**
Ramya Rajagopalan	Wisconsin	Sociology
Christine Shearer	**California, Santa Barbara**	**Social Science**
Elena Simakova	Cornell	Science & Technology Studies
Li Tang	**Georgia Tech**	**Public Policy**
Jue Wang	**Georgia Tech**	**Public Policy**

Affiliated Graduate Researchers

C. Alvial Palavicino	**University of Twente**	**Science, Technology, and Policy Studies**
Ashley Anderson	**Wisconsin**	**Life Sciences Communication**
Derrick Anderson	**Georgia**	**Public Administration**
Sanjay Arora	**Georgia Tech**	**Public Policy**
Ravtosh Bal	Georgia Tech, Georgia State	Public Policy
Andrea Bandelli	**Vu University Amsterdam**	**Communication Sciences**
Javiera Barandiaran	California, Berkeley	Environmental Sciences
Amy Barr	New Hampshire	Sociology
Christian Beaudrie	**Univ. of British Columbia**	**Resource Management Envir.Studies**
Sean Becker	**Univ. of Wisconsin-Madison**	**Sociology**
Noel Benedetti	Wisconsin	Life Sciences Communication
Gaymon Bennett	California, Berkeley	Systematic Theology
Ajay Bhaskarabhatla	Georgia Tech	Public Policy
Sonja Billerbeck	ETH Zurich	Synthetic Biology
Rachel Brockhage	**Grove City College**	**Communication Studies**
Michael Cacciatore	**Wisconsin-Madison**	**Life Sciences Communication**
Antonio Calleja-Lopez	University of Seville	Political Science
Stephen Carley	**Georgia Tech**	**Public Policy**
Gong Chao	**Dalian Univ. of Technology**	**Humanities**
Doo-Hun Choi	**Wisconsin-Madison**	**Life Sciences Communication**
Mary Collins	**California, Santa Barbara**	**Environmental Science & Management**

Rodrigo Cortes-Lobo	**Georgia Tech**	**Public Policy**
Rachel Cranfill	**California, Santa Barbara**	**Linguistics**
Yvonne Cuijpers	**Utrecht University**	**Innovation Studies**
Amy Dale	**Carnegie Mellon University**	**Engineering & Public Policy**
Kajsa Dalrymple	Wisconsin	Life Sciences Communication
Robert Del Barco	**Autonomous Univ. Zacatecas**	**Development Studies**
Ana Delgado	**University of Bergen**	**Sciences and the Humanities**
Julie Dillemuth	California, Santa Barbara	Geography
Anthony Dudo	**Wisconsin**	**Journalism & Mass Communication**
Roger Eardley-Pryor	**California, Santa Barbara**	**History**
Paul Ellwood	Leeds Univ. Business School	Business
Cassandra Engeman	**California, Santa Barbara**	**Social Science**
Gina Eosco	**Cornell University**	**Communication**
Zumel Espinoza	**Autonomous Univ. Zacatecas**	**Development Studies**
Wei Fan	**Beijing Institute of Tech.**	**Management**
Jason Gallo	Northwestern	Media, Technology & Society
Reynold Galope	Georgia Tech	Public Policy
John Garner	Georgia Tech	Computing
Matthew Gebbie	**California, Santa Barbara**	**Science and Engineering**
Harmeet Ghandi	Georgia Tech	Quantitative & Computational Finance
Cecilie Glerup	**Copenhagen Business School**	**Public Policy**
Kyle Gracey	**University of Chicago**	**Public Policy**
Ted Greenhalgh	**Nevada, Las Vegas**	**Environmental Studies**
Ying Guo	Beijing Institute of Tech.	Management
Shirley Han	**California, Santa Barbara**	**Science & Engineering**
Courtney Hanna	Univ. of British Columbia	Integrated Sciences
Shannon Hanna	**California, Santa Barbara**	**Science & Engineering**
Leela Hebbar	Rutgers	Public Policy
Elliott Hillback	Wisconsin	Journalism & Mass Communication
Raffael Himmelsbach	**University of Lausanne**	**Politics and International Studies**
Shirley Ho	Wisconsin	Journalism & Mass Communication
Travis Horsley	**Georgia Tech**	**Public Policy**
Zach Horton	**California, Santa Barbara**	**English**
Zhengyin Hu	**Chinese Academy of Science**	**Information Science**
Can Huang	Georgia Tech	Industrial Management
Jonathan Huang	**Georgia Tech**	**International Affairs, Science & Tech.**
Lu Huang	Beijing Institute of Tech.	Management
Jennifer Jensch	Wisconsin	Public Policy
Ronak Kamdar	Georgia Tech	Quantitative Finance & ISYE
Byoungyoon Kim	Rensselaer Poly. Institute	Science & Technology
Enukyung Kim	**Wisconsin**	**Journalism & Mass Communication**
Sojung Kim	Wisconsin	Journalism & Mass Communication
Ashley Kirby	Georgia Tech	Public Policy
Lotte Krabbenborg	**Groningen**	**Science & Society**
Jeanne Marie Kusina	**Bowling Green State Univ.**	**Applied Philosophy**
Pete Ladwig	Wisconsin	Life Sciences Communication
Erin Lamos	Georgia Tech	Public Policy
Brice Laurent	Ecole des Mines	Public Policy
Ricky Leung	Wisconsin	Sociology
Yin Li	**Georgia Tech**	**Public Policy**
Melian Liao	**Tsinghua University**	**Philosophy**

Monica List	**Michigan State University**	**Philosophy**
Chien-Chun Liu	Georgia Tech	Management
Maria Sonsire Lopez	**Venezuelan Ins. Sci. Research**	**Studies of Science**
Beate-Josefine Luber	University of Bielefeld	Science and Technology Studies
Federica Lucivero	**University of Twente**	**Philosophy**
Tingting Ma	**Beijing Institute of Tech.**	**Management**
Pratik Mehta	Georgia Tech	Industrial & Systems Engineering
Patrick E.T. McKeon	Georgia Tech	Public Policy
Yu Meng	Georgia Tech	Public Policy
Bastien Miorin	**Grenoble Inst. of Technology**	**Science & Technology Democracy**
Mary Moore	Wisconsin	Computer Science
Hari Narayanan	Georgia Tech	Quantitative Finance & ISYE
Christina Ndoh	NCSU	Public Administration
Jayme Neiman	**Univ. of Nebraska, Lincoln**	**Public Policy**
Tanner Osman	Georgia Tech	Public Policy
Krishna Parthasaathi	Georgia Tech	Industrial & Systems Engineering
Jayesh Patil	Georgia Tech	Computing
Ruimin Pei	Chinese Academy of Science	Management
Robin Phelps	**Colorado, Denver**	**Public Affairs**
Dena Plemmons	**California, San Diego**	**Research Ethics**
Sofia Randhawa	Georgia Tech	Quantitative Finance & ISYE
Gernot Rieder	**Vienna**	**Science, Technology & Society**
Simone Schumann	**Vienna**	**Social Studies**
Vanessa Schweizer	Carnegie Mellon	Engineering & Public Policy
Sarah Scripps	**South Carolina**	**History**
Jeongyim Seo	**Ewha Woman's University**	**Chemistry**
Lea Shanley	Wisconsin	Environment & Resources
Tsung-Jen Shih	Wisconsin	Journalism & Mass Communication
Harmeet Singh	Georgia Tech	Quantitative Finance & ISYE
John Slanina	Georgia Tech	Public Policy
Diran Soumonni	**Georgia Tech**	**Public Policy**
Anthony Stavrianakis	California, Berkeley	Anthropology
Alexa Stephens	Georgia Tech	Public Policy & City & Regional Planning
Galen Stocking	**California, Santa Barbara**	**Social Science**
Vrishali Subramanian	Georgia Tech	Public Policy
Dhanaraj Thakur	Georgia Tech	Public Policy
Francois Thoreau	**University of Liege**	**Political Science**
Juin-Yi Tsai	Wisconsin	Journalism
Rutger van Merkerk	University of Twente	Innovation & Environmental Sciences
M. Van Oudheusden	**Antwerp University**	**Political & Social Sciences**
Stephanie Vasko	**Washington**	**Materials Chemistry & Nanotechnology**
Charles Walsh	Georgia Tech	Public Policy
Wenping Wang	**Beijing Institute of Tech.**	**Management**
Rosalyna Wijaya	Wisconsin	Journalism & Mass Communication
John Willingham	North Carolina State	International Studies
Thomas Woodson	**Georgia Tech**	**Public Policy**
Jaime Yassif	**Calfornia, Berkeley**	**Biophysics**
Xuanting Ye	**Beijing Institute of Tech.**	**Political Science**
Emily York	**Calfornia, San Diego**	**Communication & Science Studies**
Edgar Zayago Lau	**Autonomous Univ. Zacatecas**	**Development Studies**
Heming Zhang	Nankai Univ./Georgia Tech	Public Policy

Shuliang Zhang	Beijing Institute of Tech.	Management
Yi Zhang	**Beijing Institute of Tech.**	**Management**
Qin Zhu	**Dalian University of Tech.**	**Philosophy**

ASU
Undergrad Interns & Researchers

Kalil Abdullah	Molecular Biotechnology
Eric Beeler	Sustainability
Nidhi Bhalla	Political Science
Brandon Borsheim	Sustainability
Linda Boyd	Geography
David Calderon	Molecular Bioscience & Biotechnology
Rahul Chhabra	Chemistry
Josh Choi	Biomedical Engineering & Economics
Kelley Conley	Psychology
Amie Dabu	**Sustainability**
Rob Davis	Biology
David Edwards	English & Creative Writing
Tara Egnatios	Public Policy
Tereza Fritz	Global Studies
Andrew Gaddis	Industrial Engineering
Ian Griffith	**Film & Media Studies**
Catherine Hoke	**Mechanical Engineering**
Rebecca Hudson	Business
Benjamin Lowenstein	Sociology
Rachel Lowenstein	Business
Alexander MacLean	Honors
Keith Martin	**Film**
Colin McDonald-Smith	Computer Science
Tobie Milford	Biology & Society
Timothy Norris	Architectural Studies
Sidra Omer	Journalism & Mass Communication
Mark Petersen	Economics
Zachary Pirtle	Mechanical Engineering
Jaron Reed	Political Science
David Renolds	Chemical Engineering
Lucas Rogers	Engineering
Dusana Schnell-Vivas	Marketing
Suzanne Shlom	Design Studies
Rachel Smith	Biology & Society
Evan Taylor	**Sustainability**
Daryl Traylor	Microbiology
Amelia Walsh	Interdisciplinary Studies
Julia Weakley	Global Studies
Brian Young	Biology & Society
Ke Wu	Biology & Society

Affiliated Undergrad Interns & Researchers

Annie Bidgood	Georgia Tech	ISYE
Audrey Campbell	Georgia Tech	Industrial Systems & Engineering
Brescia Cassellius	Wisconsin	Journalism & Mass Communication

Gordon Cutler	Georgia Tech	Computing
Sharyn Finney	Georgia Tech	Public Policy & Economics
Brian Lynch	Georgia Tech	Public Policy
John Garner	Georgia Tech	Public Policy
Clay Karwisch	Georgia Tech	History, Technology & Society
Charles Luke McCloud	Georgia Tech	Public Policy
Laura Rodriguez	Georgia Tech	International Affairs
Dave Schoeneck	Georgia Tech	Physics
Shawn Skolky	Georgia Tech	Public Policy
Charles Walsh	Wisconsin	School of Business

CNS-ASU Staff

Melissa Cornish	Biodesign Institute Liaison
Elizabeth Curran	**Program Coordinator**
Corrine Dillon	Program Manager
Michelle Iafrat	**Program Coordinator**
Regina Sanborn	**Assistant Director**
Joy Trottier	Administrative Associate

Participants affiliated, not receiving CNS-ASU support:

ASU

Azadeh Adibi	Graduate Student	Industrial Design
Luis Aguilera	**Student**	**Business**
Francisca Agusta	**Student**	**Interior Design**
Ismaeel Almarazeeq	Student	Industrial Engineering
Mohamed Alqabandy	**Graduate Student**	**Design**
G. Alvarez Sieber	Graduate Student	Engineering
Ariel Anbar	Professor	Earth & Space Exploration
Sandra Andrews	**Retired Faculty**	**Mary Lou Fulton Teachers College**
Catherine Arnold	Communications Coordinator	CSPO
Jose Ashford	**Professor**	**Social Work**
Heman Au	Student	Industrial Design
James Audiss	**Student**	**Business**
Ricardo Avila	**Student**	**Art**
Denise Baker	**Graduate Student**	**Psychology**
John Ball	**Graduate Student**	**Design, Environment & Arts**
Carl Ballard	**Graduate Student**	**Applied Math for Life & Social Sci.**
Sasha Barab	**Professor**	**Educational Leadership & Innovation**
Maribel Barba	**Wed Designer/Developer**	**Foundation**
Michelle Barry	Graduate Research Associate	Sustain. Engr. & Built Envir.
Tain Barzso	**Instructional Tech. Analyst**	**Digital Culture**
Leslie Beres	**Director College Facility**	**Design & Arts**
Zachariah Berkson	**Student**	**Chemical Engineering**
Vineet Bhosle	Graduate Student	Architecture
Jordan Biechler	**Student**	**Explore-Social & Behavioral Sci.**
Colleen Bivona	**Program Manager**	**Arts Media & Engineering**
Timur Boskailo	**Student**	**Architectural Studies**
Rachel Bowditch	Assistant Professor	Theatre & Film
Amanda Breaux	**Events Coordinator**	**Law**
Nicholas Broderick	Student	Theatre & Film

Banel Bucknor	**Student**	**Design**
Caren Burgermeister	**Project Coordinator**	**Res. & Innov. Math & Science Educ.**
Winslow Burleson	**Assistant Professor**	**Computing & Informatics**
Daragh Byrne	**Assistant Research Professor**	**Arts Media & Engineering**
Joel Carrasco	**Graduate Student**	**Landscape Architecture**
Angela Cazel-Jahn	**Artist/Graduate Student**	**Humanities Research**
M. Chavez-Echeagaray	**Graduate Student**	**Computer Science**
Jeffrey Chudy	**Student**	**Art Exploratory**
Sam Chung	**Faculty**	**Art (Ceramics)**
Daniel Cifuentes	Graduate Student	Arch. & Urban Design
Jeffrey Clancy	**Graduate Student**	**Architecture**
Robert Clinton	**Professor**	**Law**
David Corral	Student	Civil Engineering
Jacqueline Cortez	**Graduate Student**	**Architecture**
Michael Crow	**President**	**Arizona State University**
Daniel Cutrara	**Assistant Professor**	**English**
Williams Dabars	**Dir. Special Communications**	**Office of Public Affairs**
S. Doddaballapur	Graduate Student	Urban Design & Built. Environ.
Travis Doom	**Management Intern**	**CSPO**
Heather Draper	**Graduate Student**	**Design**
Michelle Duah	**Graduate Student**	**Design**
Mark Dudlik	**Management Intern**	**Office of the President**
Margaret Duff	**Graduate Student**	**Bioengineering**
Lauren Dykes	Graduate Teaching Assistant	Theatre & Film
Mark Edwards	Professor	Business
Farzaneh Eftekhari	**Graduate Student**	**Design**
Mohamed Elkhesky	Graduate Student	Mechanical Engineering
Ron Elliott	Graduate Student	Architecture
John Ernzen	Student	Biomedical Engineering
Vicki Ewald	Staff	Buckeye Express
Faye Farmer	**Associate Director**	**OKED Research Strategy Group**
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Camilla Finnie	**Student**	**Art**
Joseph Fletcher	Student	Computer Science
Alfinio Flores	Professor	Curriculum & Instruction
Mary Fonow	**Director & Professor**	**Social Transformation**
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Brian Ganter	**Student**	**Art**
Antonio Garcia	Associate Director	Hispanic Research Center
Justin Gauger	Student	History
Alan Gershfeld	**Consultant**	**Mary Lou Fulton External Projects**
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Joshua Gigantino	**Graduate Student**	**Design**
Gina Gillies	**Assistant to Director**	**LightWorks**
Maureen Goggin	**Chair & Professor**	**English**
George Goh	**Student**	**Intl. Student Exchange Partner**
Nicola Goldberg	**Sr. Healthcare Tech. Manager**	**Engin. & Phys. Sci. Research Council**
J. Gonzalez-Sanchez	Graduate Student	Computer Science
Gisela Grant	**Internship Coordinator**	**Politics and Global Studies**

Nancy Gray	**Graduate Teaching Assistant**	**Design**
Joel Greene	Professor	Public Policy
Andrey Gunawan	Graduate Teaching Assistant	Elect. Conptr. & Energy Eng.
Daniil Gunitskiy	**United Way Univ. Innov. Fel.**	**Office of University Initiatives**
Jennifer Gunther	**Student**	**Design Studies**
Lee Gutkind	**Professor**	**CSPO**
Jodi Guyot	**Dir. Res. Advance. & Comm.**	**Human Evolution & Social Change**
Jason Griffiths	Assistant Professor	Arch. & Landscape Arch.
Stuart Hadley	Vice President	Public Affairs & Foreign Rel.
Joshua Hammer	Student	Biomedical Engineering
Hilary Harp	**Assistant Professor**	**Art**
Thomas Hartman	**Associate Professor**	**Design**
Lee Hartwell	**Professor**	**EVPP Consultant Group**
Elisabeth Hayes	**Professor**	**English**
Colin Ho	**Student**	**Mechanical Engineering**
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Timothy Horn	**Graphic Designer Principal**	**Education Outreach & Student Svcs.**
Afzal Hossain	Graduate Teaching Assistant	Arch. & Landscape Arch.
Sarah Hough	**Manager Creative Services**	**Design & Arts**
Oscar Huerta	Graduate Student	Design
Amelia Huggins	**Mgr, Marketing & Comm.**	**LightWorks**
A Magdalena Hurtado	**Professor**	**Human Evolution & Social Change**
Zahra Hussaini	Student	Materials Science & Engineering
Joanna Iacovelli	**Prospect Research**	**Foundation**
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Aziza Ismael	**Student**	**Design Studies**
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Jane Jackson	**Retired Faculty**	**Physics**
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Parker Jones	**Student**	**Art**
Joseph Jurado	**Student**	**Film**
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Michael Katic	**Student**	**Applied Computer Science**
Josh Katzker	Graduate Teaching Assistant	Theatre & Film
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James Keller	**Student**	**Theatre**
Aisling Kelliher	**Assistant Professor**	**Design**
Cameron Keys	**Graduate Student**	**Science & Technology Policy**
Amruta Khanolkar	Graduate Teaching Assistant	Arch. & Landscape Arch.
Daniel Kharisma	Graduate Student	Civil, Envir. & Sustain. Engineering
Dhara Kothavala	Graduate Student	Sustainability
Matthew Krise	**Shop Superintendent**	**Design**
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Michael Lande	**Assistant Professor**	**Engineering**
Heather Landes	**Associate Dean**	**Design & Arts**
Heather Le Fur	**Graphic Design Principal**	**Design & Arts**

Tyler Libey	Graduate Student	Biomedical Engineering
Min Lin	Student	Computer Systems Engineering
Heather Lineberry	**Associate Director**	**Art Museum**
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Priscilla Long	**Student**	**Art**
Lauren Loosveldt	**Graduate Student**	**Architecture**
Richard Loveless	**Emeritus Professor**	
Ryan Luikens	**Student**	**Sustainability**
Jane Magruder	**Dir. Print Comm. & Med. Rel.**	**Law**
Giada Mannino	**Graphic Designer**	**Sustainability**
Jingzian Mao	Graduate Student	Computer Science
Erik Margolis	**Associate Professor**	**Human Communication**
Richard Martorano	**Director**	**Engineering Technical Services**
Maritza Maurer	**Support Systems Analyst**	**Design & Arts**
Michael McBeath	**Professor**	**Psychology**
Scott McClintock	**Faculty Associate**	**Sustainability**
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Michael Meeder	**Graduate Student**	**English**
Deirdre Meldrum	Dean	Fulton School of Engineering
George Moakley	Student	Theatre & Film
Erika Mohaupt	**Graduate Student**	**Design**
Adam Monroe	**Graduate Teaching Assistant**	**Chemistry & Biochemistry**
Gabriel Montemayor	Assistant Professor	Arch. & Landscape Arch.
Michael Montgomery	**Student**	**Psychology**
Scott Murphy	**Graduate Student**	**Technology**
Rafiu Mustapha	Graduate Student	Engineering
Michele Mutchek	**Graduate Research Assistant**	**Sustainability**
Anumeha Narain	Graduate Student	Industrial Design
Spencer Nelson	**Student**	**Design Studies**
Judy Newland	**Faculty Associate**	**Anthropology**
Judy Nichols	**Dir. Dig. Comm. & Soc. Med.**	**Law**
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Chi-Han Peng	Graduate Student	Computer Science
Jacob Pinholster	**School Dir. & Assoc. Prof.**	**Theatre & Film**
Vincent Pizziconi	Bioengineering	Professor
Evan Pomerantz	**Student**	**Art**
Carlan Pontious	Student	Industrial Design
Randal Pope	Graduate Student	GRES
Adriana Ramos	Student	Urban Design

Patricia Reiter	**Director of Development**	**Sustainability**
Wellington Reiter	**Special Advisor to President**	**Arizona State University**
Deborah Relph	**Program Coordinator**	**Law**
Grant Richardson	**Student**	**Graphic Design**
Thanassis Rikakis	**School Director & Professor**	**Arts Media & Engineering**
Mindy Robbins	Student	Architectural Studies
Laura Rodriguez	Office Specialist Sr.	CTI College Tech & Innovation
Susan Rubin	**Events Coordinator Sr.**	**Sustainability**
Shaily Rungta	Graduate Student	Built Environment
Richard Rushforth	**Graduate Student**	**Sustainability**
Julie Russ	**Coordinator Senior**	**Institute of Human Origin**
Michael Russo	Graduate Student	Architecture
Justin Ryan	**Graduate Student**	**Bio. & Health Systems Engin.**
Arthur Sabatini	**Associate Professor**	**Humanities Arts & Culture**
Michael Saks	**Professor**	**Law**
Jamie Sandomire	Student	Theatre & Film
Deepika Sangoi	Graduate Teaching Assistant	Arch. & Landscape Arch.
Lisa Santy	**Graduate Student**	**Landscape Architecture**
Blaire Schenck	**Student**	**Interior Design**
Sherrie Schmidt	**Librarian**	**Hayden Library**
Sara Schwabe	Graduate Teaching Assistant	Theatre & Film
Samantha Sears	Graduate Teaching Assistant	Arch. & Landscape Arch.
Allison Shannon	**Grant Proposal Writer**	**Sustainability**
Ankur R. Sharma	Graduate Student	Electrical Engineering
Nicholas Shekerjian	Student	Architectural Studies
Denis Simon	**Vice Provost**	**China Initiatives and Strategy**
Vipul Singh	Graduate Research Assistant	Built Environment
Paul Skiera	**Tech. Support Analyst Coord.**	**Technology Based Learning Res.**
Ian Smith	**Student**	**Interdisciplinary Studies**
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Michael E. Smith	Professor	Evolution & Social Change
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Joseph Spiro	**Graduate Student**	**Computer Science**
Jim St. Leger	**Technology Marketing Mgr.**	**Intel**
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Jason Sukut	**Graduate Student**	**Applied Ethics**
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Michael Thomet	**Graduate Student**	**English**
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Lisa Tolentino	**Graduate Student**	**Media Arts & Sciences**
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Pavan Turaga	**Assistant Professor**	**Arts Media & Engineering**
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David Wahls	**Regional Major Gift Officer**	**Foundation**
Sheila Wakelam	**Graduate Student**	**Design**
Qiao Wang	**Graduate Student**	**Art Media & Engineering**
Matt Watkins	Student	Theatre & Film
Zachary Watson	Student	Landscape Architecture
Eric Wheeler	Student	Theatre & Film
Jorden Whicker	Student	Computer Science
Dave White	Associate Professor	Community Res. & Develop.
Laurie Valenti	**Specialist**	**Theatre & Film**
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Greg Wise	**Associate Dean & Professor**	**New Interdisc. Arts & Sciences**
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Kuan-Chuen Wu	Graduate Student	Electrical Engineering
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Mark Zeigler	**Student**	**Mathematics**

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Soon Cheon Byeon	**Senior Researcher**	**Korea Inst. of Science & Technology**
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Rick Canady	Staff	Food & Drug Administration
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William Clark	Professor	Harvard University

Maria Coccia	**Senior Researcher**	**Italian National Research Council**
James Collins	Head of Biological Sciences	National Science Foundation
David Crowley	**Artist**	**David Crowley Gallery**
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Scott Cunningham	**Professor**	**Technical University of Delft**
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Luke Denmon	**Critical Envir., Data Ctr Adv.**	**CB Richard Ellis**
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Richard Diehl	**Senior Systems Engineer**	**General Dynamics**
Robert Diehl	**Senior Professor**	**DeVry University**
Johnathan Dillon	**Senior Applications Engineer**	**Microchip Technology Inc.**
Ira Domsky	**Princpal**	**Ira Domsky Environmental**
Heather Douglas	Professor	University of Tennessee
Kate Duckworth	Staff	NISEnet
Megan Dyer	**Research Technologist**	**Mayo Clinic**
Douglas Edgelow	**Owner**	**Equus Development Corporation**
Daniel Erasmus	**Scenario Faciliatator**	**Digital Thinking Network**
Chris Ewald	Staff	Buckeye Express
Ellen Feigal	Staff	TGen
Elizabeth Farrell	Staff	University of New Hampshire
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Jonathan Fink	V.P. Res. & Strategic Part.	Porland State University
Hunter Floyd	**Intern Architect**	**Corgan Associates**
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Brian Gleim	**Instructor**	**Glendale Community College**
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Aaron Herring	**Designer**	**Gould Evans**
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Diana Hicks	Public Policy	Georgia Institute of Tech.
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Kent Hughes	Director	Teach America
Sol Jaffe	**Indep. Mgmt. Consultant**	

Anil Jain	Computer Science & Engin.	Michigan State University
Ann Jarmusch	**Writer / Editor**	
Sheila Jasanoff	Science & Technologies Studies	Harvard University
Charles Jeffery	**Dean, Institutional Planning**	**Glendale Community College**
Carol Johnson	Planning Department	City of Phoenix
Eli Kawam	President and CTO	EKLATEK Engineering
Donna Kent	Global Studies	Televerde
Timothy Kiehl	**Artist/Craftsman**	**Airplayn**
Matt Kim	Member	Nanotech. Industry Liaison
Evgeny Klochikhin	**Student**	**University of Manchester**
Mitzi Krockover	**Senior Consultant**	**Sokolov, Sokolov, Burgess Solutions**
Fred Kronz	Philosophy	University of Texas
Ray Kurzweil	Member	Board of Visitors
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Troy Livingston	Staff	NISEnet
Eric Luchian	**Research Associate**	**Lancaster University**
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Eric Magrane	**Graduate Student**	**University of Arizona**
Uttam Malani	Public Policy	Georgia Institute of Technology
Tony Maniaci	**Director Product Develop.**	**ITel**
Benjamin M. Mann	Program Manager	Defense Science Office
Robin Marks	Staff	NISEnet
Florence Matusky	**Writer**	
Catherine May	**Senior Historical Analyst**	**Salt River Project**
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Celia Merzbacher	Staff	Office of Naval Research
Daniel Metlay	Staff	Nuclear Waste Review Board
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Danielle Millam	**Director of Development**	**Las Vegas-Clark Cty Library Dist.**
Blaine Miller	**President & Prin. Analyst**	**Modern Insights**
Elizabeth Miller	**Water Res. Planning Advisor**	**City of Scottsdale**
John Miller	**Dir. of Information Tech.**	**Litchfield Elementary School District**
Laurence Miller	**Physician**	**Mayo Clinic – Scottsdale**
Michael Moffitt	Associate Professor	University of Michigan
John Moravec	**Senior Lecturer**	**University of Minnesota**
Jeff Morris	Staff	Environ. Protection Agency
Daniel Morrison	Professor	Vanderbilt University
George Muncaster	**Professor**	**Scottsdale Community College**
Sean Murdock	Member	Nanotech. Industry Liaison
Carolyn Nelson	**Technical Delivery Manager**	**Bank of America**
Lee Nelson	**Prin., Scott L. Libby Elem.**	**Litchfield Elementary School District**
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Melissa Pulsifer	**Marketing Coordinator**	**Richard + Bauer Architecture**

Kristin Raffaelle	**Executive Director / CEO**	**PACeHR**
Priscilla Regan	Professor	Social, Behavioral & Econ.
Roger Reynolds	**Composer/Professor**	**Univ. of California, San Diego**
Jack Ring	**Systemist**	
Estelle Robichaux	**Graduate Student**	**University of Florida**
Michael Roco	Senior Advisor	National Science Foundation
Jacob Rosenthal	**Maker**	**Heatsync Labs**
Marc Rothenberg	Staff	Legislative & Public Affairs
Sean Rothman	**Professional**	**University of Manchester**
Leslie Rycroft	**Vice President**	**Scottsdale League for the Arts**
Dana Sadler	**District Human Resources**	**Home Depot**
Tind Shepper Ryen	Staff	House Committee on Science
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Laura Schiavo	Curator	National Building Museum
Karen Shakman	Project Architect	Iconic Architecture
Mark Shapiro	Member	Board of Visitors
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Gregory Simonson	Professor	Science, Tech. & Military
Mitchell Small	Professor	Carnegie Mellon University
Scott Smith	**Founder**	**Changeist, LLC.**
Jacque Sokolov	**Chairman / Senior Partner**	**Sokolov, Sokolov, Burgess Solutions**
Alexa Stephens	Public Policy	Georgia Tech
Kerri Stone	**Student**	**Colorado School of Mines**
Reva Stone	**Artist**	**Winnipeg Art Gallery**
Karen Tanenbaum	**Graduate Student**	**Simon Fraser University**
Jason Teske	**Buyer / Planner**	**Lasertel, Inc.**
Judith Testani	**Owner/President**	**Testani Design Troupe, Inc.**
D.A. Therrien	**Artist**	
Gerald Thurman	**Instructor**	**Scottsdale Community College**
Raoul Tibes	**Assoc. Dir, Leukemias Prog.**	**Mayo Clinic**
Mike Trier	**Senior Budget Analyst**	**Maricopa Community Colleges**
Joanne Tornow	Program Manager	National Science Foundation
Steve Valev	**Associate**	**Gould Evans**
Ian Vandeventer	**Owner**	**Ivy Consulting, Inc.**
Dawn Visser	**President**	**MJS Designs, Inc.**
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Fred Weber	Member	Nanotech. Industry Liaison
Fan Wei	**Student**	**Beijing Institute of Technology**
Marshall Whitmire	**Owner & Managing Director**	**RCI Surveys, Inc.**
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Jeff Williamson	**CEO/Pres. & Exec. Director**	**Phoenix Zoo**
James Wilsdon	Director	The Royal Society
Carly Wobig	Graduate Student	University of Illinois
Gregory Woodhead	**Director of Support Services**	**Corinthian Colleges**
Donghua Zhu	**Professor**	**Beijing Institute of Technology**
Ranu Zunjarwad	**Product Designer/Writer**	

Nanotechnology in Society Network PIs:

Davis Baird	University of South Carolina
Richard Freedman	Harvard University
Barbara Harthorn	UCSB

Lynne Zucker	UCLA

Expert and Oversight Panel for National Citizens' Technology Forum

Roberta M. Berry	Professor	Georgia Tech
Stephen Helms Tillery	Professor	ASU
Maxwell J. Mehlman	Professor	Case Western Reserve
Kristen Kulinowski	Executive Director	Rice
Jason S. Robert	Assistant Professor	ASU
Ida Andersen	Staff	Danish Board of Technology
David Rejeski	Director	Woodrow Wilson Center

4. (b) LIST OF ADVISORY BOARDS

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Jan Youtie, Manager, Policy Services, Georgia Institute of Technology

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Andrew Maynard, Chief Senior Advisor, Project on Emerging Technologies, Woodrow Wilson Center
Colin Milburn, Assoc. Professor, English & Science & Tech. Studies,University of California, Davis
Albert Teich, Director, Science & Policy Programs, American Association for the Advancement of Science

iii. Nanotechnology Industry Liaison Committee

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Larry Bock, Chairman, Luxe Ventures
Ellen Feigal, Director of Medical Devices and Imaging, TGen
Douglas Goodman
Herb Goronkin
John Hughes
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Donna Kent, Senior Vice President of Global Studies, Televerde
Anatoli Korkin, Director, ASU Office of Research and Economic Affairs
John McGarity
Michael Moffitt, Professor, Department of Computer Science and Engineering, University of Michigan
Sean Murdock, Nanotechnology Industry Association
Fred Weber

iv. Private Sector Engagement Committee

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Lynn Bergeson, Owner, Bergeson & Campbell, P.C.
Susan Brienza, Attorney, Ryley Carlock & Applewhite
Kurt Creager, Executive Director, Stardust Center for Affordable Homes and the Family.
Sarah Davies, Private Sector Engagement Coordinator, Center for Nanotechnology in Society, Arizona State University
Jake Dunagan, Research Director, Technology Horizons Program, Institute for the Future
Erik Fisher, Assistant Professor, School of Government, Politics and Global Studies, Arizona State University

Jason Gallo, Science and Technology Policy Analyst, Science and Technology Policy Institute
Stephen Goodnick, Professor, Ira A. Fulton School of Engineering, Arizona State University
David Guston, Professor, School of Government, Politics and Global Studies, Arizona State University
Patti D. Hill, Founder, Penman Public Relations
Travis Johnson, Scientist, Nanotechnology Measurements Division, Agilent Technologies
Frederick Klaessig, Manager, Pennsylvania Bio Nano Systems
Michael Kozicki, Chief Technology Officer and co-founder, Axon Technologies
Celia Merzbacher,Vice President, Innovative Partnerships, Semi-Conductor Research Corporation
Evan Michelson, Associate Director, The Rockefeller Foundation
Robert Ott, Associate Director, Occupational Health and Safety, Arizona State University
Rax Raimond, Senior Mediator and Program Manager, Meridian Institute
David Roessner, Senior Fellow, Center for Science, Technology, and Economic Development, SRI International
Dietram Scheufele, Professor, Journalism and Mass Communication, and Life Sciences, University of Wisconsin-Madison
Cynthia Selin, Assistant Research Professor, Center for Nanotechnology in Society, Arizona State University
Philip Shapira, Professor, School of Public Policy, Georgia Institute of Technology; Professor of Innovation Management and Policy, Manchester Institute for Innovation Research, University of Manchester
Ahmad Soueid, Principal and Senior Vice President, HDR Architecture, Inc.
Arnim Wiek, Assistant Professor, School of Sustainability, Arizona State University
Peter Yeadon, Co-founder, Decker Yeadon
Jan Youtie, Manager, Policy Services, Georgia Institute of Technology
Steven Zylstra, President & CEO, Arizona Technology Council

v. Expert and Oversight Panel for National Citizens' Technology Forum

Roberta M. Berry, Associate Professor of Public Policy; Director, Law, Science & Technology Program, Georgia Institute of Technology
Stephen Helms Tillery, Assistant Professor, Harrington Department of Bioengineering; Assistant Professor of Kinesiology, Arizona State University
Kristen Kulinowski, Executive Director, Center for Biological & Environmental Nanotechnology, Rice University
Maxwell J. Mehlman, Arthur E. Petersilge Professor of Law; Professor of Bioethics, School of Medicine; Director of the Law-Medicine Center, Case Western Reserve University
Jason S. Robert, Associate Professor, Department of Basic Medical Sciences, The University of Arizona College of Medicine; Associate Professor, School of Life Sciences, Arizona State University
Ida Andersen, Danish Board of Technology
David Rejeski, Director, Project on Emerging Nanotechnologies, Woodrow Wilson International Center for Scholars

4. (c) LIST OF PARTICIPATING INSTITUTIONS

i. ASU Academic Participating Institutions

Applied Learning Technologies Institute
Arizona Institute for Nano-Electronics (AINE)
Arizona Technology Enterprises (AzTE)
Axon Technologies
Barrett, The Honors College
Biodesign Institute
Center for Biology & Society
Center for Research on Education in Science, Mathematics, Engineering, & Technology (CRESMET)
Center for the Study of Religion & Conflict
Center for Law, Science and Innovation
Center for Solid State Electronics Research
Center for Study of Institutional Diversity
College of Liberal Arts & Sciences
College of Public Programs
College of Technology & Innovation
Complex Adaptive Systems Initiative
Consortium for Science, Policy & Outcomes
Decision Theater for a Desert City
Foundation, ASU
Global Institute of Sustainability
Graduate College
Hayden Library
Health Services
Herberger Institute for Design & the Arts
Hispanic Research Center
Institute of Human Origin
Ira A. Fulton Schools of Engineering
Learning Sciences Institute
LightWorks
Mary Lou Fulton College of Education
New Interdisciplinary Arts & Sciences
Office of China Initiatives and Strategy
Office of Knowledge and Enterprise Development (OKED)
Office of Public Affairs
Office of the President
Office of the Vice President and Provost
Office of University Initiatives
Occupational Health and Safety
Phoenix Urban Research Laboratory
Responsible Conduct of Research Program, School of Life Sciences
Sandra Day O'Connor School of Law
School of Earth & Space Exploration
School of Government, Politics, & Global Studies
School of Human Evolution & Social Change
School of International Letters & Cultures
School of Letters & Sciences
School of Life Sciences

School of Mathematical & Statistical Sciences
School of Philosophical, Historical, and Religious Studies
School of Social Transformation
School of Sustainability
Science Policy Assessment & Research on Climate (SPARC)
Stardust Center
Technology Based Learning Research
University Art Museum
University Public Schools
W.P. Carey School of Business
Walter Cronkite School of Journalism & Mass Communication

ii. Academic Participating Institutions Other than at ASU

Aarhus University, Denmark
Ansal Institute of Technology
Antwerp University
Austrian Academy of Science
Beijing Institute of Technology, China
Boise State University
Bowling Green State University
Brown University
Cardiff University
Carnegie Mellon University
Case Western Reserve University
Center for Nanotechnology in Society at University of California, Santa Barbara
Chandler Gilbert Comm. College
Clark University
Collins College
Colorado School of Mines
Columbia University
Copenhagen Business School, Denmark
Corinthian Colleges
Cornell University
Dalian University of Technology, China
Delft Technical University, the Netherlands
DeVry University
Dublin City University
Durham University, United Kingdom
Ecole des Mines, France
ETH Zurich
Eugene Lang College the New School for Liberal Arts
European Commission
Ewha Women's University
Federal University of Parana, Brazil
Federal University of Santa Catarina, Brazil
Flemish Institute of Science & Technology
Florida International University
George Mason University
George Washington University
Georgetown University

Georgia Institute of Technology
Glendale Community College
Grenoble Institute of Technology
Grove City College
Harvard University
Howard University
Illinois Institute of Technology
Indiana University
Institute of International Sociology of Gorizia
Institut d'Etudes Politiques de Grenoble, France
Iowa State University
James Martin Institute for Science & Civilization, Oxford University, UK
Karlsruhe Institute of Technology, Germany
Korea Institute of Science and Technology, Seoul, Korea
Lancaster University, UK
Leeds University Business School, UK
Lehigh University
Litchfield Elementary School District
Long Island University
Manchester Business School
Maricopa Community Colleges
Mesa Biotech Academy
Mesa Community College
Mesa High School
Michigan State University
MIT SENSEable City Lab
Nagoya University, Japan
National Academy of Sciences
National University of Singapore & Asia
New York University
North Carolina State University
Northeastern University
Northwestern University
Norwegian University of Science & Technology, Norway
NSEC/CNS-University of California, Santa Barbara (UCSB)
Osaka University, Japan
Penn State University
Portland State University
Purdue University
Queens University
Radboud University
Rensselaer Polytechnic Institute
Rhode Island School of Design
Rice University
Rice University/ICON
Rutgers, The State University of New Jersey
Said Business School, Oxford
Scottsdale Community College
Simon Fraser University, British Columbia
S.I.W.S. N.R. Swamy College, India
Stanford University

Technical University of Delft
Technical University of Denmark
Technical University of Darmstadt
Tennessee State University
Texas State University, San Marcos
The Center for International Development, Harvard University
Tokyo University
Tsinghua University, China
UCLA/Harvard/NBER: Collaborative Research; Personnel Exchanges
Unicamp University, Brazil
Universidad de Zacatecas, Mexico
Universidad del Pais Vasco, Spain
University at Albany
University of Antwerp, Belgium
University of Arizona
University of Basel
University of Bergen, Norway
University of Bielefeld, Germany
University of British Columbia
University of Calgary, Canada
University of California, Berkeley
University of California, Davis
University of California, Irvine
University of California, Los Angeles
University of California, San Diego
University of California, Santa Barbara
University of Chicago
University of Colorado, Boulder
University of Colorado, Denver
University of Copenhagen
University of Denver
University of Edinburgh
University of Exeter, United Kingdom
University of Florida
University of Georgia
University of Gothenburg, Sweden
University of Groningen, Netherlands
University of Illinois, Chicago
University of Illinois, Springfield
University of Illinois, Urbana-Champaign
University of Iowa
University of Jiangsu, China
University of Lausanne, Switzerland
University of Leeds
University of Liege, Belgium
University of Manchester, United Kingdom
University of Maryland
University of Massachusetts, Amherst
University of Melbourne, Australia
University of Michigan
University of Minnesota

University of Montana
University of Nebraska, Lincoln
University of Nevada, Las Vegas
University of New Hampshire
University of North Carolina, Charlotte
University of Notre Dame
University of Nottingham
University of Padua
University of Seville, Spain
University of South Carolina
University of South Florida
University of Southern California
University of Southern Indiana
University of Sussex, United Kingdom
University of Tennessee, Knoxville
University of Texas, Austin
University of Trieste, Italy
University of Twente, the Netherlands
University of Utah
University of Victoria
University of Vienna
University of Virginia
University of Washington
University of Wisconsin, Madison
UT-Battelle
Utrecht University
Vanderbilt University
Virginia Tech University
VU University of Amsterdam
Washington University, Saint Louis
West Chester University of Pennsylvania
Western Michigan University
Yale University

4. (d) Non-Academic Participating Institutions

Agilent Technologies
Airplayn
ALD Nano Solutions
Alsek Research
American Association for the Advancement of Science (AAAS)
American Bar Foundation
Apriva ISS
Arizona Bioindustry Organization
Arizona Commerce Authority
Arizona Corporation Commission
Arizona Department of Education
Arizona Department of Health Services
Arizona Nanotechnology Cluster
Arizona Public Service (APS)
Arizona Research Institute for Solar Energy
Arizona Science Center
Arizona Technology Council
Australian Government
Bank of America
Bassetti Foundation
Bioindustry Organization of Southern Arizona
Boudreaux and Associates
BrasEq
Brilliant Concepts LLC.
British Embassy
Buckeye Express
Cambridge Public Health Department
Carnegie Mellon
CB Richard Ellis
CEA-Saclay
Cell Publishing
Center for Business Models in Health Care
Center for Responsible Nanotechnology
Changeist, LLC.
Chemical Heritage Foundation
City of Apache Junction
City of Phoenix
City of Scottsdale
Complex Global Risks
Corgan Associates
Danish Board of Technology
David Crowley Gallery
Decker Yeadon LLC
Department of Energy (DOE)
Department of the Treasury
Department of Transporation
Digital Thinking Network
Downtown Phoenix Journal
Ecological Society of America

EKLATEK Engineering
Emerging Leaders in Science & Society (ELISS)
Engineering & Physical Sciences Research Council (EPSRC)
Environmental Protection Agency (EPA)
Equus Development Corporation
European Commission
Exploratorium, San Francisco
Federal Aviation Administration Office of Environment & Energy
FBI Weapons of Mass Destruction
Food and Drug Administration (FDA)
Gallagher and Kennedy
General Dynamics
Genøk Centre for Biosafety
Genome British Columbia
German Parliament
Global Business Network
Gould Evans
Gordon Research Conferences
Greenwall Foundation
HDR Architecture
Heatsync Labs
Heliae
Home Depot
Iconic Architecture
Institute for Agriculture and Trade Policy
Institute for Ecological Economy Research, Germany
Institute for the Future
Institute of Technical Assessment & Systems Analysis
Intel
Intelligent Information Services Corporation (IISC)
International Nanotechnology in Society Network (INSN)
International Research Center
Ira Domsky Environmental
Italian National Research Council, Turin, Italy
ITel
Ivy Consulting, Inc.
Jennings, Strouss, & Salmon PLC
Kristine Wilcox Consulting
Las Vegas-Clark County Library District
Lasertel, Inc.
Lawrence Livermore Lab
Leathers Milligan & Associates
Loka Institute
London Science Museum
Luxe Ventures
Mabelson Law Group
Max Chandler Robot Art
Mayo Clinic – Scottsdale
Meridian Institute
Metacurrency Project
Microchip

MJS Designs, Inc.
Modern Insights
Museum of Life & Science, North Carolina
Museum of Science, Boston
Nanoscale Informal Science Education Network (NISENet)
National Academy of Engineering
National Advisory Committee on Aeronautics (NASA)
National Business Museum
National Geographic Society
National Institute of Standards and Technology (NIST)
National Institutes of Health (NIH)
National Nanomanufacturing Network (NNN)
National Nanotechnology Coordinating Office
National Nanotechnology Infrastructure Network
National Research Council
National Science Foundation
Nature Publishing Group
New Haven Independent
Norwegian Institute
Nothing but NET
Nuclear Waste Review Board
Office of Naval Research
Oregon Museum of Science & Industry
PACeHR
Penman PR
Pennsylvania Bio Nano Systems, LLC.
Phoenix Zoo
Physician Services Group
PING Inc.
Planetary ONE
Practical Action
Presidential Commission for the Study of Bioethical Issues
QuantTera
Rathenau Institute
RCI Surveys, Inc.
Research Council of Norway
Research Councils U.K. (RCUK) in the U.S.
Re/Max Fine Properties
Richard + Bauer Architecture
Rockefeller Foundation
Ryley, Carlock & Applewhite Attorneys
Salt River Project
Sandia National Laboratory
Savage Film
Science and Technology Institute
Sciencenter, New York
Science Foundation Arizona
Science Museum of Minnesota
SciTech Strategies, Inc.
Scottsdale League for the Arts
Semi-Conductor Research Corporation

SETI Institute
SmithGroup
Snell and Wilmer Law
Sokolov, Sokolov, Burgess Solutions (SSB)
Spirit of the Senses Salon
Springer Publishing
SRI International
Strategic Advantage, Inc.
Sundt Construction, Inc.
Synthetic Biology Engineering Research Ctr. (SynBERC)
Targeted Genetics Corporation (TGen)
Teach America
Tempe Festival of the Arts (Fall and Spring)
Televerde
Testani Design Troupe, Inc.
The Elumenati, LLC
The Embryo Project
The Energy and Resources Institute
The Foresight Institute
The Galaxy Organization
The Rockefeller Foundation
The Royal Society
The Washington Post
Translational Genomics Research Institute (TGEN)
TraskBritt Intellectual
Underwood Bros., Inc.
Unicorn Media, Inc.
U.S. Government Accountability Office (U.S. GAO)
U.S. Department of Agriculture
U.S. Department of Homeland Security
U.S. DOE/Center for Integrated Nanotechnology (CINT)
Venezuelan Institute for Scientific Research
Will Bruder & Partners Ltd.
Winnipeg Art Gallery
Woodrow Wilson International Center for Scholars

5. Quantifiable Outputs

Table 1: Quantifiable Outputs - NSF Award #0937591

	Reporting Year -1	Reporting Year-2	Reporting Year-3	Reporting Year-4	Reporting Year 5	Total
Outputs	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	
Publications resulted from NSEC Support						
in Peer Reviewed Journal	19	40				59
in Peer Reviewed Conference Proceedings	0	0				0
in Peer Reviewed Book Chapters	9	16				25
Technical Reports	7	6				13
Working Papers	7	2				9
Books	3	2				5
Theses	9	8				17
in Trade Journals	3	0				3
Other Journal Publications	1	4				5
Internet	24	8				32
with Multiple Authors	35	42				77
co-authored with NSEC faculty	34	41				75
NSEC Technology Transfer						
Inventions Disclosed	0	3				3
Patents Filed	0	0				0
Patents Awarded	0	0				0
Software Licensed	0	0				0
Spin-off Companies Started	0	0				0
Degrees to NSEC Students						
Bachelors Degrees Granted	14	8				22
Masters Degrees Granted	12	11				23
Doctoral Degrees Granted	14	10				24
NSEC Graduates Hired by						
Industry	12	15				27
NSEC participating Firms	0	0				0
Other US Firms	12	15				27
Government	3	2				5
Academic Institutions	15	12				27
Other	0	0				0
Unknown	10	0				10
NSEC Influence on Curriculum						
New Courses Based on NSEC Research	4	7				11
Courses Modified to Include NSEC Research	0	0				0
New Textbooks Based on NSEC Research	0	0				0
Free-standing Course Modules or Instructional CDs	0	0				0
New Full Degree Programs	1	0				1
New Certificate	0	0				0
Information Dissemation/Educational Outreach						
Workshops, Short Courses to Industry	0	3				3
Workshops, Short Courses to Others	5	9				14
Seminars, Colloquia, etc.	112	141				253
World Wide Web courses	1	0				1
Academic Presentations	60	86				146
Industry Presentations	18	27				45
Science Cafes	7	8				15
Visiting Speakers	17	5				22
Community Speaking Engagements	4	3				7
Newsletters	0	0				0

6. Mission, Significant Advances, and Broader Impacts

The Center's mission is to: 1) *research* the societal dimensions of nanoscale science and engineering (NSE); 2) *train* a community of scholars with new insight into these dimensions; 3) *engage* various publics and NSE researchers in dialogues about the goals and implications of NSE; and 4) *partner* with the NSE enterprise to generate greater *reflexiveness* in research, development, education and policy. Using the methods of real-time technology assessment (RTTA; Guston and Sarewitz 2002), CNS-ASU weaves together these activities to support a broad-based societal capacity for the *anticipatory governance* of emerging technologies.

The Center has made significant strides in accomplishing this mission. In particular, the Center's RTTA methods and its anticipatory governance vision have been recognized in important scholarly venues, e.g., the field-defining *Handbook of Science and Technology Studies*, which includes Barben et al.'s (2008) chapter, and the series on innovation policy in *Nature*, which published Guston's (2008) commentary. The Center's work also includes a more detailed genealogy of anticipatory governance (Karinen and Guston 2010) and synoptic piece placing anticipatory governance in the NNI's approach to responsible development and in the context of some recent scholarly debate (Guston revise and resubmit, *SSS*). A forthcoming submission of a special issue (edited by Barben and Guston) on reflexive and anticipatory governance to *Social Studies of Science* delves deeper into the constituent capacities anticipatory governance. Beyond such publications, a number of programs and scholars have begun to adopt anticipatory governance and scrutinize it for their own purposes, from the incorporation of anticipatory governance into the programmatic agenda of the Nano-scale Informal Science Education Network's (NISE Net) public forums (see **Section 12 Outreach and Knowledge Transfer**), to the work of a cadre of international scholars and practitioners who have visited CNS-ASU to imbibe its perspective (see **Section 13 Shared and Other Experimental Facilities** [**International Collaborations**]), to sessions at the annual meetings of the AAAS Science and Technology Policy Forum (May 09), the Society for the Study of Nanoscience and Emerging Technologies (F 09; F 10; F 11) and the Society for Social Studies of Science of Science (F 09; F 10) dedicated to anticipatory governance.

Moreover, anticipatory governance and its component capacities are represented in NNI and other official planning documents, including: endorsement of scenario development as a route to understanding nanotechnological futures, in the NNI 2007 strategic plan; highlighting of integration research as an important element in future NSE collaborations with social science, in the FY 2012 NNI budget summary from NSF; focusing importantly on anticipatory governance in the 2010 NSF/WTEC report on the future of nanotechnology; etc. Guston (revise and resubmit, *SSS*) has begun to collect many of these responses in the community and respond to some critics that have emerged. Guston (under review, *Minerva*) has also explored, through a narrative historical approach, the meaning of anticipatory governance in the case of atomic weapons.

CNS-ASU research is having a substantial influence on the scholarly literature. The *Yearbook of Nanotechnology in Society* series (Springer; Guston, series editor) has published two volumes (Fisher, Selin and Wetmore 2008; and Cozzens and Wetmore 2011) and, after some delays, has nearly in hand a third (Hays, Robert, Miller and Bennett 2012). A fourth is well underway, with draft chapters from most authors (Miller and Barben in preparation 2013). The two-volume *Encyclopedia of Nanoscience and Society* (Sage; Guston, editor) was published in 2010. Both of these publications serve community-forging purposes. The *Yearbook* helps create a community of scholars around a narrow topic and then provides them with relatively high visibility. The *Encyclopedia* has brought together a larger community of scholars in its production – roughly 220 authors – and will help introduce a younger scholarly audience – high school and undergraduate students – to nearly 500 topics in nanotechnology in society. In total, Center researchers have 11 books published, under review or under contract around Center-related material, five of which are primary CNS publications.

The Center's researchers have published, had accepted or submitted for review 145 peer-reviewed journal articles (124 of which are primary CNS-supported publications), covering a range of outlets including:

- broad-based audiences in science and technology studies (e.g., *Science, Technology & Human Values*; *Science as Culture*; *Minerva*; *Social Studies of Science*),
- policy and innovation studies (e.g., *Science and Public Policy*; *Research Policy*; *Journal of Technology Transfer*, *Technological Forecasting & Social Change*, *Review of Policy Research*, *Research Evaluation*),
- law and ethics (*Science and Engineering Ethics*; *Journal of Law, Medicine, and Ethics*, *Jurimetrics*),
- communication (*Science Communication*; *Journal of Mass Communication Quarterly*; *Public Understanding of Science*; *New Media and Society*, *International Journal of Public Opinion Research*),
- urban sustainability issues (*Cities*; *Journal of Urban Technology*, *Sustainability Science*),
- other interdisciplinary specialty journals (*Appetite*; *Long-range Planning*; *China Intellectual Property*) and
- specific, NSE-related audiences for
    - scientists (*Journal of Nanoparticle Research*; *Nature Nanotechnology*; *Journal of NanoScience and Nanotechnology*),
    - social scientists and humanists (*NanoEthics*) and
    - educators (*Journal of Nanotechnology Education*).

The Center's researchers have produced three special issues of peer reviewed journals:

- Fisher, *Science and Engineering Ethics* 17(4), "Public Science and Technology Scholars"
- Bozeman and Sarewitz, *Minerva* 49(1) "Public Value Mapping" and
- Shapira and Youtie, *Journal of Technology Transfer* 36(6) "Nanotechnology and Innovation Policy,

and they are at work on five additional special issues:

- Barben and Guston, *Social Studies of Science*
- Davies and Invernizzi, *Journal of Nanotechnology Law and Business*
- Guston, *Review of Policy Research*,
- Selin, *Futures* and
- Selin and Pereira, *International Journal of Foresight and Innovation Policy*.

The Center has 26 non-peer-reviewed publications in trade journals and other journals, including commentaries by Guston in *Nature* (2008) and in *People & Science* (2009), by Shapira and Wang (2010) in *Nature*, by Scheufele and Corley in *The Scientist* (2010), and by Wetmore and Posner in *NanoToday*.

Center researchers have further published or have forthcoming 61 book chapters (51 of which are primary CNS-supported publications), including three contributions to the field-defining *Handbook of Science and Technology Studies*, many contributions to the *Yearbooks* and other new nano-in-society anthologies, and major new works on interdisciplinarity, governance, and on innovation policy and assessment. The *Encyclopedia of Nanoscience and Society* also drew on the expertise of Center-affiliated researchers for 59 entries, or about 12% of the total number.

Although citations are a somewhat crude measure of scholarly impact, this body of published work is already garnering an impressive number – more than 1500 citations as documented in Google Scholar (as of Mar 12), up from 983 citations in Mar 11, roughly 500 citations in Apr 10, and 188 citations in Apr 09. The Center's H-index has risen to 21, from 19 last year (indicating precisely 21 publications with 21 or more citations each). (This total does not include the roughly 80% of the 241 Google Scholar citations to the original RTTA article by Guston and Sarewitz [2002] that have occurred since CNS-ASU was

founded and which represent the visibility of the Center and its core intellectual ideas as well. It also excludes some recent *Nature Nanotechnology* publications, which do not appear accessible on Google Scholar, as well as citations to *Yearbook* chapters not written by CNS researchers or individual *Encyclopedia* entries whether or not written by CNS researchers.)

CNS-ASU has also attempted to make its research and other products available in other formats, including 32 reports of various types available on the Internet and numerous video and audio clips available through the CNS website, YouTube, and other organized blogs.

As evidence of its impact on education, the Center has primarily contributed to the completion of 39 student theses, including 11 doctoral theses, 3 master's theses, and 25 undergraduate honors theses, across a variety of disciplines. CNS has contributed to the completion of an additional 19 student theses, including CNS-Biodesign fellows and others completing the PhD+. These numbers include only the first three of roughly one dozen doctoral students whose research is formally being guided by the STIR project, as well as additional students who have become affiliated with that project but are not formally part of it and other students advised by Center faculty outside CNS-ASU on related topics.

Data and instruments produced by CNS-ASU are sought by and shared with an increasing number of researchers across the globe. For example, the searchable definition of nanotechnology produced by RTTA 1 has been adopted by the European Nano Observatory. The public opinion survey instrument developed by RTTA 2 was not only developed in coordination with EuroBarometer but also has been shared with researchers in Singapore, Ireland, France, and Poland. Survey data has also been provided to policy officials, including the National Nanotechnology Communication Office. NCTF data have been used not only by the distributed groups of scholars who hosted local citizens' technology forums, but have also been provided at the request of researchers at NYU and in France. In Feb 12, CNS-ASU collaborated with librarians at UMass Amherst in submitting a $48K proposal to Institute for Museum and Library Services for a planning activity, Oct 12 – Sep 13 for "Nanoscience and Emerging Technologies in Society: Sharing Research and Learning Tools."

Center activities have also helped generate additional research projects, including more than $4.3M of associated and spin-off awards at ASU and roughly $3.1M at the collaborating universities. At ASU, these awards include:

- Boradkar, et al., National Collegiate Inventors and Innovators Alliance, $30K, Sep 07 – May 08 (this award supported one year of InnovationSpace on CNS agenda);
- Sarewitz and Bozeman, NSF SciSIP, $203K, Oct 07 – Sep 10, Public Value Mapping: Developing a Non-Economic Model of the Social Value of Science and Innovation Policy (this award included collaborations with TRC 1 and RTTA 4);
- Sarewitz and Fisher, NSF SciSIP, $35K, Aug 10-Sep 10, How to STIR Public Values for Policy Making: A Supplemental Proposal for Web-based Dissemination of Two SciSIP Projects (a supplement to the PVM award above, this award extended outreach and dissemination via video for both PVM and STIR projects across RTTA 1 and RTTA 4);
- Herkert, Wetmore, et al., NSF Ethics Education in Science and Engineering, $300K, Jan 08 – Dec 10 (this award tested a number of macro-ethics education interventions, several initially piloted by CNS-ASU);
- Guston, NSF Conference Award for the Gordon Research Conference, $60K, Aug 08 (this award supported the GRC on "Governing Emerging Technologies");
- Guston, Greenwall Foundation Conference Award for the Gordon Research Conference, $10K, Aug 08 (this award supported the GRC on "Governing Emerging Technologies");

- Fisher and Guston, NSF Socio-Technical Integration and Research, $540K, Apr 09-Mar 12 (this award extends the RTTA 4 agenda to create an international team of doctoral students doing interventionist-oriented comparative laboratory ethnographies);
- Fisher, National Nanotechnology Infrastructure Network, 09-10, $5,300 (this award documents the integration of social and ethical considerations into a number of NSEC and NNIN sites);
- Corley, Marchant and Sylvester, DOE, $245K, Sep 10-Aug 12, Governing Nanotechnology Risks and Benefits in the Transition to Regulation: Innovative Public and Private Approaches (this award draws on and extends Corley's RTTA 2 work);
- Corley, Lincoln Center for Applied Ethics, ASU, $20K, May 10 – Dec 11, An Exploration of the Ethical Implications of Human Exposure to Nano-Materials in University Research Laboratories (this award draws on and extends Corley's RTTA 2 work);
- Selin, Science Museum Minnesota, $9K, Sep 11-Dec 11, Civic Scenarios on Climate Change Adaptation (this award extends Selin's RTTA 3 research and outreach);
- Wiek, Housing and Urban Development, $2.9M, Reinvent Phoenix: Cultivating Equity, Engagement, Economic Development and Design Excellence with Transit-Oriented Development (continues TRC 2 work to address socio-technical change as a key aspect of sustainability transition research).

At GA Tech, these awards include:

- Porter, NSF National Partnership for Managing Upstream Innovation, $45K, Nov 04 – present;
- Shapira, Youtie, Rogers, NSF Measurement and Analysis of Highly Creative Research, $340K, Jan 08 – Dec 10;
- Porter et al., NSF Measuring and Tracking Research Knowledge Integration $393K, Sep 08 – Aug 11;
- Porter et al., NSF NER: Representations of Active Nanostructures Across Scientific, Popular, and Policy Realms of Discourse, $85K, Jan 07 – Aug 09;
- Porter et al., UK Royal Commission, $20K, Jan 08 – Apr 08;
- Porter, Youtie and Meyers, Euronano, $21K, Jul 07 – Jan 08;
- Fernandez-Ribas, Kauffman and GA Research Alliance, Small Businesses International Nano Patent Strategies, $16K, Jun 08 – May 09;
- Randles, Shapira, et al. National Research Council of Canada, UK Nanoclusters, $40K, Jan 09 – Apr 09;
- Rogers, Youtie, Porter, Shapira, NSF Assessment of Nanoscale Science and Engineering Systems, $200K, Oct 09 – Sep 10;
- Shapira, Tang, Meng. Chemical Heritage Foundation, Development of Advanced Materials in China: Case Studies of Nanotechnology Materials Innovations, $10K, Sep 09 – Aug 11;
- Shapira, Youtie. National Nanotechnology Infrastructure Network, Social and Ethical Issues Seed Grant Competition, 2010, Nanotechnology's Transition from Discovery to Commercialization in Small and Medium-sized Enterprises: An Exploration of Evidence from Novel Unstructured Sources, $19,712, May 10 – April 11; and
- Arora, Georgia Tech Research and Innovation Conference, $1.5K, Feb 12.

At Wisconsin, these awards include:

- Scheufele, University of Wisconsin—Madison Graduate School, Science and Social Responsibility: Tapping Values and Perceptions among Researchers in Nanotechnology, $9,029, Sp 07;
- Scheufele, NSF, Media, Talk, and Trust: The Social Amplification of Risk during Site Selection for a Bio-research Facility, $400K, Sep 08- Oct 10;
- Scheufele (co-PI with PI Berube at NCSU), NIRT: Intuitive Toxicology and Public Engagement, $1.4M ($150K at UW), Sep 08- Oct 10;

- Scheufele (consultant with PI Hallman at Rutgers), USDA CSREES National Research Initiative (NRI) Food Nanotechnology: Understanding the Parameters of Consumer Acceptance, $200K, Sep 08- Oct 10; and
- Scheufele (with PI Wilson), DOE, Developing a User Experience for the Next Generation Nuclear Fuel Cycle Simulator, $1.2M, Sep 11-Oct 14.

CNS-ASU has been a force for institutional change at ASU and its collaborating universities. Programs have adopted CNS-ASU tools and approaches as well as the broader theme of anticipatory governance, which has emerged as an important element in the conceptualization of new ASU initiatives. In addition to having created numerous undergraduate and graduate courses and its PhD+, CNS-ASU has:

- collaborated with ASU's Biodesign Institute to require integrated societal training of the doctoral students in its new Biological Design PhD program;
- collaborated with ASU's new Professional Science Master's program in Nanoscience to offer a societal training course in the new curriculum;
- collaborated with ASU's new Professional Science Master's program in Solar Energy Engineering and Commercialization to offer integrated societal training in the new curriculum;
- collaborated with ASU's new NNIN node to develop a training program in the societal dimensions of nanotechnology and in informal science education for its users;
- helped instigate the creation of a PhD+ program at GA Tech;
- provided leverage for a proposal by Scheufele at Wisconsin for a "Science and Culture" cluster hire to add personnel to the infrastructure that CNS has supported there;
- begun to collaborate with the Ira A. Fulton Schools of Engineering at ASU to plan for the possible hiring of faculty in engineering and society;
- collaborated with ASU's university-wide energy initiative, LightWorks, to integrate research on the social and governance challenges of energy systems transitions ; and
- collaborated with a number of proposals to NSF (STC, ERC, IGERT and NUE), DOE (ARPA-E and Hub) and NIH emerging from ASU containing programs that CNS pioneered. Funded NSE and emerging technology awards at ASU with CNS-ASU partnerships and activities include:
  - Lindsay, NSF NIRT for organic photo-voltaics, $1.1M, Sep 06 – Aug 10;
  - Posner, NSF CBER, Interaction of Engineered Nanomaterials with Artificial Cell Membranes, $313K, Sep 09 – Aug 12;
  - Posner, NSF CBER, Collaborative Research: Rational Design of Enhanced Catalytic Nanomotors, $600K, Mar 09 – Feb 12;
  - Phelan, NSF PSM, Professional Science Master's in Solar Energy Engineering and Commercialization, $700K, Jul 10 – Jun 13;
  - Honsberg, NSF ERC, Quantum Energy and Sustainable Solar Technologies, $20M, Aug 11 – Jul 16; and
  - Panchanathan, NSF IGERT, Person-Centered Technologies and Practices for Persons with Disabilities, $3M, Aug 11 – Aug 16.

Additionally, CNS-ASU researchers have the following associated or collaborative proposals that incorporate CNS ideas under review or in preparation for imminent submission:

- Guston, NSF SAVI for Virtual Institute for Responsible Innovation, $500K, submitted Feb 12;
- Guston, NSF for Workshop on Anticipatory Governance of Complex, Engineered Nanomaterials, $50K, submitted Feb 12;
- Fisher and Wiek, NSF STS for STIR City, $328K, submitted Feb 12;
- Miller, NSF SRN with Golden (Duke) lead on Bio-based Sustainable Transformations and Resilient Technologies Network, $12M, submitted Apr 12;

- Guston, NSF SRN with Theis (UIC) lead on Life Cycle Assessment for Sustainable Nanoproducts, $12M, submitted Apr 12;
- Wiek, NIEHS Superfund Research Center with Halden lead on Center for Sustainable Management of Mixtures of Hazardous Compounds (SUMMIT), $11.3M that addresses the socio-technical changes and risk at the Motorola 52nd St. site in Phoenix;
- Graduate students Foley and Kalinowski, ASU Graduates in Integrative Society and Environment Research on Future Visions at M52: Investigating Social, Ethical, and Legal Constraints, $2K; and
- Graduate students Foley and Wender, ASU Graduates in Integrative Society and Environment Research on Anticipatory Life Cycle Assessment: Methodological Development, $2K.

While **Section 13 Shared and other Experimental Facilities** details the visits and other contributions by eighty-three international scholars and practitioners to the Center from more than 20 countries, CNS-ASU scholars have also engaged in substantial international collaborations based on their Center-related work. For example:

- Selin is a senior researcher on a EU 7th Framework funded project led by Strand (Bergen) on "Integrated Assessment of Societal Impacts of Emerging Science and Technology from within Epistemic Networks," to investigate how different methods of analyzing and assessing new and emerging fields of technology can be better integrated, $2.1M, Apr 12-Mar 15.
- Guston is a named international associate on a fivr-year project funded by the Leverhulme Trust led by Nerlich (Nottingham) on "Making Science Public," to investigate how changes in public engagement with science affect the theory and practice of democracy, $2.84M, May 12-Apr 17.
- Guston has been asked to serve as the chair of the international advisory board for a EU 7th Framework project proposal led by Mejlaard (Aarhus) on "Framework for Innovating Responsibly in Europe (FIRE)," to develop a Europe-wide framework for understanding and implementing responsible research and innovation, $4.67M
- CNS-ASU is a named international collaborator on a proposal to the European Research Council Synergy programme, led by Maroto-Valer (Cardiff) on "Transforming Sustainable Chemicals Supply: (Nano)engineering Catalytic CO2 Photoreduction," to assess the sustainability of transforming chemical supply chains, submitted Jan 12.
- Shapira and Youtie are principals with the Innovation Co-Lab – a collaboration of researchers at Georgia Institute of Technology, the University of Manchester (UK), and the Beijing Institute of Technology (China) to advance methodologies and analyses to anticipate the trajectories of emerging technologies. The Co-Lab's focal technologies include graphene, other nanotechnologies and advanced green goods. Co-Lab projects are sponsored by the British Council, the UK Economic and Social Science Research Council, and Chinese Ministry of Science and Technology. Georgia Tech CNS-ASU researchers Porter and Rogers and students Arora, Kay, and Horsley are among those also engaged in the Innovation Co-Lab.
- Shapira was appointed in 2011 to the advisory board of the Foresight Centre, National Research University - Higher School of Economics (HSE), Moscow, Russia, which focuses on the analysis of emerging technologies including nanotechnology. The Georgia Tech RTTA1 group is a partner with HSE and the Beijing Institute of Technology in a University of Manchester pending proposal to examine nanotechnology emergence in the rising powers of China and Russia.
- Scheufele is member of the External Advisory Committee for the *Wellcome Trust Monitor*, a national tracking survey conducted by the Wellcome Trust in London, UK. He advises on questionnaire construction, data analysis etc.
- Wetmore was a "Bright Ideas" Visiting Research Fellow in Summer 2011 at the ESRC Genomics Policy & Research Forum, University of Edinburgh, Scotland to continue his collaborations on developing new ways to help scientists and engineers better understand the social implications of their work.

- Fisher serves on the Scientific Advisory Boards for the "Applied Metagenomics of the Watershed Microbiome" project (Tang, PI), funded by Genome Canada, and for the "Exploring Possibilities for Patient Involvement in Translational Medicine" project (Boenink, PI), funded by the Netherlands Genomics Institute and Centre for Translational Molecular Medicine.

CNS-ASU has engaged with the NSE community more broadly than just with researchers at its own institutions. For example, CNS-ASU researchers created societal training activities for staff and visiting researchers at the Department of Energy's Center for Integrated Nanotechnologies, and we have collaborated with the NNIN to produce a training video for all NNIN users that reached roughly 1000 NNIN users in earlier years. While the training video is still available on www.nnin.org, NNIN is moving away from its use and we are in ongoing communication about additional training activities (see **Section 13 Outreach and Knowledge Transfer** for more details). Through its associated STIR project, CNS researchers are conducting integrated studies in 20 laboratories world-wide, and the directors and other members of those laboratories have also become involved in publications and other collaborative activities. One measure of the external demand for such activities is CNS-ASU's DC Summer Session, which expanded in Summer 10 to two, two-week sessions with paid subscribers from universities including not only ASU but also Cal Tech, City College of New York, Colorado School of Mines, Delaware, Florida, Princeton, and RPI. In Summer 11, the DC Summer Session expanded to three sessions and continues at that level in Summer 12, when it now appears we will have to turn paying applicants away.

The following section briefly summarizes the most significant advances of the Center over the last year in terms of fundamental knowledge and technology (here conceived as applied and/or reflexive knowledge, processes, and capacities, often but not exclusively for internal use).

Fundamental knowledge. Each research program, and most individual research projects, contributed significant advances in fundamental knowledge of the societal aspects of nanotechnology in the last year. This section provides some highlights.

- RTTA 1 Research Program Analysis: Analyzing extensive global databases of Science Citation Index records, other publication databases, and patent databases (MicroPatents, PatStat), CNS-ASU researchers have found:
    - The international rise of China's position in nanotechnology has been underwritten by the emergence of a series of regional hubs (Tang and Shapira 2011);
    - Nano EHS research is growing rapidly although it is orders of magnitude smaller than the broader nano S&T domain. Nano EHS work is moderately multidisciplinary, but gaps in biomedical nano EHS's connections with environmental nano EHS are apparent (Youtie et al. 2011);
    - Nano-scientists who consider setting moral limits to be important are more apt to cite EHS publications in their research (Youtie et al. 2011);
    - Green nanotechnology patents have the same number of inventors as the average green patent, but more claims, more citations, and more technology codes and thus may be more "inventive" or "novel" (Lobo and Strumsky in preparation); and
    - While graphene as a whole is experiencing concurrent scientific development and patent growth, country- and application-specific trends offer some evidence of the linear and double-boom models (Shapira et al. in preparation).
- RTTA 2/2 Scientists' Survey: Based on a national-level survey of highly cited nano-scientists (N=363, conducted Jul 07), CNS-ASU researchers found:
    - Some nano-scientists support local-level regulation of nanotechnology, but most support national- or international-level regulation (Kim, Corley and Scheufele forthcoming 2012); and

  - There are three distinct types of nano-scientists with unique perspectives on regulation: cautious innovators, nano-regulators, and technological optimists (Corley, Scheufele and Kim forthcoming 2012).
- RTTA 3/1 Scenario Development
  - There is a risk of overly systematizing measures of plausibility, thus rendering it a less useful concept beside risk and probability.
- RTTA 3/4 National Citizens' Technology Forum: Based on reports from citizens' participating in the NCTF, pre- and post-tests from the event, transcripts, a follow-up survey, and other data, CNS-ASU researchers have found:
  - NCTF participants believe that their experience was valuable and that such forums should be used to foster democratic principles and promote public understanding and engagement with science (Cobb and Gano under review).
- RTTA 4/2: Through a set of integrative research and educational activities with NSE researchers, CNS-ASU researchers have found:
  - Integrative research tends to increase reflexive awareness among researchers, can introduce changes in practice, and often has longer-lasting residual effects (various STIR reports and manuscripts in preparation);
  - Significant support for the midstream modulation proposition that the acknowledgement of social and ethical dimensions of their work by scientists and engineers can constitute a prerequisite for an increased capacity on their part to effectively take such broader dimensions of their work into account; and
  - In-lab interventions as well as both integrated and stand-alone courses can significantly increase the ethical awareness of science and engineering graduate students (EESE report).
- TRC 1: Through field work in South Africa, combined with bibliometric and patent analysis and other documentary research, research on Equity, Equality and Responsibility has found:
  - There have been only a small number of isolated cases in which South African researchers have explored pro-poor technologies, but there have been signs in other areas that nanotechnology is being used to further equity efforts in the country and across the continent (various manuscripts in preparation).
  - The pro-poor promise of a number of nanotechnologies is not playing out well in actual nanotechnology research agendas (various student publications).
- TRC 2 (former): Through an "end-to-end" process in which issues in Human Identity, Enhancement, and Biology are systematically connected with RTTA activities, CNS-ASU researchers and other contributors to the *Yearbook of Nanotechnology in Society: Nanotechnology, the Brain and the Future* (Hays, Robert, Miller and Bennett 2012) have found that there is significant and substantive connection between nanotechnology and issues in human cognitive and other potential enhancements.
- TRC 2 (current): Through its workshops and field research, TRC 2 researchers have found:
  - By developing and analyzing indicators that map to five "sustainability syndromes" characterizing the City of Phoenix, numerous challenges for achieving urban sustainability in the region; and
  - The "demand" of urban sustainability problems and prospective "supply" of nanotechnology innovations are not well matched.

Technology (in this case, mostly applied and/or reflexive knowledge, processes, methods and capacities; often these are developed in one part of CNS-ASU and used in another, thus forming the intellectual core of "ensemble-ization").

- RTTA 1 Research and Innovation System Analysis:

  - RTTA 1 completed its redesign of the searchable definition of nanotechnology, which is supported by numerous programs and dictionaries to enable its use.
  - Several targeted bibliometric studies supported ongoing CNS-ASU work.
- RTTA 2 Public Opinion and Values:
  - RTTA 2's media database is tapped by other programs.
- RTTA 3 Anticipation and Deliberation:
  - InnovationSpace discloses three inventions per year to Arizona Technology Enterprise (AZTE) under CNS-ASU sponsorship.
- RTTA 4 Reflexivity and Integration:
  - STIR protocol is used by numerous researchers outside of the official project.
  - RTTA 4/3 researchers created a large database that has been used for additional projects by other RTTA researchers.
- TRC 2 Urban Design, Materials and the Built Environment
  - The NICE Database catalogues nanotechnologies for the urban environment that is available for users within and without CNS-ASU in short order.

Education and Training:

- At the post-doctoral and junior researcher level, CNS-ASU continues to train high-quality junior researchers and place them into important positions. Most recently Selin, who began as a CNS post-doc in Fall 06, assumed a tenure-track position at ASU's School of Sustainability in Fall 11. Former post-doc Sean Hays received a three-year post-doc from the University of Bergen, beginning Fall 12, and current post-doc Sarah Davies will begin a research associate position at University of Copenhagen in Summer 12.
- At the graduate level, CNS-ASU has involved more than two dozen graduate students (funded, unfunded, and visiting) in its YR 7 activities. The Center designed new courses for graduate students, advanced plans for a new graduate certificate, and expanded the DC Summer Session. We are collaborating to teach students at ASU's Professional Science Master's Program in Nanoscience, Professional Science Master's Program in Solar Energy, and in the Biological Design PhD program, and we continued other courses at the graduate level. The Center continues to play an integral role in the Human and Social Dimensions of Science and Technology doctoral program and the Professional Science Master's degree program in Science and Technology Policy, both coordinated by Center associate director Miller at ASU.
- At the undergraduate level, CNS-ASU continues to teach classes influenced by the Center, including "Introduction to Science and Technology Policy" for 125 undergraduates at ASU. InnovationSpace continued to make contributions in the cross-training of business, design, and engineering students and the production of provocative and concrete ideas of future nanotechnology products.
- In informal science education, CNS-ASU deepened its strategic and highly generative partnership with NISE Net, not only participating in NanoDays in Mar 11 but more importantly working through a series of meetings to develop real innovations in NISE Net materials, tabletop displays, planned exhibits, and training for museum staff in societal aspects of nanotechnology.
- In training for scientists and engineers, CNS-ASU continues its improved relationship with NNIN through the local node at ASU, providing both required social and ethical implications training and an informal science communication program to NNIN users.

Industrial collaborations. The most significant private-sector collaborations that CNS-ASU participated in over the past year are:

- conducting the 5-6 May 11 Private Sector Engagement workshop and associated activities;
- the disclosure of InnovationSpace inventions to AZTE and other private sector contact through ISpace;

- the completion of intensive interviews and workshops with private-sector participants in the regional nanotechnology innovation system in Phoenix;
- the planning of a special issue of the *Journal of Nanotechnology Law and Business*; and
- the participation of high-profile private-sector participants in providing sponsorship, leadership, and content in *Emerge*.

The following section briefly describes the current and potential impacts of CNS-ASU on teaching, training, and learning; outreach to pre-college institutions; broadening the participation of underrepresented groups; enhancement of infrastructure of research and education; dissemination to scientific and technological communities; and benefits to society.

Teaching, training and learning. At any given time, CNS-ASU, across its three constituent universities, is training in various capacities approximately one-half dozen junior research faculty and post-doctoral fellows, two dozen graduate students, and one dozen undergraduate students in the societal aspects of nanotechnology. At the constituent universities, most of this training consists of working on CNS-related research projects under the subcontracts to those universities. In each location, but at Wisconsin in particular, the community of trainees is larger than that of funded student researchers because the data developed by the Center are too extensive to be analyzed entirely within the budget. At Wisconsin and ASU, CNS-related research is being incorporated into numerous classroom modules and activities. At ASU, CNS has engaged in extensive training and curriculum development and innovation. In this reporting year, CNS-ASU has continued to influence undergraduate courses in disciplinary areas, expanded its graduate training with new coursework and research opportunities for both social scientists and NSE students, and collaborated with NISE Net to expand the inclusion nano-in-society ideas in informal science education.

Outreach to pre-college institutions. CNS-ASU has arranged for continuing education credit for in-service teachers for attending its Science Cafes. In previous years we have reported on the development and teaching of what we believe to be the nation's only graduate-level course for in-service high school teachers in nanotechnology and society, and on our inability to find an appropriate financial model for attracting enrollment to the course. We previously modified the course for inclusion in the PSM in Nanoscience degree program, and we have taught it again the current year. CNS is therefore actively seeking ways to fund credit-hours on campus, as well as ways to market the syllabus to other training programs. The *Encyclopedia of Nanoscience and Society*, published in YR 6, has high school and college libraries as its target market. We are also orienting our interactions with NISE Net to help develop materials for the in-service teachers with whom science museums work. In conjunction with ECAST, CNS-ASU has developed a model for deliberative engagement with high school students over issues in emerging technologies. While two (on geoengineering and synthetic biology) were conducted in the prior year, and several are planned in conjunction with WWV on Biodiversity, no deliberations were conducted in the current year.

Broadening participation of under-represented groups. CNS-ASU, including its constituent universities, has developed a strong record of including women in key research and leadership positions and recruiting members of under-represented groups into graduate and undergraduate research positions. In most measurement categories, CNS-ASU equals or exceeds national averages. In previous years, we have focused attention on disability communities as an under-represented population through the activities of TRC 1 Equity and Responsibility and (former) TRC 2 Human Identity, Enhancement, and Biology. In a previous year, we replaced the symposium for under-represented students with a training activity more akin to the DC Summer Session and other training activities that CNS-ASU has made successful, but targeted for under-represented students in partnership with the Hispanic Research Center. Held for the first time in Sp 09 for two dozen graduate students from under-represented communities, the seven-week course was quite successful and we repeated it in Fall 11.

Enhancement of infrastructure for research and education. CNS-ASU maintains a web site (http://cns.asu.edu) that provides information about its research, education and outreach programs to a general audience. It is currently being redesigned by an approved ASU vendor. CNS-ASU has most of its monthly seminars and occasional speakers' presentations available on the web site in audio, video, and PPT versions – including new video formats on YouTube, and the re-designed site will emphasize access to video and other resources. The website connections to several associated projects in-depth, including:

- The Plausibility Project site (http://www.cspo.org/projects/plausibility/), which has detailed information, references, and papers about the project;
- An educational clearinghouse (http://cns.asu.edu/educate), which offers the syllabi of all nano-related courses and some co-curricular activities that CNS has developed, as well as some documents from other sources. This site will continue to expand as CNS-ASU develops additional curricular and co-curricular material and gathers material from elsewhere; and
- The STIR project website (http://cns.asu.edu/stir/) and Facebook site, which provides general information about the project and a password protected site for collaborative work among the far-flung international STIR network.

CNS-ASU has been crucial in the creation and maintenance of the Society for the Study of Nanoscience and Emerging Technologies (S.NET; Guston is a founding member of the board, a member of the first and second program committees, and a co-chair of its third program committee). It co-hosted, with CNS-UCSB, the third annual meeting of S.NET in Nov 11, with more than 200 attendees from more than 20 countries. CNS-ASU co-sponsored, with NNIN, NISE Net and other ASU projects, the first Congress on Teaching the Social and Ethical Implications of Research, with more than 100 participants. CNS-ASU has also created a number of research tools and instruments, e.g., the searchable definition of nanotechnology and the databases derived with it, survey protocols and opinion data, and the NCTF reports, internet transcripts and video data that have been sought by and provided to other scholars. CNS-ASU has also received more than 80 international visiting students, scholars and practitioners seeking a vibrant intellectual community and training in the Center's methods.

Dissemination to scientific and technological communities. CNS-ASU has engaged in extensive dissemination activities, both to its social science and humanities colleagues, but also to the community of NSE researchers with whom it interacts. Roughly 20% of its published, forthcoming or under review journal articles appear in journals like *Nature Nanotechnology*, *Journal of NanoParticle Research*, *Journal of Nanoscience and Nanotechnology*, *EMBO Reports*, and others that are oriented toward science and engineering researchers. We have also published in trade and professional journals that target scientists, e.g., *Materials Today* and *Nano Today*, and have published two commentaries in *Nature* as well as letters in *Science* and *Nature*. CNS-ASU researchers have given more than 600 presentations, roughly 60% of which were delivered to their social science colleagues and roughly one-third of the remainder to targeted audiences of scientists and engineers. Our dissemination activities have also included supported and unsupported invitations to our All Hands meeting, extended to roughly 10 individuals, including students, each year, and the workshops we conducted in YR 7. Dissemination also includes *Emerge*, which reached more than 700 people directly and many more through extensive media coverage.

Benefits to society. In its Jul 07 memorandum, NSF describes a set of questions (sub-criteria) related to its broader impacts criterion. Here we articulate the contributions of CNS-ASU for each of these sub-criteria:

- *"How well does the activity advance discovery and understanding while promoting teaching, training, and learning?"* The integration of research, education, and outreach is a particular focus and strength of CNS-ASU, and many of its programs are designed toward this goal from the outset.

  - CNS-ASU has teaching, training, and learning projects at all levels from the pre-college education to post-doctoral training, as well as informal science education projects and training for scientists and engineers.
  - Most of these teaching, training, and learning projects integrate research, education, and outreach, e.g.:
    - Students and trainees participate in the NISE Net-sponsored NanoDays by staffing a booth of nano-demonstrations at a local arts festival;
    - Undergraduate research, e.g., as represented in the third *Yearbook*, is well-integrated with research programs;
    - Graduate course development, e.g., Selin's studio course derived from *Emerge* is driven by research interests and outreach opportunities;
    - Research frames are brought to bear on high school engagement programs in geoengineering, synthetic biology, and biodiversity; and
    - CNS-ASU research activities become case studies for concurrent educational activities, e.g., integrating nanotechnology cases into the units of "Introduction to Science and Technology Policy."
  - CNS-ASU partnerships with NSE researchers have enriched its Science Cafes, which local teachers may use for credit;
  - CNS-ASU trains a small number of CNS-Biodesign Fellows, CNS-FSE Fellows, and other PhD+ students to conduct societal implications research or perform outreach projects around their NSE research, and this program is expanding to GA Tech;
  - Student authors are included on a large plurality of CNS-ASU manuscripts;
  - Students are first or sole-author on roughly one in six CNS-ASU presentations, and they have presented their CNS-related work in a variety of venues;
  - CNS-ASU has created and will continue to develop a section of its website to serve as a clearinghouse for nano-in-society curricular activities.
- *"How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?"* CNS-ASU meets or exceeds almost all standards for the participation of underrepresented groups. For the Center, however, diversity is not just a matter of inclusion of a diverse research population but making aspects of diversity explicit parts of the research agenda.
  - CNS-ASU fosters research topics that explicitly address issues of underrepresented groups, e.g.:
    - RTTA 1/1 Innovations Systems Assessment has investigated female involvement in nanotechnology patenting;
    - (former) RTTA 1/2 Public Value Mapping included attention to the differential impacts of minority participation in clinical trials for potential nano-therapeutics; and
    - An entire research program area on Equity, Equality and Responsibility (TRC 1), which in part addresses ethnic and geographic issues in the distribution of benefits and risks from nanotechnologies; and
  - CNS-ASU collaborates with the Hispanic Research Center on science policy training for its two dozen graduate-level fellows from underrepresented groups;
  - Through associate director Miller, CNS-ASU is collaborating on an IGERT award to ASU's Panchanathan on "Person-centered Technologies and Practices for Persons with Disabilities."
- *"To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?"* CNS-ASU envisions itself as a national and international leader in promoting research, education, and outreach in nano-in-society topics and in integrating those topics into NSE research and education settings.

- CNS-ASU exists as the largest node of the NSF-instigated nano-in-society network and has taken leadership in the generation of the following networks and collaborations (outside ASU):
  - CNS-ASU was co-sponsor and co-organizer of *Emerge*, a three-day workshop and public festival at ASU involving more than 150 specially invited faculty members, students, and professionals and roughly 700 members of the public in developing and experiencing "design fictions" and other ways of considering the future;
  - CNS-ASU has hosted more than eighty international visitors, from more than 20 different countries;
  - CNS-ASU is becoming a "core partner" in NISE Net, recognizing the extent and depth of collaborations centered on enhancing informal science education with expertise from the societal aspects of NSE;
  - The Center is planning a Winter School on the Anticipatory Governance of Emerging Technologies, which will involve more than one dozen junior scholars;
  - CNS-ASU co-hosted the 2011 annual meeting of the Society for the Study of Nanoscience and Emerging Technologies in Nov 11, with more than 200 attendees from more than 20 countries;
  - CNS-ASU co-sponsored the first Congress on Teaching Social and Ethical Implications of Research, with more than 100 attendees;
  - The associated STIR project leads an expanding international network of graduate students and laboratories; and
  - CNS-ASU partnered with the Consulate of the United Kingdom to host a workshop on responsible innovation, including a discussion with 20 US program officers and other science policy professionals.
- Within ASU, CNS-ASU is a hub for transdisciplinary research and teaching, with specific activities including:
  - CNS curricular offerings currently enhance graduate education in the Biodesign Institute, the Ira A. Fulton Schools of Engineering, the Department of Physics and the Department of Chemistry and Biochemistry;
  - CNS supports InnovationSpace, which bridges the schools of design, engineering, and business;
  - CNS graduate coursework helps link the Schools of Politics and Global Studies, Human Evolution and Social Change, Life Sciences, and the Human and Social Dimensions of Science and Technology doctoral program; and
  - CNS collaborative research and teaching activities are included on virtually every large NSF proposal (IGERT, ERC, SRN, STC) submitted by ASU.
- CNS-ASU partners with the Arizona Science Center for the production of monthly Science Cafes during the academic year;

- *"Will results be disseminated broadly to enhance scientific and technological understanding?"* CNS-ASU aims to reach a variety of audiences – scholarly, professional, and public – with its research, education, and outreach activities.
  - CNS-ASU's e-mail distribution list reaches roughly 1400 individuals;
  - CNS-ASU researchers have given more than 600 talks across all audiences since the inception of the Center, with just over 100 in YR 7 alone;
  - CNS-ASU targets networks and user facilities for the distribution of nano-in-society training material, e.g.:
    - NISE Net has disseminated CNS-ASU products to approximately 300 museums and other participants in NanoDays;
    - NNIN continues to disseminate the CNS-ASU led PPT training module to its network of user facilities on its website; and

  - CNS-ASU conducts monthly (academic year) Science Cafes – many directly involving CNS personnel – during the academic year, averaging approximately 50 persons in attendance at the Arizona Science Center;
  - CNS-ASU has a contract with Springer to produce the first five volumes of the *Yearkbook of Nanotechnology in Society* (Guston, series editor), the first two of which are published, the third of which is due imminently, and the fourth of which is significantly in preparation;
  - CNS-ASU Director Guston has published the two-volume *Encyclopedia of Nanoscience and Society* (Sage, 2010) that transmits detailed concepts in nano-in-society to high school and college students;
- *"What may be the concrete and demonstrable benefits of the proposed activity to society?"* The concept of anticipatory governance – comprising foresight, engagement, and integration – provides the intellectual framework for the broader benefits to society that CNS-ASU seeks to generate.
  - Foresight activities create an opportunity for diverse publics to encounter, explore, and evaluate nanotechnologies prior to the actual emergence of these technologies;
  - Engagement activities, including the small-scale intensive Science Cafes as well as informal science education activities informed by CNS perspectives and the larger-scale planned Futurescape City Tours, create more informed citizens on important topics in nano-in-society;
  - Interaction with NSE researchers, including courses, training activities, workshops, laboratory collaborations, and interventions results in identifiable changes in knowledge, identity, and practice in the laboratory;
  - CNS-ASU has had important informational and educational exchanges with decision makers, including:
    - Sarewitz is part of the bipartisan National Commission on Energy Policy task force on Geoengineering, which reported in the current year;
    - Guston, Shapira, and Selin participated in the International Study of the Long-term Impacts and Future Opportunities for Nanoscale Science and Engineering, which reported;
    - The Center collaborated with The New America Foundation, Slate.com and other ASU entities to develop and present the Future Tense series of discussions on the societal aspects of emerging technologies in Washington, DC;
    - The Center collaborates with the CSPO office in Washington, DC on the "New Tools for Science Policy" series, which has hosted CNS scholars in conversations with 20-30 science policy makers on several occasions in the reporting year.
    - Ga Tech RTTA 1/1 research on a variety of topics has been disseminated to many public offices, including to the President's Council of Advisors for Science and Technology (through the Science and Technology Policy Institute).
    - Shapira and Youtie were invited by the OECD Working Part on Nanotechnology to develop a white paper on "The Economic Contributions of Nanotechnology to Green and Sustainable Growth," which they presented at the OECD/NNI International Symposium on Assessing the Economic Impact of Nanotechnology in Washington, DC, Mar 12.
    - RTTA 1 collaborator Deborah Strumsky is serving on an advisory group to the US Patent and Trademark Office, to help it assemble patent data to be useful to research.
    - Scheufele is co-organizer, with Ralph Cicerone (NAS), Barbara Schaal (Washington University), Alan Leshner (AAAS), and Baruch Fischhoff, of a major colloquium at the National Academy of Sciences on "The Science of Science Communication."

- Cozzens co-authored a paper with Paul Stern (NRC), Thomas Wilbanks (ORNL), and Eugene Rosa (WSU) on "Generic Lessons Learned about Societal Responses to Emerging Technologies Perceived as Involving Risk," which was released and discussed by the Woodrow Wilson International Center in Dec 11.

7. Highlights

CNS-ASU and Private Sector Nanotechnology

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

Workshop finds significant overlap between CNS-ASU research and private sector interests.

As part of a new initiative to engage and collaborate with private sector organizations, the Center for Nanotechnology in Society at ASU (CNS-ASU) held a workshop that included participants from all over the United States who represented a wide range of nanotechnology-related private sector organizations.

The workshop provided CNS-ASU with an opportunity to introduce key experts from various fields of nanotechnology to the work the Center does in researching, communicating, and discussing the societal dimensions of nanotechnology. Participants came from fields including law, architecture, policy, non-governmental organizations, industry, and the local business community.

Additionally, the workshop created a networking space for participants to collaborate and exchange knowledge from their fields of expertise.

Sarah Davies, Private Sector Engagement Coordinator
The Center for Nanotechnology in Society at Arizona State University

Through the wide array of private sector participation, the workshop revealed significant overlap between the center's research and private sector interests. Key synergies included CNS-ASU research on innovation and patenting in nanotechnology and on public opinion and its effects on markets.

The full workshop report is online and can be accessed here.

As a further component of this research initiative, CNS–ASU is conducting video interviews with key industry experts from different nanotechnology-related sectors. The interviews explore the interests these private sector groups have in nanotechnology and showcase their views on what it will mean to develop the technology in a responsible manner. Watch the videos here.

Private sector research and development is key to the ways in which nanotechnology will be applied and regulated in the U.S. over the coming years. In recent months, CNS-ASU has been finding new ways to create mutually beneficial interactions with private sector organizations.

Research, education and outreach activities at the Center for Nanotechnology in Society at Arizona State University are supported by the National Science Foundation under cooperative agreement #0937591

CNS-ASU Authors Produce Special Issue of Science and Engineering Ethics

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

Last year, Springer Press called upon the exceptional collection of international scholars affiliated with The Center for Nanotechnology in Society at Arizona State University to guest edit a special issue of its journal, *Science and Engineering Ethics*. The issue's theme was "Science and Technology Policy in the Making: Observation and Engagement."

The December, 2011 issue (Volume 17, Number 4) features guest editors Erik Fisher of CNS-ASU and Stephanie J. Bird, a neuroscientist whose current research interests focus on neuroethics as well as the ethical, legal and social policy implications of research and technology in general. The issue consists of articles and commentaries from an international array of science and technology studies (STS) scholars affiliated to varying degrees with CNS-ASU.

The issue offers a survey of cutting-edge, intervention-oriented forms of publicly engaged research. This research plays out in diverse cultural and institutional settings, from town halls and laboratories to shopping malls and bureaucracies.

The special issue also provides a forum for scrutinizing the assumptions, methods and purposes of STS-informed public engagement in science and technology (i.e., that lay publics can reframe, reshape and redirect science and technology when they participate in policy decisions earlier and more actively).

The issue is comprised of nine papers that reflect various modes of engagement. Each article is followed by a dedicated commentary, organized into three divisions (three papers and their commentaries in each division) that correspond to the *observation, design* and *attestation* of engagement.

The collection of articles and commentary pieces does not look at the social and ethical issues that are associated with emerging science and technologies *per se*, but at the efforts to facilitate dialogue, debate and deliberation among diverse public stakeholders about such issues. Nearly all convey a sense of experimentation regarding the approaches they describe.

Individually and as a whole, the articles in this collection offer a range of newly experimental forms of publicly engaged STS scholarship that inspires both confidence as well as caution.

Dr. Erik Fisher, Assistant Professor
School of Politics and Global Studies, and The Center for Nanotechnology in Society at Arizona State University

Research, education and outreach activities at the Center for Nanotechnology in Society at Arizona State University are supported by the National Science Foundation under cooperative agreement #0937591

CNS-ASU Hosts Third Annual S.Net Conference

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

Three years ago, CNS-ASU was instrumental in the formation of the Society for the Study of Nanoscience and Emerging Technologies (S.NET), an international association that promotes open intellectual exchange towards the advancement of knowledge and understanding of nanotechnologies in society.

The society pursues its mission primarily through the organization of an annual meeting. CNS-ASU utilized the first such meeting in 2009 to begin the process of teaching/transferring its concepts and methodologies of anticipatory governance and real-time technology assessment. Last fall, CNS-ASU continued to extend its outreach and advance the critical reflection of nanotechnologies by hosting the third annual S.Net conference at Arizona State University in Tempe, Arizona.

Meryna Lim was inspired to produce this work of art while listening to the final plenary session on *Imagining the Future of S.Net*.

The conference program was packed with 44 panels and six plenary sessions that covered diverse topics, including: immigration and emerging technologies; emerging technologies in medicine and food; toxicity and risk of nanomaterials; how nanotechnologies are portrayed in media; governance of ethically controversial emerging technologies; trends in industry and union perspectives; issues of gender, race, and other inequalities in emerging technologies; science policy and regulatory implications of emerging technologies; engaging the public; responsible innovation in public and private sectors; anticipating future commercial applications; how emerging technologies are represented in imagery, language and writing.

Arie Rip (above) kicked off the first plenary session about ethical dilemmas associated with geoengineering, i.e., the use of technologies to control climate.

Conference attendees had a chance to bask in Tempe's beautiful mid-November weather during an outdoor break.

In addition to the presentations, the conference featured optional field trips, a night out for students, a poster session and a silent auction. Field trips included a walking tour of Tempe to explore and uncover commonplace and emerging technologies in Tempe's urban setting, and a walk-through of the Phoenix Gateway neighborhood to learn about the multiple environmental sustainability challenges that residents who live there face.

Dr. David H. Guston, Professor of Political Science;
Director, The Center for Nanotechnology in Society at Arizona State University;
Associate Director, Consortium for Science, Policy & Outcomes, Arizona State University

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Artists and Scientists Redesign the Future in Arizona State University's Emerge Event
The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY
Singular questions about what it means to be human in the face of emerging technologies were recently explored during a large-scale, interdisciplinary ASU event called Emerge. CNS-ASU played a primary role in supporting, planning and implementing the three-day event.
In an unparalleled campus-wide collaboration, Emerge brought together artists, bio scientists, social scientists, engineers, story tellers, designers and students to "redesign the future" by thinking critically about it. Leaders from industry, prominent authors and futurists joined ASU participants for an intense exploration of emerging technologies and the implications of those breakthroughs.
At the heart of Emerge were nine simultaneously-run workshops designed as social science experiments in futures thinking. Each workshop used a different foresight methodology to inspire its interdisciplinary participants to create games, products, monuments, images and stories that revealed the texture and feel of emerging futures.
Cynthia Selin, Assistant Professor
School of Sustainability and The Center for Nanotechnology in Society at Arizona State University
The workshop activities, known collectively as "design fictions," build upon CNS-ASU methodological research on Mediated Futures, in that the workshops served as opportunities to investigate the effectiveness of exploring the future through diverse media. For example, in one workshop, participants created mock-ups of future products and made a short video in a local convenience store. Another workshop had its members develop a performance around the symbol of collapse, acting out an invented mythology as a means to prompt thinking about alternative futures. Another used science fiction as a learning tool to rehearse and critique plausible new technologies and products, another focused on game design, while still another used game play, and so on.
The design fictions used in every workshop strove to prompt ethical reflection, asking not just "Can we?" but "Should we?" CNS-ASU believes such a discussion requires hands-on construction and creative interventions. As such, the workshops were important examples of future-oriented discussions that move away from the purely logical, discursive and technical to consider the material, affective and creative aspects of the futures possible from contemporary scientific research. CNS-ASU researchers have argued that this move is a vital next step in public and stakeholder engagement with science policy. A team of CNS ethnographers observed each of the nine workshops to record the material culture involved, the meanings that participants constructed around it, and the dynamics of group participation. The resultant dataset is in the process of being analyzed.
After the workshops, Emerge continued with a digital culture festival featuring performances and installations around the ASU Tempe campus. This finale, Immerge, was an interactive multi-media performance, which engaged visitors to create a new myth of renewal for the digital age. Members of the public interacted with installations, architectural projections and fantastical creatures, all within a multi-layered sonic environment generated by live musicians and digital technology.
Research, education and outreach activities at the Center for Nanotechnology in Society at Arizona State University are supported by the National Science Foundation under cooperative agreement #0937591
NSF

The Center for
Nanotechnology in Society
ARIZONA STATE UNIVERSITY
The Emerging Dynamics of Nanotechnology Commercialization: How are Corporations Entering into Nanotechnology Innovation?
US companies
Non-US companies
Worldwide
Discovery
Application
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008*
CNS-ASU has developed a bibliometric search method that has produced real-time databases of nanotechnology publishing and patent activity in the U.S. and globally. Researchers at Georgia Institute of Technology used these databases to examine, from a global perspective, where and how corporations are entering into nanotechnology innovation. They found that a shift has been underway in nanotechnology corporate activity, from research discovery prior to 2000, to patented applications (commercialization) after 2003.
Early predictions suggested that by 2015, about one-tenth of the world's manufacturing output would be associated with nanotechnology. However, the 2007-2008 global financial crisis and subsequent downturn have dampened nanotechnology's growth. Although more than 1,000 nanotechnology-enabled products have been inventoried as of the end of the last decade, many of these are incremental improvements to existing products rather than transformative innovations. Thus, after a decade of sustained public funding for nanotechnology R&D in the United States, the point has been reached where further public investments are increasingly scrutinized based on progress in commercialization. Given the timeliness of this issue, the Journal of Technology Transfer recently asked CNS-ASU to guest edit a special symposium issue that focused on nanotechnology's commercialization accomplishments, strategies and trajectories.
Corporate publications (log)
100,000
10,000
1,000
100
10
1
1
10
100
1,000
10,000
Corporate patent applications in WIPO (log)
Bubble size represents number of companies
The results also indicate that the general characteristics of national innovation systems in developed countries have a positive and significant effect on both corporate commercialization as well as corporate R&D. These findings highlight the ongoing importance of broad-based national policies for investing in both nanotechnology R&D and commercialization. The results further show that both national and international factors are significant, highlighting the need for national policies that include an open and international orientation.
The seven articles in the journal's symposium issue demonstrate that there are diverse and non-linear pathways to nanotechnology commercialization, with considerable uncertainty and risk, and much experimentation in strategies for transferring research knowledge into usable and marketable applications. Further work needs to be undertaken to probe both the general and specific features of nanotechnology commercialization and to assess its implications.
(To access the entire symposium issue: Journal of Technology Transfer (2011), Volume 36: p.p. 581-586)
Dr. Jan Youtie
Principal Research Associate, Economic Development Institute
Georgia Institute of Technology
Dr. Philip Shapira,
Professor of Public Policy, Georgia Institute of Technology
Professor, Manchester Institute of Innovation Research,
Manchester Business School, University of Manchester
NSF
Research, education and outreach activities at the Center for Nanotechnology in Society at Arizona State University are supported by the National Science Foundation under cooperative agreement #0937591

SEI Congress Explores How to Teach Social & Ethical Implications of Research to Scientists & Engineers

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

In 2008, ASU faculty were awarded a $300K NSF grant to explore ways to integrate micro and macro ethics into graduate science and engineering education. At that time, a "results dissemination workshop" at the end of the study was proposed as the means by which to present the study's findings. Over time, however, as the project's researchers talked to others who wanted to work in the area of ethics education, it became clear that the lessons learned in the grant would be valuable for a much broader set of teachers.

Because the trend to educate scientists and engineers on the broader, ethical implications of their research is relatively new, there are no cohesive curricula or recognized sets of best practices. Social and ethical implications (SEI) education today occurs in a wide variety of spaces, including laboratory training sessions, science museums, online modules, study abroad experiences, and the classroom.

Therefore, in November, 2011, CNS-ASU co-sponsored the first **Congress on Teaching Social and Ethical Implications of Research** to bring together those who have already developed such approaches to share their programs, materials, assessment methods and experiences. Over 100 participants from across the U.S. attended.

CNS-ASU will continue with this project by developing macro ethics modules for inclusion in the online Responsible Conduct of Research (RCR) courses offered through the Collaborative Institutional Training Initiative (CITI).

The presentations at the congress revealed a myriad of SEI approaches, including:

- Integrating technical and social analysis with creative design education using a problem-based learning approach.
- A 3D computer "virtual world," which engages students in authentic learning activities that address issues at the intersection of science and ethics.
- Reading *Mewing* dystopian science fiction (i.e., the film *Minority Report*) to engage first-year engineering students in discussing the ethical implications of engineering research and practice.
- Interdisciplinary classroom experiences that bring in guest lecturers and integrate ethical and social implications with (astro)biology) space exploration and life detection scenarios.
- Utilizing debates and communication skills training to help students explore and reflect upon the social and ethical consequences of technology.
- Online resources, such as the National Center for Professional and Research Ethics website, Ethics CORE (Collaborative Online Resource Environment, at http://nationalethicscenter.org).
- Utilizing partnership opportunities between research institutions and science museums.
- Assessment of microethics and macroethics education

Research, education and outreach activities at the Center for Nanotechnology in Society at Arizona State University are supported by the National Science Foundation under cooperative agreement #0937591

Dr. Jameson Wetmore, Assistant Professor,
School of Human Evolution and Social Change, and The Center for Nanotechnology in Society at Arizona State University

8. Strategic Research Plan

The long-term research goals of CNS-ASU are to demonstrate and refine the ability to perform RTTA and, in doing so, cultivate reflexivity and build the capacity for anticipatory governance in the NSE enterprise broadly conceived. By "reflexivity" we mean a capacity for social learning – by individuals, groups, institutions, and publics – in the NSE enterprise narrowly and society more broadly that expands the domain of and informs the available choices in decision making about nanotechnologies. By "anticipatory governance" we mean a broad-based capacity that extends through-out society that can collect, analyze, synthesize and interpret a wide range of information to manage emerging knowledge-based technologies while such management is still possible (Barben et al. 2008; Guston 2008; Karinen and Guston 2010; Guston 2010; Sarewitz 2011; Guston revise and resubmit).

In the first seven years of the Center, we have demonstrated the ability to perform RTTA through the individually successful programs, the synergies among them, and the successful completion of the "end-to-end" activity related to TRC 2, Human Identity, Enhancement and Biology (Hays et al. 2012), which integrates those programs, along with the integrative research within TRC 1, Equity, Equality and Responsibility (Wetmore and Cozzens 2010). The ability to extend and refine RTTA required developing two related strengths: the connection among, or "ensemble-ization" of, the Center's programs, and the guiding role provided by the strategic vision of anticipatory governance – and its component capacities of foresight, engagement, and integration – for the research programs. The success of these two crucial efforts was greatly enhanced by our commitment to embark on empirical projects aimed at the Center's activities – in a reflexive mode of turning our methods on ourselves – to gather strategic intelligence. As described in the YR 4 and YR 5 annual reports, to improve "ensemble-ization," post-doctoral fellow Matt Harsh studied TRC 2's end-to-end process and conveyed his findings to TRC 1. Also as described in the YR 4 and YR 5 annual reports, to strengthen the guiding role of anticipatory governance as the Center's strategic vision, we held a Visioning Workshop on futures of anticipatory governance (Selin 2008).

Within its strategic vision of anticipatory governance and supported by the methodologically oriented RTTA activities, thematic research at CNS-ASU is also crucial. As the former TRC 2, Human Identity, Enhancement and Biology, has wound down with the long-awaited publication of volume three of the *Yearbook* in May 12, the Center has focused on a new TRC 2, Urban Design, Materials and the Built Environment, a.k.a., "Nano and the City." The primary rationale for selecting this new theme was to ground and locate discussions of the responsible (and sustainable) development of nanotechnology in the city. This grounding is appropriate for reasons including: 1) the transition of the majority of human beings on the planet to being urban dwellers; 2) the promising role of cities for sustainability, e.g., lower energy use per capita; 3) the challenging role of cities for sustainability, e.g., lack of local food and water resources used by cities, and highly skewed income distributions; 4) the location in urban areas of large-scale socio-technical systems – such as water, energy, communication, health, and transportation – for which nanotechnology will have important ramifications; 5) the central role of cities in the geography of innovation; and 6) the decline, over the past two generations, of scholarship (apart from regional economic development) linking the urban with the scientific and technological.

With the "end-to-end" and "ensemble-ization" perspectives firmly established, the new TRC 2 has commenced in a nearly fully integrated manner, e.g., with RTTA 1 providing bibliometric and other data and for joint research with TRC 2, RTTA 2 incorporating questions dedicated to TRC 2 concerns into the public opinion survey fielded in the current year, RTTA 3 planning its major public engagement activity around city tours, RTTA 4 submitting together with TRC 2 an associated proposal to NSF for STIR City, and TRC 1 in essentially constant contact on issues of equity in urban sustainability. Changes in team leadership have emphasized substantive connections among the research programs, e.g., new TRC 2 co-leader Wiek arrived at CNS-ASU familiar with anticipatory governance and nanotechnology; new RTTA

1 co-leader Lobo, an urban economist, and new RTTA 3 co-leader Lim, with training in architecture, bring substantive connections to interactions with the new TRC 2.

In addition to strategic planning for research, the Center's Visioning Workshop contributed to strategic planning for education and outreach. With respect to education, a major plan in the renewal has been to conduct a Winter School in the Anticipatory Governance of Emerging Technologies on an annual basis in Tempe, AZ beginning in Winter 11-12. This plan has been set back with a decision by the ASU administration to reorganize the academic calendar and eliminate winter session. After studying the consequences of this change for the planned Winter School and considering the possibility of conducting the school later in Spring 12 at an off-campus site, we have instead decided to keep the Winter School in that season starting in Winter12-13 and hold it in close conjunction with our annual All Hands meeting.

CNS-ASU's strategic partnership with NISE Net has continued to strengthen, resulting in the Center's being named a "core partner" in NISE Net. The current year's success was placing social and ethical issues squarely at the center of a new nano mini exhibit that NISE Net has developed and an agreement for NISE Net to commit substantial resources for CNS-ASU personnel to train hundreds of museum staff and volunteers to discuss social and ethical issues with their visitors. CNS-ASU continues to make video communication an important focus of activities, and the Center is completing an overhaul of its website to show video, social media, etc., in a more attractive way. The Center's commissioned short video, related in part to the Nano and the City theme, was completed this year, and we are in discussion about how to use it to seed more active outreach around the question of where nanotechnology is in *your* day. The FutureTense documentary project with which CNS-ASU has been collaborating is not dead but is significantly slowed due to funding challenges and "creative difficulties." The documentary filmmaker following the associated STIR project continues to make strong progress.

CNS-ASU outreach to the private sector has strengthened under post-doctoral fellow Davies, who planned and conducted the Center's first Private Sector Engagement workshop 5-6 May 11. This workshop brought a mix of presentations and discussions to achieve a greater understanding between the Center and a variety of private sector stakeholders about what the Center's projects and programs might offer to the private sector. Follow-ons to this workshop include strong private sector engagement in TRC 2's research activities and in the *Emerge* conference at ASU, which the Center co-sponsored. While outreach in Washington, DC has suffered some setbacks because federal budget difficulties have distracted potential congressional partners like the Congressional Nanotechnology Caucus, the Center has been active through CSPO's Washington, DC office in hosting numerous "New Tools" seminars. More on this collaboration, as well as video and private sector outreach may be found in the **Outreach** section.

In the Center's renewal review, site visitors asked about the apparent mismatch between the huge list of Center participants accounted for in **Section 4, List of Center Participants** and the **List of Center Publications**, which is small in comparison. The response, which the committee found appropriate but which we reiterate here, is that as the largest center dedicated to the study of the societal aspects of nanotechnology in the country and, likely, in the world, CNS-ASU sees itself as an important producer of public goods like networking and infrastructure (capacity-building) – as a good hegemon, in other words. While we identified "growth" as an important strategic goal in our 08 Visioning Workshop, we also limited the size and number of our formal external collaborations (subcontracts) in our renewal. Yet, by accounting for the participants in our capacity-building activities, we can provide a transparent account of the reach the Center has had. This reach has included a vast number of international scholars and practitioners who have visited the Center in a way akin to a user facility in which the Center's faculty, its conceptual tools, and its ongoing collaborations with scientists and engineers provide the infrastructure for work they cannot perform in their home institutions (see also **Section 13, Shared and Other Experimental Facilities**). Thus, the Center does not displace or dilute traditional deliverables like peer review with such activities but adds to them.

CNS-ASU's partnerships with scientists and engineers continue to thrive. At the undergraduate level, InnovationSpace stands as a unique example of cross-functional collaborations among design, business and engineering. At the graduate level, we are transforming the PhD+ into a university-wide certificate program in Responsible Research and Innovation, and the training program in collaboration with ASU's NNIN node is, along with the activities derived from CNS-ASU and elaborated and evaluated in the associated EESE project, becoming a model for teaching societal and ethical implications (SEI) that was explored by more than 100 scholars at the SEI Congress, held here at ASU in Nov 11 and co-sponsored by CNS-ASU. The associated STIR project is consolidating its findings, and Fisher and Wiek submitted in Feb 12 a revision of their follow-on project – STIR City – that links embedded research activities through a more widespread network of sites to sustainable urban nanotechnologies. Last year, the Center achieved its goal at ASU of being a partner on all appropriate, large-scale science and engineering proposals. This year, the Center's collaboration with Honsberg's NSF-funded Quantum Energy and Sustainable Solar Technologies (QESST) Engineering Research Center has commenced, with Miller and Guston supervising post-doctoral associate Daniel Higgins in anticipatory governance activities for QESST and CNS-Fulton School of Engineering graduate fellow Ben Wender conducting "anticipatory life cycle assessment" research at the interface of the two centers. The Center also collaborated with Panchanathan's IGERT on Person-Centered Technologies and Practices for Persons with Disabilities, which commenced this year (Miller is co-PI). With these awards, CNS-ASU is partner to roughly $26M in science and engineering funding at ASU. Outside of ASU, the Center submitted, in collaboration with Notre Dame, a small workshop proposal on the anticipatory governance of active nano-materials and nano-systems with CNS-UCSB and the two Centers for Environmental Implications of Nanotechnology at UCLA and at Duke. Guston and Miller are also involved in final Sustainability Research Network proposals that include CNS-ASU programs like anticipatory governance in life cycle assessment of nanotechnology, the DC Summer Session training program, and NISE Net-related participatory technology assessment activities. The *Emerge* workshop co-sponsored by CNS-ASU, the Herberger Institute of Design and the Arts and its School of Arts, Media and Engineering, and the Sandra Day O'Connor School of Law and its Prevail Project – as well as other entities on campus including the School of Sustainability, the Ira A. Fulton Schools of Engineering and LightWorks – highlighted interdisciplinary collaboration on campus around future-oriented technology and society issues.

Finally, in CNS-ASU's renewal site visit, the review committee encouraged the Center to be more embracing of emerging technologies other than nanotechnology. While the Center's strategic vision of anticipatory governance has always meant to embrace emerging technologies generally, we have focused on nanotechnology for the obvious reasons. Nevertheless, the Center has extended its activities to engage more directly other emerging technologies:

- RTTA 2's recent data collection involved synthetic biology and nuclear energy in addition to nanotechnology;
- Wiek and Guston have written with Frow and Calvert (Edinburgh), in the aftermath of their visit to CNS last year, on sustainability and synthetic biology, and Wetmore was a fellow at Edinburgh's Genomics Forum;
- Guston and Wetmore have been in close contact with Meagan Palmer, co-lead for Human Practices and Education at the NSF-funded Synthetic Biology Engineering Research Center;
- Conz and Davies have begun investigating DIY manufacturing;
- Miller is involved in an NSF SRN proposal (Duke University lead) on the bio-economy; and
- Miller, Sarewitz, and Guston are involved in meetings and publishing around geoengineering.

These activities will continue and, alongside collaborations with scientists and engineers, provide perhaps the best opportunities for additional and extended funding for the Center in the medium- to long-term.

9. Research Program, Accomplishments, and Plans

As described briefly above, CSN-ASU research programs are divided into two types: the Real-Time Technology Assessment programs with a more use-inspired agenda, and the cross-cutting Thematic Research Clusters with a more curiosity-driven agenda. Key to the success of the Center is not only their individual productivity, but also the interaction among them and their accord with the strategic research plan. While key contributions in foresight, engagement and integration are evident from other areas in this Report, we continue to offer descriptions of "ensemble-ization" at the conclusion of each section.

RTTA 1: Research and Innovation Systems Analysis (RISA)

Personnel – faculty and senior participants

Jan Youtie (Georgia Tech, senior researcher, Enterprise Innovation Institute and adjunct associate professor of Public Policy) (team co-leader; GT Co-PI; CNS-ASU Co-PI)
Jose Lobo (ASU, associate research professor, School of Human Evolution and Social Change) (team co-leader)

Alan Porter (Georgia Tech, professor emeritus, ISYE and Public Policy)
Juan Rogers (Georgia Tech, associate professor, Public Policy)
Philip Shapira, (Georgia Tech, professor, Public Policy) (GT PI)
Deborah Strumsky (University of North Carolina, Charlotte, assistant professor, Geography)

Other Personnel – graduate students (4), undergraduate students (2), visiting scholars (3)

Goals. The overarching goal of RTTA 1/RISA is to characterize the technical scope and dynamics of the NSE enterprise and the linkages between it and a variety of public values and outcomes. A major research theme – RTTA 1/1: Organization, Structure, and Trajectories of Emerging Nanoscience – characterizes the NSE enterprise and its dynamics through data-mining techniques such as bibliometric and patent analysis, as well as through text-mining, interviews, and other methods. The strategic areas of emphasis are: the organization, structure and trajectories of emerging nanoscience and nanotechnology enterprise and application. A second major activity – RTTA 1/2: Nanotechnology Enterprise and Applications – will develop real-time strategic intelligence about nanotechnology commercialization in the US and globally, through methods including those above but also through the creation of a corporate panel data set.

Research Accomplishments and Plans, RTTA 1/1.

RTTA 1/1 Organization, Structure, and Trajectories of Emerging Nanoscience originally constructed a large-scale set of global databases of nanotechnology research publication records comprised of 1.6 million articles including 821,000 from the Web of Science's Science Citation Index (SCI) and others from INSPEC and Compendex, covering the period 1990-2011. In addition to the publication database, we also have developed a patent database that includes 116,000 nanotechnology patent applications and grants (from 71 patent offices worldwide including USPTO, EPO, WIPO, Chinese State Patent Office) and 91 countries covering the 1990-2010 (January) time period.

The database originates out of a two-stage bibliometric search method that was developed and published in Porter et al. (2008). This method is emerging as a public tool that other research groups are using or adapting. The article describing the database has garnered 142 citations in Google Scholar (as of Mar 11) and 55 citations in the Web of Science. Researchers associated with the Euro Nano Observatory compared six search approaches in preparation for its research monitoring activities and found that five of

the six, including our approach, converge on a similar definition (Huang et al. 2008). As a result, the Euro Nano Observatory (a Framework Programme 7 project involving 16 partners from 10 European nations; see http://www.observatory-nano.eu/project/) is following our search approach as its benchmark for monitoring nanotechnology R&D.

A major effort in YR 6 is a review of our bibliometric search method in light of changes to the emerging nanotechnology domain. Several analyses have been accomplished: (1) examination of the top keywords in 2009 when we apply a simple nano* search term in our existing 2009 global nanotechnology publication database to understand upwardly trending keywords; (2) share of "nano-ness" of a keywords based on the number of hits in the 2009 global nanotechnology publication dataset compared to the number of hits in a random set of general scientific articles; (3) for new upwardly trending search terms, an examination of cited references to determine if the cited references include an article in the existing global nanotechnology publication database. Preliminary results suggest that although there are new terms that have arisen in the last several years which not fully captured in the original bibliometric search method, such as graphene and mesoporous silica, the share of terms captured with the nano* prefix has increased since 2006.

Selected findings from this research in the reporting year include:

- The international rise of China's position in nanotechnology has been underwritten by the emergence of a series of regional hubs of nanotechnology R&D activity within the country (Tang, Shapira, 2011).
- While most of the leading nanodistricts are found in locations that were prominent in previous rounds of emerging technologies, new geographic concentrations of nanotechnology research have also surfaced (Shapira and Youtie 2008, Shapira, Youtie and Carley forthcoming). This finding is based on an examination of nanotechnology research and commercialization at a regional level. Leading US and European prototype "nanodistricts" or metropolitan areas active in nanotechnology research are identified based on publication characteristics over the 1990-2006 timeframe. The factors underlying the emergence of these metropolitan areas are probed through exploratory cluster analysis. Total publications and corporate publications are most consistently and positively associated with nano patenting in US nanodistricts.
- Nano environmental health and safety (EHS) research is growing rapidly, although it is orders of magnitude smaller than the broader nano S&T domain. Nano EHS work is moderately multidisciplinary, but gaps in biomedical nano EHS's connections with environmental nano EHS are apparent (Youtie et al. 2011).
- Nanotechnology scientists who consider setting moral limits to be important are more apt to cite environmental, health, and safety publications in their research (Youtie, Carley, Shapira, Corley, Scheufele 2011).
- A significant change has occurred in recent years in the orientation of corporate nanotechnology activities, from research discovery to patented applications (Shapira, Youtie, Kay 2011). Only 17% of nanotechnology patents have women inventors, but the gender gap is closing (Meng and Shapira 2011). Female inventors are especially prominent in nanotechnology patents in the life sciences area.

Several new research papers are in the pipeline, including:

- The cognitive geography of nanotechnologies and knowledge flows (Porter and colleagues). This strand of research seeks to use overlay maps, citation analysis, and case studies to examine the flow of knowledge across disciplines in nanotechnology.
- Research centers as a policy tool in the US National Nanotechnology Initiative (Rogers, Kay, Youtie, Shapira). Using a database that compares nanotechnology research centers to other research centers

and unaffiliated researchers, this study suggests that many companies are using the nanoscale science and engineering centers as a network.

- The aggregate transition from research to commercialization does not exist within a given firm, but rather there are, in fact, at least two types of firms that enter markets in different time periods and focus on either research or patenting, respectively (Shapira, Youtie, Kay 2012).
- Graphene applications involve companies that specialize in the technology and those who offer a wider range of applications (Arora, Ma, Gao, Shapira, Youtie).
- While graphene as a whole is experiencing concurrent scientific development and patenting growth, country and application specific trends offer some evidence of the linear and double-boom models (Shapira, Youtie, Arora)
- Sectoral differences in the financing and technology approaches exist between nanobiotechnology, nanoenergy, and nanoelectronics firms. Nanobiotechnology firms are more likely to rely on venture capital whereas customer sales and international partners are more prevalent among nanoenergy and nanoelectronics firms (Youtie, Hicks, Shapira, Horsley).

Research Program, Accomplishments, and Plans, RTTA 1/2

One activity of RTTA 1/2 is the creation of a corporate panel of nanotechnology corporate enterprises. A corporate panel is a set of corporate enterprises which have "entered" nanotechnology as evidenced by a nanotechnology publication authored or co-authored by an individual in a corporate enterprise and/or a nanotechnology patent assigned to a corporate entity. The notion behind the corporate panel is to track changes in panel companies nanotechnology activities over time. We developed a database of 120,000 records (57,000 publications and 63,000 patents from 18,000 companies). This database was used to select the US portion of the corporate panel, which is comprised of 125 large US nanotechnology companies and 125 small and medium-sized US nanotechnology enterprises (SMEs). A large company is defined as one that is mentioned in the EU Industrial R&D Investment Scoreboard and the Global Forbes 2000. Our corporate panel includes 125 large US nanotechnology enterprises, which fall (based on their industry classification) into six different segments: (1) industrial equipment, (2) electronics/energy/ICT, (3) health/medicine, (4) materials/chemicals, (5) transportation/aerospace, and (6) food/other consumer. The panel also includes 125 SMEs which fall (based on their industry classification or market offerings) into the first four segments; we did not find a sufficient number of SMEs in the latter two segments to populate them. Our next effort, planned for the following six months, is to match these 250 large and small US nanotechnology enterprises with companies in the same segments outside the US.

This panel will be used to address research questions such as: (1) What kinds of linkages do these companies have with universities and other research institutions? (2) How is strategy for introduction of nanotechnology-enabled products and materials construed in the face of uncertainty? (3) Where do these companies and their products fit in the global supply chain and where is inventive activity geographically located? (4) What international boundaries are these supply chains crossing and what role do consumer values and demand play? (5) What kinds of employment and training needs and issues do these companies face? and (6) How does nanotechnology-related governance and regulation affect the plans and practices of these companies?

A second activity of RTTA 1/2 is characterizing the nature of the nanotechnology enterprise and its applications through patent analysis. A team consisting of new RTTA 1 co-leader Lobo at ASU and new other senior personnel Strumsky (at North Carolina, Charlotte) uses two new patent databases constructed with other NSF support – one on patent applications submitted to the U.S. Patent Office matched with granted patents, and the other a database on the technology codes used by the Patent Office to classify the technologies utilized by a patented invention – Lobo and Strumsky have calculated patent success rates and measured the technological complexity of nanotechnology patents. Results from this research,

indicating that patent applications in the area of nanotechnology have a lower success rate than the norm and are more technologically complex than the average patent, were presented at the Transatlantic Conference on nanotechnology held at Georgia Tech in Mar 10.

Lobo and Strumsky have also examined the presence of nanotechnology in US patents classified as "green." The classification of US patents as green is one that the research team has developed previously based on one produced by the Patent Office but augmented after discussions with personnel from the Patent Office, NSF, and the White House Office of Science and Technology Policy. The results from this work will be included as part of a comprehensive report on the "Green Economy" which the Brookings Institution released in Jul 11 and a Brookings working paper on the "geography of green patenting." Lobo and Strumsky are preparing a report on "How Green is Nano?" as a CNS-ASU report. Preliminary results indicate that green nanotechnology patents have the same number of inventors as the average green patent but more claims, more citations received, and more technology codes, suggesting that these patents are substantially more inventively novel than the average green patent.

Contributions to "ensemble-ization" or other center-wide activities.

RTTA 1/1's presentation at the 2009 S.NET Conference workshop led to an article on environmental, health, and safety in nanotechnology published in 2011 which is co-authored with a CNS-ASU PhD+ graduate. This publication would have never been possible without access through CNS-ASU to the CNS-ASU graduate student who is a scientist in the nanotechnology environmental, health, and safety area.

In addition, there are several other activities to which RTTA 1/1 has contributed:

- RTTA 1/1's organization of the EU-US Transatlantic Workshop on Nanotechnology Research and Innovation Policy included two researchers from CNS-ASU, including one from RTTA 3.
- RTTA 1/1's co-authorship of a paper with RTTA 2, based on merging data from the scientists' survey with information from the global nanotechnology publication database on the presence of nanotechnology environmental, health, and safety entries in the cited references of articles co-authored by these scientists.
- RTTA 1/1 provided bibliometric analyses for TRC 2;
- RTTA 1/1 researchers contributed 3 chapters to TRC 1-led *Yearbook* and provided bibliometric data for TRC 1 case studies;
- RTTA 1/2 is examining the "green" nature of nanotechnology applications in conjunction with TRC 2.

Research Program, Accomplishments, and Plans, (former) RTTA 1/2

(Former) RTTA 1/2 Public Value Mapping (PVM) explores the connections between claims of contributions to public values made on behalf of a research activity like nanotechnology and empirically identifiable outcomes associated with those values. The Public Value model has been developed by Bozeman and others and some of the RTTA 1/2 is collaborative with an associated project (NSF SBE-0738203; Sarewitz, PI; Bozeman, co-PI) to elaborate PVM across a number of case studies, some of which include nanotechnology. PVM provides a model of innovation based on widely shared and non-economic, i.e., public, values. As there are potential market failures, there are likewise potential public values failures, including: interest articulation or aggregation, imperfect monopolies, benefit hoarding, scarcity of providers, short time horizon, conservation of resources, and threats to human dignity and subsistence.

Much of the work with RTTA 1/2 is represented in three recent publications:

- A chapter in an anthology on the US National Nanotechnology Initiative from a public value perspective (Boardman, Slade and Bozeman 2011);
- A study of the relationship of public value statements found in nanotechnology policy and their evolution over time, which employs factor analysis and quantitatively measured content analysis to pioneer a new approach to operationalizing PVM (Fisher, Slade, Anderson and Bozeman 2011); and
- A special issue of the journal *Minerva*, consisting of a substantive introductory article (Bozeman and Sarewitz 2011) and two case studies (Slade 2011; Valdivia 2011), among others in the issue, involving nano-based cancer therapies and technology transfer (also derived from TRC 1), respectively. This activity formulated a standard approach for each case, involving narrative descriptions of the social problems and stakes involved in the case, the imputed public values and policy statements articulated, the case content, the state of the knowledge value and user communities, an assessment of the public values failures involved, an assessment of the market values involved, an analysis of the values chain that links articulated public values to outcomes, and recommendations.

RTTA 2: Public Opinion and Values

Personnel: Faculty and senior participants

Dietram Scheufele, RTTA 2 co-leader (Wisconsin, John E. Ross Professor, Life Sciences Communication)
Elizabeth Corley, RTTA 2 co-leader (ASU, Associate Professor, School of Public Affairs)

Dominique Brossard (Wisconsin, Professor, Life Sciences Communication)
Michael Xenos (Wisconsin, Associate Professor, Communication Arts)
Other Personnel – post-docs (0), graduate students (9; 3 paid, six not), undergraduate students (0)

Goals. The overall goal of RTTA 2 POV is to monitor, among both the public and scientists, the understanding of and values relating to NSE and its potential societal outcomes, track these variables over time, and examine the role of the media in reflecting and influencing them. POV comprises a set of inter-related research themes around the public, NSE researchers, and the media. RTTA 2/1 Public Opinion Polling is the major project, conducting nation-wide public opinion polls to understand at an aggregate level the public's knowledge of and values regarding nanotechnologies. RTTA 2/2 Scientists' Opinions and Values is a research theme that conducts polls of NSE researchers to understand their perceptions and values regarding nanotechnologies. RTTA 2/3 Media Influence is a research theme that tracks media stories of nanotechnologies and, using a quasi-experimental design, attempts to understand how various media frames for nanotechnology stories can influence the knowledge and opinions of the public.

Research Accomplishments and Plans, RTTA 2/1.

As part of the Public Opinion Polling research, Corley & Scheufele have capitalized on their experiences with some of the earliest public opinion surveys on NSE (e.g., Scheufele & Lewenstein, 2005) and have continued to develop and refine ways of measuring attitudes, information seeking, and policy stances. This methodological work is a necessary condition for doing sophisticated basic research. But it has also allowed the POV team to assist other researchers across the globe (e.g., Université de Caen Basse-Normandie, France; Poznan University of Economics, Poland; and Dublin City University, Ireland) by sharing instruments and expertise. During YR 7 of the CNS-ASU grant, the POV team has also been able to provide real-time feedback to policy makers when they need specific information about policy-relevant public attitudes.

RTTA 2/1 has completed two general, full-scale public opinion data collections: in Jul 07 and Jan 12. The 2007 survey was a CATI survey with a combined RDD and listed household sample conducted May – Jul 07 (N=1,015; margin of error, +/- 3%). The 2012 survey was conducted by Knowledge Networks (N=2,806; margin of error, +/- 2%), and it embedded experimental manipulations into a nationally representative survey. This new approach has three analytic advantages: First, it allows us to examine different subpopulations – serving goals of TRC 1 by including those that have been traditionally underserved by science communication efforts (defined by gender, age, ethnicity, or other factors). Second, the large sample is divided into three, nationally representative samples, each focused on a separate technology (nanotechnology, synthetic biology, and nuclear energy) to help us examine the processes of opinion formation and market dynamics surrounding nanotechnology in comparison to other technologies. Third, we embedded a series of experimental manipulations in each of the issue-specific subsamples. By drawing on the external validity of nationally representative samples and the internal validity of random-assignment experiments, we are able to capitalize on the advantages of both methods and build a deeply granular understanding of the cognitive and affective processes that lay publics use to make sense of emerging technologies.

We also continue to coordinate our data collections with related efforts at Wisconsin, Singapore, Rutgers and elsewhere in order to build comparable data sets that can be used for comparative quantitative work down the road. Because RTTA 2/1 has played a prominent role in sharing these innovations with other scholars, the leaders of the POV team serve as consultants or co-PIs on other related NSF and USDA grants. This methodological outreach is being formalized by RTTA 2/1 researchers through the formal archiving and sharing some of data collection instruments.

RTTA 2/1 has developed several analytical themes in its research, included religiosity and public acceptance of nanotechnology, widening knowledge gaps about nanotechnology, and risk and benefit perceptions about nanotechnology. While the former two have inspired interactions with TRC 1, the latter has interacted with RTTA 2/2 and with RTTA 1. In YR 7, publications drawing on the first data collection have continued while data analysis on the Jan 12 collection has just begun.

Religiosity and Public Acceptance of Nanotechnology

As with many other political and scientific issues, citizens rely on cognitive shortcuts or heuristics to make sense of issues for which they have low levels of knowledge. These heuristics can include predispositional factors, such as ideological beliefs or value systems, and also short-term frames of reference provided by the media or other sources of information. By combining CNS-ASU public opinion survey data from the US with Eurobarometer surveys about public attitudes toward nanotechnology in Europe, Scheufele, Corley and colleagues (2009) concluded that respondents in the United States are significantly less likely to agree that nanotechnology is morally acceptable than respondents in many European countries. These moral views correlated directly with aggregate levels of religiosity in each country, even after controlling for national research productivity and measures of science performance for high-school students.

Widening Nanotechnology Knowledge Gaps

RTTA 2/1 research on the change in nanotechnology knowledge among the public over time has generated some particularly important results for TRC 1 and outreach. In particular, Corley & Scheufele (2010) found that there are widening gaps in knowledge about nanotechnology since 2004 between the least educated and most educated of the US public. Americans with at least a college degree have shown an increase in understanding of the new technology, while knowledge about nanotechnology has declined over time for those with education levels of less than a high school diploma. Closing these informational gaps among public audiences is a necessity, especially in light of a US budget that has reduced spending for "educational and social dimensions" of nanotechnology in recent years. There is a real urgency to find ways of communicating effectively with all groups in society. Unless researchers find ways to close these learning gaps, we may create two classes of citizens – those who are able to make informed consumer and policy choices about these new technologies, and those who simply cannot. Corley & Scheufele also concluded that the Internet is one of the most effective methods in closing gaps and informing the less educated about nanotechnology.

Risk and Benefit Perceptions

RTTA 2/1 research has produced multiple continuous streams of research that have contributed to the literature about how nanotechnology was covered in media and how audience characteristics interact with these messages to shape attitudes about nanotechnology. For example, Scheufele and colleagues (2007) demonstrated that nanoscientists are more optimistic than the public about the potential benefits of nanotechnology; however, for some issues related to the environmental and long-term health impacts of nanotechnology, nanoscientists were significantly more concerned than the public. Therefore, RTTA 2/1 researchers concluded that nanotechnology may be one of the first emerging technologies where

researchers have observed this trend of scientists' being more concerned about some risks than the public. Building on this research, more fine-grained analyses have shown that when making risk judgments, nanotechnology experts use trust in scientists to make decisions while the public uses religious beliefs as heuristic cues. Although deference to scientific authority, science media use, and trust in scientists shape perceived benefits in both scientists and the public, these heuristic cues influence public perception to a larger extent than experts' perceptions.

RTTA 2/1 has also examined the changing nature of risk and benefit perceptions to conclude that as the field of nanotechnology matures, public opinion research focused on judgments about abstract risks and benefits, rather than attitudes toward specific applications, is less useful. Recent RTTA 2/1 research shows that individuals who associate nanotechnology with particular areas of application, such as the medical field, take risk perceptions much more into account when forming attitudes than respondents who do not make these mental connections. Therefore, the RTTA 2/1research program increasingly focuses on assessing measurement tools for the field of public opinion about emerging technologies more broadly.

Research Accomplishments and Plans, RTTA 2/2.

RTTA 2/2 has also completed two national-level nano-scientist surveys: in Jul 07 and Sep 11. The 2007 survey was a mail survey of leading US nano-scientists (N=363; AAPOR RR-3: 39.5%). The 2011 data collection was conducted as a mail survey of leading US nano-scientists (N=444; AAPOR RR-3: 31.6%). The content of the 2011 survey was slightly different from the 2007 survey by focusing on more granular perceptions about the risks and benefits of nanotechnology, nano-regulation, public engagement, and the ethics of nanotechnology laboratory practices.

Risk, Benefits, and Regulation of Nanotechnology

The RTTA 2 team considers regulation of nanotechnology to be an important area for study because even though there is a high degree of scientific uncertainty about the risks of nanotechnology, policy-making cannot be placed on hold until risk assessments are complete. In the absence of risk assessment data, decision makers often rely on scientists' input about risks and regulation to make policy decisions. RTTA 2/2 research has shown that nanoscientists are more supportive of regulating nanotechnology when they perceive higher levels of risks; yet, their perceived benefits about nanotechnology do not significantly impact their support for nanotech regulation. The research also finds that male nanoscientists are less supportive of nanotech regulation than their female peers and materials scientists are more supportive of nanotechnology regulation than scientists in other fields.

In addition, Corley & Scheufele concluded that the leading U.S. nanoscientists see the areas of surveillance/privacy, human enhancement, medicine, and environment as the nanotech application areas that are most in need of new regulations. Based on the 2007 survey results, Corley, Scheufele and Ho (2009) found that in addition to risk perceptions, nano-scientists use their economic and social values to make decisions about nanotech regulation, and that surveillance/privacy, human enhancement, medicine, and the environment are the application areas in which nano-scientists see the greatest need for new nanotechnology regulations.

Most recently, Kim, Corley & Scheufele (forthcoming 2012) used the 2007 results to explore the perceptions of nano-scientists regarding the regulation of nanotechnology, with a particular focus on the governmental level (local, national, or international) at which the scientists believe nanotechnology regulation should be implemented. This regulatory discussion is important because international regulations are often difficult to adopt and implement; yet, local or state-level regulations could lead to the nanotechnology equivalent of the Pollution Haven Hypothesis (PHH). The results indicate that some

scientists support local-level nano-regulations, but most scientists support the regulation of nanotech at the national level or international level.

Corley, Scheufele & Kim (forthcoming 2012) found that there are three distinct categories of nano-scientists that have unique perspectives on regulation: "cautious innovators," "nano-regulators," and "technology optimists." The "cautious innovators" are more supportive of implementing nano-regulations at the local level. Additionally, these scientists think that public opinion is more important than scientists' opinions for research decision- and that we depend too much on science and not enough on faith. This group is also more likely than their peers to support the regulations of academic nanotech research. The second group of scientists is the "nano-regulators." These scientists are more likely to say that the government should protect the public from unknown nanotech risks. Also, these "nano-regulators" are more supportive than their peers of nano-regulations at the national and international level. Lastly, they are more likely to support the regulation of commercial nanotech research. While many scientists acknowledged the importance of nanoregulation, some scientists are less supportive of restricting nanotech advancements using regulations – i.e., the "technology optimists." These scientists are more likely to think that advancing nanotechnology is more important than protecting society from the potential nano-risks. Also, these scientists tend to think that scientists know best when it comes to making scientific decisions that can impact the public.

Perceptions of Media Coverage

Exploring public perceptions and scientists' perceptions about media coverage of nanotechnology – as well as the public communication of research - were also key focal areas for the RTTA 2/2 team in the 2007 data. Using the 2007 survey results, Corley, Kim and Scheufele (2011) also explored leading U.S. nano-scientists' perceptions about media coverage of nanotechnology and the public communication of research findings, concluding that leading U.S. nano-scientists perceive an important connection between the public communication of research findings and public attitudes about science. Additionally, there is a significant relationship between the scientists' perceptions about media coverage and their views on the timing of public communication; scientists with positive attitudes about the media are more likely to support immediate public communication of research findings, while others believe that communication should take place only after research findings have been published through a peer-review process. In addition, leading U.S. nano-scientists tend to view media coverage of nanotechnology as less credible and less accurate than general science media coverage. These results indicate that leading U.S. nano-scientists do feel a sense of responsibility for communicating their research findings to the public, but attitudes about the timing and the pathway of that communication vary across the group.

The RTTA 2/2 team is currently analyzing the results of the 2011 scientist survey. Corley & Scheufele are currently working on an article for a special issue of *Review of Policy Research* that uses the 2011 data to explore nano-scientist perceptions about existing nanotechnology policies, the development of new nanotech policies, levels of governmental regulation, current and future risk levels for public exposure to nanomaterials, we well as mandatory policies about the implementation of safe lab practices for federally funded nano-research. In addition to exploring the scientists' perceptions about these pressing policy issues, Corley & Scheufele also test relationships between scientists' perceptions and control variables such as gender, disciplinary affiliation, political ideology, academic rank, employment affiliation and religiosity. Lastly, the article will emphasize a comparison between the data collections in 2007 and 2011 to explore any changes over the four-year time period.

Research Accomplishments and Plans, RTTA 2/3.

Finally, RTTA 2/3 continues to analyze media content in three different outlets. First, we continue to use the infrastructure built during the first five years of CNS-ASU funding to analyze in real time content data

from small, medium-sized and large newspapers in the US. Papers from this work appeared in disciplinary journals (e.g., *Journalism & Mass Communication Quarterly*) and also in outlets specific to particular scientific fields (e.g., a piece of food nanotechnology in *Appetite*). Second, RTTA 2/3 partnered with the UW NSEC on Templated Synthesis and Assembly at the Nanoscale to purchase access to Crimson Hexagon. This software license allows us to analyze content streams in real time from all online and social media outlets (including Twitter, Facebook, blogs, online newspaper sites etc.). RTTA 2/3 continues to collect and mine data for traditional media, but our collaborations with the UW NSEC have allowed us to provide real-time insights into the ongoing debates around nano that are unique in the field of the social studies of science. An article comparing online and offline media environments is forthcoming in *New Media & Society*. Finally, students at UW have begun to use the content analytic tools we built as part of CNS-ASU to branch out into other fields of research. Most recently, Maria Stubbings is working on a content analysis of media coverage of gene patenting in the US; she will defend this work in May 12.

Contributions to ensemble-ization or other Center-wide activities

RTTA 2/2's study of nanotechnology risk perceptions has led to collaborative work with RTTA 1 (specifically Youtie & Shapira) to better understand the relationship between societal perspectives held by nano-scientists and their publication actions (Youtie et al. 2011). This collaborative research between RTTA 1 and RTTA 2/2 explored the relationship between scientists' risk perceptions about nanotechnology and their actions in citing nanotechnology environmental, health, and safety (EHS) publications.

RTTA 3: Anticipation and Deliberation

Personnel: Faculty and senior participants
Cynthia Selin, RTTA 3 co-leader (ASU, assistant professor, CSPO, School of Sustainability)
Merlyna Lim, RTTA 3 co-leader (ASU, assistant professor, School of Justice and Social Inquiry, CSPO)

Prasad Boradkar (ASU, associate professor, School of Design)
Sidnee Peck (ASU, program manager, W.P.Carey School of Business)
Angela Pereira (European Commission, Joint Research Centre)

Other Personnel: Post-docs (1); grad students (14; 12 as event ethnographers); undergraduates (9 in InnovationSpace).

Goals. The central goals of RTTA 3 are to appreciate multiple, plausible visions of nanotechnology-enabled futures, elucidate public preferences for various alternatives and, using such preferences, help further refine future visions and enhance contextual awareness. RTTA 3 consists of four tightly integrated approaches that address research, education, and outreach. RTTA 3/1 Futures of Foresight explores and assesses alternative approaches to imagining plausible nano-enabled futures. RTTA 3/2 InnovationSpace is a collaborative undergraduate design course among ASU's Schools of Design, Engineering, and Business in which transdisciplinary teams of students create product designs, marketing plans, and engineering models of potential products within a framework of responsible innovation. RTTA 3/3 Probing Future-Oriented Deliberation is plans to probe in experimental settings the frameworks, inputs, structures and qualities of future-oriented deliberation. RTTA 3/4 FutureScape City Tours (FCT) builds on the foregoing to implement a large-scale citizen engagement activity that includes independent and joint deliberation of six groups of locally representative lay citizens from across the US on issues related to nanotechnology and the city.

Research Accomplishments and Plans
As revealed in the Timeline below, the major focus for YR 7 is on RTTA 3/1 and RTTA 3/2. However, as will be described, preliminary work and experiments are taking place in order to ensure the robust implementation of the Futurescape City Tours (RTTA 3/4).

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RTTA 3.4 TOURS		DESIGN PRINCIPLES, LITERATURE REVIEW, PILOT (NOV. 2012), DEVELOPMENT, TOURS (OCT. 2013), ANALYSIS & DISSEMINATION

Research Accomplishments and Plans, RTTA 3/1.

This section describes two major research thrusts in Futures of Foresight: the more theoretical PLAUSIBILITY PROJECT, the more methodological MEDIATING FUTURES. A special section is presented for the cornerstone RTTA 3 activity for YR 7 EMERGE which was a large-scale interdisciplinary collaboration and event that explored anticipation, deliberation and emerging technologies.

THE PLAUSIBILITY PROJECT

The Plausibility Project seeks to better understand the meaning and significance of plausibility through questioning the ways individuals and communities know, explore, assess and shape futures across time, cultures and professional practices. In YR 7 the Plausibility Project continues to explore the conceptual and methodological implications of plausibility and knowledge quality and foresight research and practice. In addition to the publication of a book chapter on plausibility (Selin 2012), the main activity in YR 7 has been preparation for a special issue in the *International Journal for Foresight and Innovation*. The authors of contributed articles will convene in Ispra, Italy for a writing workshop sponsored by the Joint Research Centre of the European Commission in collaboration with the CNS-ASU. This workshop, lead by Selin and Pereira in May 12, will build on the Plausibility workshop (YR 5) and the Institute of the Protection and Security of the Citizen's (JRC) emerging research programme on societal challenges of emergent technologies. We will explore future-oriented research and its relationship to and role in policy formation. Following on results from the CNS-ASU workshop, we will drill more specifically into the notion of plausibility as a paradigmatic shift and explore the implications of that shift for contemporary practices of foresight used to inform public policy. Select articles include:

- "Governance and the Human Condition," by Roger Strand and Silvio Funtowicz (Centre for the Study of the Sciences and the Humanities, University of Bergen, Norway)
- "Plausibility, Science Fiction, and Anticipatory Governance," by David Guston (Center for Nanotechnology in Society at Arizona State University, USA)
- "There is no time like the present (the whole story)," by Alfred Nordmann (Philosophy Department, Darmstadt Technical University, Germany)
- "Plausibility and Narrative: Toward a Unified Analysis," by James D. Faubion (Department of Anthropology, Rice University, USA)
- "What are plausible claims?" by Rene von Schomberg (European Commission, Brussels) and Robb Hoppe (University of Twente, the Netherlands)
- "The Role of Plausibility in Research and Innovation Policy," by Daniel Barben (RWTH Aachen University, Germany)

MEDIATING FUTURES

This methodologically focused research thrust explores how diverse media (visual, numerical, experiential) represent technology futures. We combine field studies, case studies, experimental settings, and site visits to catalogue and assess scenario activities used to improve decision-making and reflexive learning in a variety of settings. We focus on new and emerging media for future-oriented research, including scenario performance, 3-D interactive modeling, video and film, and physical models of proto-type designs. RTTA 3/1 also develops a range of visual/digital and material/tactile "scenaric devices" to contribute to a variety of CNS activities. In this section, we highlight several key activities and ongoing projects advanced in YR 7 that investigate the future of foresight.

Mediating Futures Book Project
Much of the research conducted under RTTA 3/1 on the futures of foresight will be synthesized in a book under development by Selin, Davies, Pereira, Gano and Lim. We have described our efforts in the following extended abstract:

> Emerging technologies make and remake everyday life in subtle and transformative ways that are often taken for granted. And yet it is vital that such technologies are interrogated by citizens, as they are and as they are predicted to be. Whose visions are being enacted in urban planning, sustainable building, new mobilities, or high-tech consumer products? Such interrogations have so far tended to draw on well-established techniques from political science, including citizens juries and councils, consensus conferences, or scenario workshops. Many of these formal techniques, however, are open to the same kinds of critiques that have been levelled at deliberative democracy as a whole: in particular, that there is a fundamental reliance on notions of 'reasoned discourse'. It is the spoken word that is important: the to and fro of conversation and the persuasion of your hearers through rational argument. The nondiscursive is excluded within this framework: there is little scope for deliberation which takes into account the material, affective, creative or playful.

To date, we have outlined each case, developed a table of contents and drafted the introductory chapter. We hope to submit this manuscript to MIT Press under their Leonardo Book series that focuses on art, technology and science by YR 9.

Making and Hacking Research Project
Hackerspaces and the "maker" movement are thus far understudied communities in which "creative, resourceful people who like to tinker and love to make things" come together in "community-operated physical places, where people can meet and work on their projects" (quotes taken from advertising for the Phoenix Maker Faire). Hacking and making can be seen as being at the intersection of, and relevant to, a number of different STS literatures, including those around public engagement, science communication, material cultures of science and technology, and technology assessment. Hacking and making also intersect with a number of CNS research interests, including RTTA 3/1 research on material deliberation and the anticipatory governance notion of capacity building, in which societal capacity for reflexive governance of emerging technoscience is developed.

We are currently in the early stages of research into the cultures of hackerspaces, at six locations in the US, using participant-observation and semi-structured interviews. This preliminary work focuses on the question of whether we can understand material practices of hacking and making as a form of lay technology assessment. Thus far, research – carried out by CNS researchers Davies and Conz – has included one local hackerspace, and research trips to a number of other locations (including Boston, San Francisco, and New York) are planned for Summer 2012.

Along with Conz and Davies, Selin will resubmit a grant to NSF STS to develop a new platform for public deliberation about the future of emerging technologies around food security, decentralized energy production, and the built environment. The proposed ~$500K project will design and investigate qualitative, participatory methods for looking at complicated, multi-faceted practices of technoscience through the development and application of multiple iterations of a gaming platform with three different groups over three years: a large group of experts from IEEE, a select group of grassroots, self-trained "Do-it-Yourselfers," and members of the broader public participating in the CNS-ASU Futurescape City Tours (see below). This proposal builds on lessons learned from the "Making and Hacking" research described here.

EMERGE

In YR 7, the main activity for RTTA 3/1 involved collaborating in the design, planning, coordination, and hosting of a large ASU-wide event called: *Emerge*: Artists and Scientists Redesign the Future. *Emerge* was a large-scale interdisciplinary event that explored anticipation, deliberation and emerging technologies.

Emerge took place on the ASU campus 1-3 Mar 12 and brought together artists, scientists, engineers, students, and educators in an attempt to "redesign the future" by thinking critically about the future of emerging technologies. *Emerge* kicked off with nine presentations about nanotechnology, information technology, biotechnology, synthetic technology and robots involving several CNS-ASU senior personnel (Woodbury, Helms-Tillery, Allenby), as well as director Guston. These "Futures@ASU" presentations were orchestrated as fodder for nine 1.5 day workshops in which faculty, students, futurists, and professionals used foresight methods to consider the implications of such research. The workshops presented their results on the third day of *Emerge* to a large public audience. In this Saturday event, the workshop report outs were complemented by keynotes by world-class future-oriented thinkers. The finale to *Emerge*, *Immerge*, involved evening performances, installations, and exhibits that performed some of the themes explored in the workshops. Over the course of 3-days *Emerge* engaged over 700 faculty, students, professionals and members of the local community in an exploration of the future of technology and society.

CNS-ASU was a primary sponsor of the event, contributing about one-fifth of the hard funds for the roughly $150K budget and a much more modest share of the roughly $300K in in-kind contributions for event coordination, communication, marketing and publicity, facilities, technical and material support, etc. Other sponsors at ASU were the Herberger Institute for Design and the Arts, the Office of the President, The Prevail Project of the Sandra Day O'Connor College of Law, the School of Sustainability, the Ira A. Fulton Schools of Engineering, and ASU LightWorks, as well as Intel from outside ASU. The three prime developers and organizers of *Emerge* were CNS-ASU's Selin, Thanassis Rikakis (Director of the Herberger Institute School of Art, Media + Engineering (AME) and the Herberger Institute Digital Culture Initiative), and Joel Garreau (Lincoln Professor of Law, Culture and Values at the Sandra Day O'Connor College of Law). Faculty from Herberger Institute for Design and the Arts, which includes AME, School of Theater and Film, School of Dance, and the School of Art were heavily engaged in the production of *Emerge* and the evening event *Immerge*.

Workshops

At the heart of *Emerge* were nine simultaneously run workshops designed as social science experiments in futures thinking and practice. Each workshop employed a different foresight methodology to engage an interdisciplinary group in creating games, products, monuments, images and stories in an effort to reveal the texture and feel of emerging futures. This activities, known collectively as "design fictions," build on CNS methodological research on Mediated Futures in that the workshops served as opportunities to investigate the effectiveness of exploring the future through diverse media. These experiments in future thinking aimed to prompt ethical reflection, asking not just "Can we?" but "Should we?" Our research strategy is explained in the section "*Emerge* Ethnography." Below is an outline of each workshop, highlighting the method used and some of the key questions that CNS researchers were interested in.

1. **Literally creating the future** (led by Julian Bleecker and Nick Foster of the Near Future Laboratory) This workshop created a design fiction called Corner Convenience, an idea led by the observation that the final resting place for many world-changing innovations is the corner convenience store. Think of what you can find there in a disposable form: fire (cigarette lighters), birth control (condoms), reading glasses (generic spectacles), power (batteries) and effective analgesics (aspirin). What will be convenient in a similar way in the near future? What will the checkout counter of your local corner convenience look like in 2016? This workshop focused on the near term to consider the trajectory of future products – those that

may eventually become mundane and specifically those everyday technologies that have a dual function (e.g., TicTacs with pheromones). Workshop participants brainstormed potential future products, mocked them up in Photoshop, revising actual products, and shot a short film in a local convenience store. Of particular interest was the use of material prototypes and a short film that worked to simulate an ordinary experience with what today would be considered an extraordinary technology.

2. **Monumental performance: The People Who Vanished** (led by Stuart Candy, futurist at Arap, and Jake Dunagan, futurist at the Institute for the Future)
This workshop took inspiration from the notion of "experiential scenarios," a method that offers a corrective to projections of change that are often inaccessible, impersonal and irrelevant. The idea is that people cannot relate to numerical or statistical representations of change, and that instead what is needed to spark the critical imagination is a lived experience, an enactment of change, in the present to offer a more tangible, emotional experience of a future world. In a further attempt to locate and ground this visioning experience, workshop leaders wanted to focus on place and thus brought in an archeologist with expertise on the Hohokam, the "people who vanished" from Phoenix centuries ago. Participants explored different strategies for evoking a strong sense of the possibility of collapse of contemporary civilization. Toward this end, they developed a performance around the symbol of collapse, acting out an invented mythology as a means to prompt thinking about alternative futures.

3. **Humanist narratives for energy** (led by Gary Dirks, ASU Lightworks & Clark Miller, associate professor, political science, CSPO, and associate director, CNS-ASU)
How will Arizonans produce and consume energy in 2050? This workshop involved an in-depth discussion of plausible energy futures, developing four scenarios around critical uncertainties. Each scenario weaves together social, political, technological, environmental and economic drivers that could influence what the energy landscape looks like in 2050. While the future is unknowable, scenarios look to

current trends and play out how they might interact over time. In these four accounts, key dilemmas around energy are drawn in sharp relief. Scenario planning is a more traditional foresight methodology, one used by CNS in the past (Selin 2008, on medical diagnostics), but CNS researchers were particularly focused on the metaphors in play, the use of a graphic recorder and the power dynamics in the group in relation to the materiality of the workshop.

4. **Sci-Fi prototyping** (led by Brian David Johnson, futurist, Intel)
This workshop used science fiction as a learning tool to rehearse, critic and investigate plausible new technologies and products and how they might be used. Using the "Sci-Fi Prototyping" framework for generating stories, the participants looked to current science and engineering research and developed out the worlds they might inhabit. They were asked to notice the human questions and problems as an anchor point to their stories and then explore a "scientific inflection point" to propel the plot for the short stories, short films, artwork and comics they conceived and executed. CNS scholars Miller and Bennett (2008) have written about science fiction as a tool of technology assessment, and this workshop provided an opportunity to practice the art.

5. **Games and impact** (led by Sasha Barab & Alan Gershenfeld, ASU professors and game designers)
In attempts to harness the appeal and compelling mechanics of virtual games toward assessing the implications of emerging technologies, this workshop designed the initial specs for a game focused on 3-D printing. While regularly discussed as a key ingredient of the next technological revolution, DIY manufacturing through 3-D printing also holds some risks and surprising systemic effects. Inspired by Lee Hartwell, the Nobel Prize winning scientist who joined the *Emerge* workshop, such distributed making of consumer products also has implications for sustainability and the natural world. In this game, the player is to buy a gift for their beloved, yet that gift needs to be tailored to their mate's ecological and political values. Thus, to play well, you must review the product's material forms, life cycle and carbon footprint to select a winning gift. Through the game play, the risks and benefits of a future product can be assessed, modified and connected with social values. CNS researchers were interested in how the constraints of the game architecture supported or limited discussion of the societal issues.

6. **Starting with the universe now** (led by Gretchen Gano, ASU HSD graduate student and former CNS-ASU GRA, Ned Gardiner, NOAA, & David McConville, media artist, President of the Buckminster Fuller Institute)
Using a combination of immersive visualization tools – to make the invisible visible – and world café-style, small-group inquiry, participants explored the components of a transformative learning process for understanding and addressing complex problems head on. This workshop considered how to position people as decision-makers in the roles they play as artists, scientists, engineers, educators, learners, and citizens. They asked how to develop the habit of doing comprehensive, anticipatory design through individual, organizational, institutional and sectoral change. Inspired by Buckminster Fuller's Design Science process, the workshop built on the activities of the Worldviews Network – a collaboration of pioneering institutions committed to integrating visual systems and design thinking. While highly focused on facilitated discussion, this workshop initiated with a shared experience of the cosmos inside of geodesic theater, thus exploring prompts to promote deep reflection.

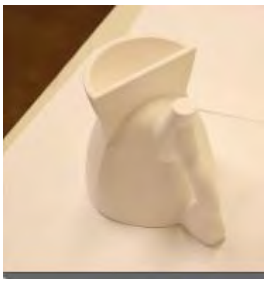
7. **I know where we stand game** (led by Ken Eklund, game/interaction designer and Mina Johnson-Glenberg, ASU research scientist and Chief Learning Officer of SMALLab)
A second gaming workshop focused more on play as a component of group learning. This workshop combined real world activities with the immersive mixed-reality game space, SMALLab. The players considered the following scenario: It's the future. You know where everyone is. How does this change how you do your work, live your life, spend your money, gather information, share knowledge, and express your politics? Will "playing with others" be the norm? By drawing on the tools of embodied gaming, this workshop explored how to create the games that collectively might bring on the "Triumph of

the Commons." With the use of diverse media, props, and technologies, this workshop offered CNS researchers an intimate opportunity to notice how space and materiality affects the deliberative capacity of the group.

8. **Seeing beyond ourselves** (led by Julie Anand, ASU assistant professor, art & Edgar Cardenas, ASU School of Sustainability graduate student)
To imagine where we're heading, it helps to consider where we come from and where we've arrived. This studio workshop was conceived as a series of social experiments to explore relationships to the past, present, and future. The participants gathered perspectives using brainstorming, writing, photographing, mining the internet, and recording video and curating a collaborative book. In a letter writing exercise, participants were asked: "What do we have to say to people living beyond the span of our own lifetimes? How will our culture(s) be understood through the distance of history?" Participants were asked to photograph "contemporary artifacts that may be illuminating with regards to understanding our culture(s) by future civilizations. You might choose something ubiquitous, vividly contemporary, something clearly on its way toward obsolesce, or something you imagine will be "strange" through the lens of a future perspective." The focus was on explicating the values that are tied to our notions of change and timeframes. The results of these reflections are collected in a self-published book containing images of everyday objects augmented by provocations about future worlds, e.g. 'mining landfills will be common." The group also interviewed members of the public about their imaginations of the future and created a short video.

9. **Crafting archeology from the future** (led by Dave Conz, CNS-ASU research professor & Daniel Erasmus, scenario planner)
In this workshop, participants imagined and created prototypes of artifacts from the future. Beginning with meditations with clay, the participants "thought" scenarically with their hands to develop artifacts that might populate the future. They presented these objects to people on Mill Avenue in Tempe, asking for their interpretation of the objects. In this way, the prototypes became centerpieces for a critical appraisal of future technological artifacts and their uses, abuses, (dys)functions, hack-abilities, lifecycles, and disruptive potentials. The objects were printed in 3D and participants developed gallery-style object labels (see insert) describing the function, meaning and historical context of the artifact. This workshop connects tightly with the notion of "material deliberation" developed by CNS researchers, in that the object provides a grounded entre point for deliberation about the social value and political dimensions of emerging technologies, as well as with the Center's interest in DIY manufacturing.

Timeless Cup (c. 2032)
Porcelain embedded with neuro-sensors
Sam Chung, Carlo Sammarco



This cup was designed to bring together past and present. The handled side references the ornamental and labored qualities of historical vessels, while the simpler side channels the more efficient design of the present. One can experience past, present, or both at the same time, depending on which side one drinks from the cup.

The cup's rim is embedded with a neuro-sensing material that is activated by touch and liquid. Once one touches the lip of the cup, and liquid passes over the rim, the sensors engage the cerebral cortex of the user's brain, and heightens a memory of drinking the same beverage from an earlier time in one's life. The cup thus functions to bring back lost experiences and create awareness of the passing of time.

Participants for each workshop were carefully selected based on their disciplinary background, thematic expertise, and technical or artistic skills. We also sought to balance age, gender and ethnic diversity in each workshop.

Emerge Ethnography

Emerge involved discussion of both the kinds of futures that are being created by emerging technology, and their desirability and implications. Significantly, this discussion involved hands-on construction and creative interventions. As such, the workshops were an important example of future-oriented discussion and deliberation which moves away from the purely logical, discursive, and technical to incorporate attention to the material, affective and creative aspects of the futures afforded by contemporary scientific research. CNS researchers have argued that this move is a vital next step in public and stakeholder engagement with (science) policy (see Davies et al. 2012). Building on this theoretical work, we used *Emerge* as a case study of such future-oriented deliberations, and we developed a research engagement around it that sought to explore how the quality of deliberation is affected by the incorporation of the material, affective and creative. This effort took the form of an "event ethnography." A team of ethnographers – largely graduate students in relevant disciplines from around ASU – was recruited and trained in ethnographic (participant-observation) techniques. They observed each of *Emerge's* nine workshops with an eye to the material culture it involved, the meanings participants constructed around it, and the dynamics of participation. The research team produced a dataset of several hundred pages of field notes, notes from informal interviews, and research photos and sketches; these are in the process of being analyzed (as a collaborative exercise led by CNS researcher Davies and Selin) and are expected to yield material for both descriptive accounts of these experimental forms of engagement and more analytical studies of the dynamics of material deliberation.

Public Event

The capstone for *Emerge* was a day-long public event on 3 March for ASU and public audiences that featured presentations from the nine workshops, keynote lectures and an evening interactive performance. More than 650 people RSVP'd for the event, and the auditorium was full throughout the day. Keynote speakers included ASU President Michael Crow, Stewart Brand, Sherry Turkle, Bruce Mau, and Bruce Sterling. Moderators for the workshop reports included RTTA 3 co-leader Lim, CNS-ASU board of visitors member Colin Milburn, and science fiction author Neal Stephenson.

In conjunction with ASU's "Night of the Open Door" – a major, university-wide outreach event, *Emerge* continued with a Digital Culture Festival involving the following performances and installations:

- *Interactive performances including Digital Culture Music Ensemble and the ASU Laptop Orchestra*
- *Powered by Fiction: Artists, Makers, Tinkerers and the Backstories that Inspire Them to Create, presented by Intel*
- *Echo:System*
- *2012: A Golf Odyssey*
- *Emerge Embodied Gaming Experience*
- *Starting With the Universe: Design Science Now*
- *Sensory Meadow* and
- *Your _____ here*.

Emerge concluded with the ***Immerge*** Interactive Multimedia Performance. While *Emerge* offered the opportunity to explore the future in innovative ways, *Immerge* engaged visitors to create a new myth of renewal for the digital age. Members of the public interacted with installations, architectural projections, giant spiders, and other fantastical creatures, all within a multi-layered sonic environment generated by live musicians. An interdisciplinary team of ASU faculty and student artists collaborated to produce this immersive and carnivalesque narrative performance, in which bubbling streams of water transformed a desolate environment.

Outcomes

The key outcome of *Emerge* involved engaging over 700 people in thinking critically and imaginatively about the societal implications of emerging technology. Through workshops, public events, media appearances and mentions, ideas of anticipatory governance and technology assessment, as well as nuanced approaches to exploring the future, were broadly shared and experienced. Participants in the workshops commonly reported benefiting – socially, intellectually and professionally – from working with a diverse group in an uncommon way. Many in the public audience of *Emerge* expressed enthusiasm for ASU's serious attention to the futures we are making. In addition to the publications planned to arise from the event ethnography, CNS has been approached to produce a special issue for the journal *Futures* to relay the themes and methodological approaches featured during *Emerge*. Though only a few weeks out from the event, one grant proposal has been drafted based on an *Emerge* method, two games are under further development, and plans are underway to take a set of scenarios developed in an *Emerge* workshop about the future of energy to policy makers in Arizona. ASU leadership is also eager to see *Emerge* as an annual event and to see this kind of approach to futures of technology and society become part of ASU 101, a semester-long orientation course for incoming freshman. Materials and themes from *Emerge* will also be preserved and curated through an exhibition at the ASU Art Museum, scheduled to open later in Apr 12. Students in a studio course co-taught by Selin and AME's Kelliher will develop an online archive of *Emerge* data to be launched in Summer 12.

Research Accomplishments and Plans, RTTA 3/2.

InnovationSpace is an entrepreneurial joint venture among the College of Design, Ira A. Fulton Schools of Engineering, and W.P. Carey School of Business at Arizona State University. The goal of this transdisciplinary education and research lab is to teach students how to develop products that create market value while serving real societal needs and minimizing impacts on the environment. The two-semester InnovationSpace course satisfies the studio, capstone and thesis requirements for senior majors in each unit. In addition, many of the students are Barrett Honors College students and write their honors theses about their InnovationSpace work. In the course, cross-functional teams of students drawn from industrial design, visual communication design, business and engineering use a product-development model known as Integrated Innovation to research, develop, test and refine real-world product concepts for paying sponsors including, in recent years, CNS, Intel, and Herman Miller.

Since 2006, CNS-ASU has supported the work of three transdisciplinary teams (a total of 12 students) annually. CNS-ASU has partnered with InnovationSpace to investigate nano-based technologies that ensure the freedom, privacy and security of citizens (AY 06-07), to visualize socially beneficial opportunities for nanotechnology in the areas of human health and enhancement (AY 07-08), to develop product concepts that utilize nano-enhanced solutions for ensuring equitable access to clean energy (AY 08- 09), and to develop product concepts that utilize nano-enhanced solutions for addressing urban sustainability in relation to waste management, energy efficient transportation and energy awareness (AY 10- 11). In AY 11-12, students focused on nanotechnology solutions to public health. Thus for the last two years, the student teams are tightly aligned with the TRC 2 program. InnovationSpace is led by Boradkar, and CNS researchers Guston, and Selin liaise regularly with the students. Wetmore, Bennett, and Davies each had significant interaction with the students. Under the public health theme, CNS teams are exploring access to clean water, safety of emergency services, and drug abuse prevention. In contrast to previous years, student teams are focusing more on near-term, entrepreneurial projects ready for market.

Outcomes from InnovationSpace include not only invention disclosures made to AZTE (12 from previous years and three more expected this year), but also spectacularly detailed documentation of the student-led innovation process known as Innovation Proposals. These include summaries of user research, product renderings and prototypes, engineering specifications, branding and communication strategies, ecological impact assessments and business plans.

Research Accomplishments and Plans, RTTA 3/3.

While currently unfunded, plans are underway to seek additional funding for the "Probing Future-oriented Deliberation" project, which aims to explore and experiment with alternative contexts and experiential learning paths for reflexive anticipation and public deliberation about the Nano-enabled City. This experimental study will explore the usage of scenario devices for authentic deliberation on nanotechnology issues, identify and reduce threats to authentic deliberation, compare and learn the tradeoffs between different media for delivering scenarios of nano-enabled cities. The research findings will answer the question of whether the IT-enhanced scenario device can evoke more future-oriented conversations about nanotechnology through direct experience and interactions, and build shared understandings of challenges and opportunities imposed by nanotechnology development. All of the efforts will finally advance knowledge on informed deliberative engagement in issues with competing values, shared challenges, and uncertain risks. These activities will also inform our approach to the large-scale deliberative activity in RTTA 3/4. In YR 7, we pursued a supplemental grant for this originally planned work, but we learned that the research was not eligible for a supplement. In order to coordinate with results and parallel research programs, a new proposal is slated for submission in YR 8.

Research Accomplishments and Plans, RTTA 3/4.

Futurescape City Tours (FCT) is a distributed, deliberative activity that expands on the successes of the NCTF by increasing the experiential richness and contextual relevance of the deliberative process. Research and practice around innovative forms of public engagement with technoscience have been a key component of RTTA 3. Specifically, CNS-ASU researchers are investigating how to move "beyond discourse" within deliberation so as to incorporate the material, visual, and affective. These ideas have been discussed at a theoretical level in two recent papers (Davies and Selin 2012; Davies et al 2012), but CNS-ASU is also exploring how to put this thinking into practice at the level of particular deliberative processes. Thus, similar to the NCTF, small groups of citizens in different cities across the country will join together to deliberate in the FCT. Bur rather than replicate the "bunch of guys sitting around the table" method of technology assessment, they will explore their local surroundings, visualize how these might change as a result of nanotechnologies, and deliberate about technological choices, preferences, complexities, and outcomes. The FCT will involve direct and in-depth interaction with decision-makers in urban communities. As outlined in the timeline above, FCTs are scheduled for Fall 13.

Doctoral student Gano, the Center's former communication coordinator and current librarian at Amherst College, has been active in developing foundational ideas behind the tours and in other RTTA 3-related projects. As a collaborator with the Expert and Citizen Assessment of Science and Technology (ECAST) network, Gano made a plenary presentation to the Citizen Science forum at West Virginia University and she has been engaged with the US-based efforts to plan and conduct the World Wide Views (WWV) on Biodiversity – a follow-on to WWV on Global Warming conducted by the Danish Board on Technology. Gano will serve as the US site representative for Massachusetts, traveling to Denmark in Mar 12 for the training session. Gano also serves as steering group member for the Public Engagement with Science Community of Practice of the Association of Science-Technology Centers (ASTC). PES CoP helps informal science education institutions become more valuable to their communities by helping publics and scientists engage in issues and content where science, policy and public aspirations about local, national and global communities intersect. We expect that PES CoP and WWV networks will be useful partners in FCT and other ongoing RTTA 3 activities.

Finding Futures

In a series of experiments that have served as informal testbeds for techniques to be used in the FTCs (which will be carried out nation-wide in 2013), CNS researchers have explored ways in which

participants might draw upon the visual qualities of the city in order to reflect upon their hopes and expectations for technology in urban environments.

To date, researchers on RTTA 3 (CNS-ASU's Selin, Gano, Davies, and Lim, in collaboration with Pereira of the European Commission) have carried out two Finding Futures tours. These tours, which seek to attune participants to new ways of seeing the city and to use these gazes to enable reflection on technological futures, consist firstly of a loosely guided walking tour around a segment of an urban environment (in the first tour, Lisbon, Portugal, and in the second, Tempe, Arizona). Within this first stage participants were asked to be attentive to, in the words of the guide provided to them, "what these pasts might become … Spot signs of the times … [Identify] the future breaking through", and to take digital photographs (on smartphones or cameras) capturing these moments. Participants are thus asked to look at the city with an eye to its temporal dimensions as well as to the ways in which it is structured – perhaps invisibly – by technological systems. In a second stage, after the tour has ended, participants are asked to annotate the photographs they have taken – with a tag that identifies the relevant tour ('lisboafindingfutures' or 'tempefindingfutures') and a caption which explicates the significance of the image – and to upload them to the photo-sharing website Flickr. From here, they can readily be pulled together into a 'Finding Futures' group which enables their viewing as a composite entity. Specifically, we used a customised version of the JQuery plugin 'Supersized' to pull participants' photos from Flickr and display them in a slideshow that simultaneously rolled each image's caption across the bottom of the screen.

The third stage, involving display, consolidation and discussion of the images and experiences each tour had resulted in, differed between the two tours. In Lisbon, the images were viewed within an installation environment and participants asked to reflect upon the contrasts and themes they presented. In Tempe a more structured environment was used, with a workshop format enabling a number of different activities (including the development of timelines and sketches of the worlds they suggested) around the images. In both cases the viewing of the images, collected by different people at different points within the walking tour, in a collective environment enabled shared reflection on the trajectories that technologies within a particular city were and should be taking.

The Finding Futures tours were experiments, and as such it is important that they are viewed in terms of the learning developed through them. Finding Futures Lisbon was evaluated through an interview protocol, and has been written up as an analysis of a new type of art-science interchange (see Davies et al forthcoming). Taken together, the tours have enabled RTTA 3 researchers to experience some of the practicalities of drawing on the visual as a component of deliberative engagement. Their implications – for instance in terms of the value of fostering a 'new gaze' on a familiar city, the need for structure within deliberation, and the technical requirements in developing this approach further – will be applied to plans for the FutureScape City Tours and to the Phoenix-based pilot process to be carried out in Fall 2012.

National Citizens' Technology Forum (NCTF)

While no longer a funded project, publishing activities related to the NCTF continue. In the reporting year, NCTF co-organizer Cobb at North Carolina State University has submitted two manuscripts for review, both in collaboration with doctoral student Gano, on evaluation and learning from the NCTF.

Other Collaborations:
Selin has been involved in several grant proposals that emerged from the RTTA 3 research:

- Selin is a senior researcher on the recently funded EU 7th Framework funded project 'Integrated Assessment of Societal Impacts of Emerging Science and Technology from within Epistemic Networks.' Commencing Apr 12, this $2.1M project investigates how different methods of

analyzing and assessing new and emerging fields of technology can be better integrated. This collaboration with University of Bergen and University of Lancaster scholars plans to review and evaluate assessment methods commonly used to address societal impacts of new and emerging S&Ts. The project will also develop tools to integrate these methods with reference to three case studies that aim to identify and engage with new networks of social, scientific and technological actors as they emerge in three innovation domains: 1) biosensors/wearable sensors for activity and physiological monitoring; 2) cognition for robots (cognitive factories), and 3) synthetic/ in-vitro meat.

- Selin, Miller and Sarewitz have collaborated on a full-scale development grant with Science Museum Minnesota and University of Michigan's Institute for the Environment. A Climate of Uncertainty would build a 5000 square foot, traveling exhibition that invites visitors to experience plausible futures concerning the human and social dimensions of climate change. While unfunded in YR 7, Selin and SOS graduate students Minowitz and Rodegher worked with the Science Museum Minnesota Aug-Oct 11 to design and facilitate a scenario development workshop with the City of St. Paul. Extending prior CNS work with the City of Phoenix, this effort strove to raise the capacity of the city and key stakeholders to respond to climate change. Selin received a $9K grant to participate in the project and conduct interviews to assess the qualities of this method of public deliberation.

Contribution to "ensemble-ization" or other center-wide activities.

RTTA 3/1 is involved in the activities of the TRC 2, serving to coordinate the SNET tours which both contribute to the development of the Futurescape City Tours. RTTA 1's Youtie attended RTTA 3/1's Finding Futures tour and deliberative exercise. RTTA 3/1 enrolled faculty from RTTA 4 in the *Emerge* conference. TRC 1 graduate student Bal is completing her dissertation, which provides a detailed analysis – using RTTA 3 data – of equity in interactions at two NCTF sites. Bal defends her dissertation in Mar 12. CNS-ASU's collaboration with ASU's new Engineering Research Center on Quantum Electronics and Sustainable Solar Technology (QESST) incorporates elements of RTTA 3, as QESST post-doctoral associate Daniel Higgins, who co-locates with CNS, has been trained at Institute for the Future in moderating scenario development workshops and will use the method to assist strategic planning in QESST.

RTTA 4: Reflexivity and Integration

Personnel – faculty and senior participants

Erik Fisher, RTTA 4 leader (ASU, assistant professor, Political Science and CSPO)
Elizabeth Corley, RTTA 4 co-leader (ASU, associate professor, Public Affairs)

Ira Bennett (ASU, assistant research professor, CSPO)
Dave Conz (ASU, assistant research professor and lecturer, CSPO and Bachelor of Interdisciplinary Studies)
David H. Guston (ASU, professor, School of Politics and Global Studies, CSPO)
Farzad Mahootian (NYU, master teacher, Global Liberal Studies)
Cynthia Selin (ASU, assistant research professor, CSPO)
Jameson Wetmore (ASU, assistant professor, School of Human Evolution and Social Change and CSPO)

Other Personnel – graduate students (15)

Goals. The overarching goal of RTTA 4 Reflexivity and Integration is to understand through ethnographic and other methods the NSE laboratory as a locus of governance. RTTA 4/1 Annual Interviews documents the influence of CNS-ASU research and engagement activities on the knowledge, values, and choices of NSE researchers and others. RTTA 4/2 Laboratory Engagement Studies develops and implements the integrative agenda of anticipatory governance through field research, methodological refinement and other interactive and collaborative work that CNS-ASU performs with NSE researchers. RTTA 4/3 Integration Policy Studies seeks the meaning and implementation of integration and reflexivity in the sphere of science policy. Projects under the RTTA 4 rubric include: annual interviews with collaborating NSE researchers; laboratory studies and engagements, including the associated STIR project (and previously, the Tubes in the Desert project and the associated Ethics in the Lab project); co-curricular activities including the DC Summer Session; and various projects that characterize, map and assess the integration of societal dimensions into NSE research and policy.

Research Accomplishments and Plans, RTTA 4/1.

RTTA 4/1 Annual Interviews attempt to document and assess the influence of Center activities on the NSE researchers with whom we collaborate. We implement an interview protocol annually each spring/summer/fall. This protocol has focused on the knowledge, identity, and practices of our collaborating scientists, particularly around their understanding of the societal aspects of their work. We conducted baseline research in Spring 06 and annual spring rounds in 07, 08 and 09, adding Fall rounds as well in 10 and 11.

During the Center's initial years the annual interview sample frame focused on respondents from the Biodesign Institute. In Spring 09 the interview pool was expanded to include the School of Life Sciences, the College of Engineering, the School of Design, and other academic units on two ASU campuses. Despite these gains in breadth, overall response rates were significantly lower, which may have been due to interview fatigue, scheduling conflicts, or other factors. In YR 6 we hired doctoral student Trinidad and in Fall 10 trained her to conduct solo interviews. Simultaneously, we transitioned away from an academic year to a calendar year timeframe in order to increase scheduling flexibility for both the Center and NSE researchers. In YR 7, we continued to experience lower response rates in part because NSE researchers are, we suspect, less likely to respond to a request for an interview from a graduate student. Interestingly, the majority of the ten (10) YR 7 interviews that were granted took place with NSE scientists and administrators affiliated with the Biodesign Institute (note: data from one interview was lost). ASU NSE respondents consisted of 6 faculty/administrators and 3 doctoral students. In YR 7 we also conducted

targeted interviews with nine (9) STIR project participants (note: data from one interview was lost). STIR respondents consisted of 5 faculty/administrators and 3 doctoral students. Although the interview schedules were not identical, the interviewer was the same (Trinidad) and there was sufficient overlap in the interview schedule questions, themes and discussion topics to allow us to offer some initial comparisons between these two CNS-ASU participant sub-groups.

ASU NSE graduate students (3) each reported undergoing a significant change in their perspective regarding the connections between broader societal considerations and their own research as a result of interacting with CNS. Additionally, each reported significant changes in their career plans and choices (e.g., pursuing a science policy track post graduation, more effectively incorporating broader societal consideration earlier in research design, etc.). Each also reported that, although their faculty mentors did not prevent them from interacting with CNS, it was clear that faculty did not actively encourage or support these interactions, preferring instead for students to be solely in the lab rather than engaging in "softer stuff." ASU faculty/administrators (6) reported low levels of inclusion of societal considerations evident in the programs they participate in and oversee. One reported a lack of conversations around broader considerations among the faculty whom he directs, and others gave a similar sense.

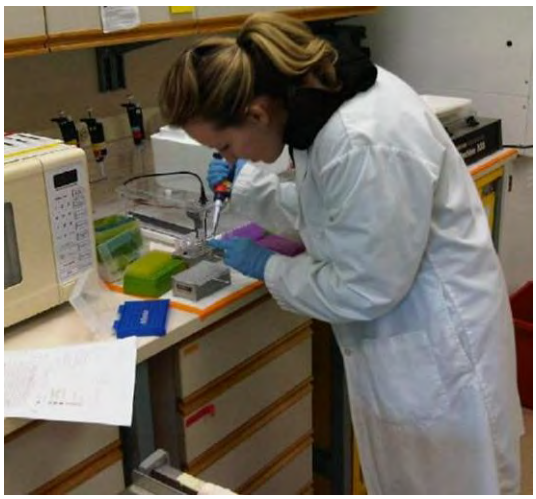
The annual interviews ask several questions that center around interdisciplinarity. An interesting comparison emerges between the two sub-groups in relation to this topic: In almost all cases when ASU and STIR sub-groups participants agreed that value and benefits were realized working an interdisciplinary-oriented environment, this was reported to be the case only after initial language and/or cultural barriers were somehow transformed or transcended. However, the conditions (such as length of time) for the transformation varied distinctly between the two subgroups. STIR respondents reported increased reflective capacities and richer interdisciplinary dialogues as language or other barriers were negotiated over the 12-week laboratory engagements. Respondents felt that the project design itself "required" barriers between social science / humanities and natural science / engineering to be overcome if integrative effects were to be forthcoming. Respondents also reported experiencing a built-in motivation for all parties to "hang in there" and stay committed to the STIR process in the form of a common goal outside of, yet related to, the research. In the ASU group, the disciplinary boundaries respondents discussed were those among the natural scientists themselves, and there were fewer indications that language and cultural barriers were effectively negotiated. Some ASU respondents reported that the interdisciplinary structure of research units actually served to fragment members of the unit, while one suggested that cultural and language tensions between biologists and engineers persisted after approximately two years, presenting obstacles to research progress. Consequently there is little to no room for dialogue around broader societal considerations during day-to-day operations, whether of the laboratory or the department.

Research Accomplishments and Plans, RTTA 4/2.

RTTA 4/2 Laboratory Engagement Studies are not traditional laboratory ethnographies with a focus on observation and explication, but rather efforts to integrate social science and humanities with NSE research. In previous years, the Center reported on various integrative efforts of Wetmore and McGregor in the Woodbury lab; of Fisher in the Center for Integrated Nanotechnologies (CINT) in the Department of Energy's Sandia and Los Alamos National Laboratories; of Selin in the Johnston lab; of Fisher in the Lindsay lab; and of Conz in the Tubes in the Desert project of the Biodesign Institute. In YR 7, we report on the ongoing integrative laboratory engagement studies that CNS-ASU continues to conduct through Fisher's STIR project.

The STIR Project

As previously reported, Fisher is PI and Guston Co-PI on the associated Socio-Technical Integration Research (STIR) project. Since 2009, under Fisher's direction, STIR has coordinated a set of twenty-eight comparative, international, intervention-oriented "laboratory engagement studies" in North America, Western Europe, and East Asia. To date the project has mentored and trained nineteen (19) graduate students or "STIRers"—including eighteen (18) doctoral students and one (1) master's student. They are divided into a "core" group of ten original project investigators and seven "associated" investigators who have since joined the program. STIRers are trained in Fisher's midstream modulation framework and integrative decision protocol, which are used over the course of each 12-week study in the attempt to conduct socio-technical collaborations, study the social and cultural conditions that prohibit and enable them, and assess the policy and political relevance of their outcomes. The 18 doctoral students (four of whom have received their degrees so far) and one master's student (who has graduated and since become a doctoral student) are: Antonio Calleja-Lopez, University of Seville; Shannon Conley, ASU; Paul Ellwood, University of Leeds; Steven Filpse, Delft Technical University; Cecilie Glerup, Copenhagen Business School; Birgitte Hansen, Copenhagen Business School; Byoungyoon Kim, Rensselaer Polytechnic Institute; Miao Liao, Tsinghua University; Federica Lucivero, University of Twente; Christine Luk, ASU; Bastien Miorin, Grenoble; Robin Phelps, University of Colorado; Daan Schuurbeirs, Delft Technical University; Anthony Stavrianakis, UC Berkeley; Frank Theys, Katholieke Universiteit Leuven; François Thoreau, University of Liège; Brenda Trinidad, ASU; Michiel Van Oudheusden, University of Antwerp; Qin Zhu, Dalian University of Technology. In addition, STIR has also involved the participation of four post-docs (one of whom has since joined the private sector): Dorothy Dankel, Ana Delgado, Hannot Rodriguez, and Daan Schuurbiers.



STIR laboratory engagement studies have been completed in the Curtiss, Johnson, Lindsay, Seo, Vermass, Westerhoff and related laboratories at ASU alone. Beyond ASU, STIR engagement studies have been completed in 19 additional laboratories around the world. To date, 25 studies have been completed, not counting Fisher's original pilot studies. YR 7 saw the completion of Zhu's second paired study (in China) and Filpse's two studies (two private laboratories in the Netherlands) and the commencement of Glerup's first of two studies (at ASU). Currently, three more studies are planned for YR 8 (in the US, Denmark and the Netherlands). After taking his sabbatical at CNS-ASU in YR 6 to work with Fisher, Rune Nydal (in collaboration with Astrid Lagreid) is overseeing an extended STIR-influenced laboratory engagement in Norway.

The project has found strong indications of both the possibility and the utility of socio-technical integration through social science-natural science collaborations. In particular, we identify the following integration capacity-building outcomes:

Reflexive awareness: Laboratory researchers have realized that there are inconsistencies in their views about the role of science in society.

Changes in practice: Interactions with STIRers have sparked new research ideas, catalyzed laboratories to engage in outreach activities, and occasioned debates about and changes in human and environmental health and safety practices—from lab coats and safety gloves to nanomaterial waste disposal practices.

Residual effects: Laboratory participants have returned to contact several STIRers, either with further observations and requests in relation to the broader aspects of research or with invitations to participate in collaborative publications.

Table RTTA 4-1: STIR at a glance. Each row indicates a "core" student investigator.

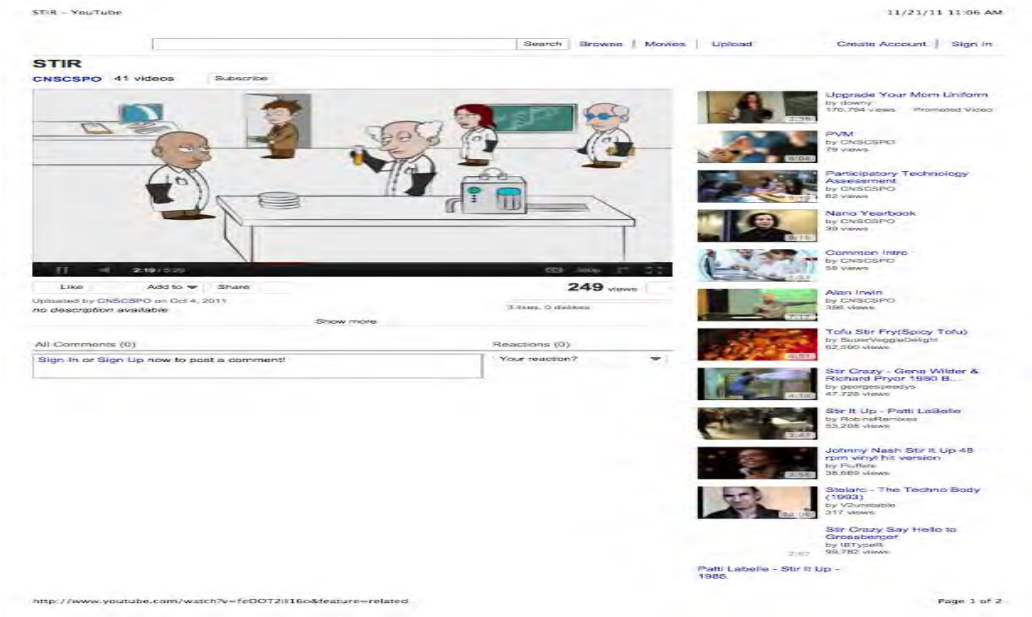
	Social Science	Site 1	Site 2	Natural Science
US Investigators	STS	Tempe	Beijing	BioPhysics
	Political Science	British Columbia	Oxford	Fertility
	Public Affairs	Denver	Belfast	Materials
	Anthropology	Berkeley	Basel	Synthetic Biology
	STS	Tempe	Seoul	Chemistry & Bio
EU & Asian Investigators	Philosophy	Tempe	Madrid	Physics
	Business	Leeds	York	Manufacturing
	Philosophy	Golden	Dalian	Fuel Cells
	Political Science	Walloon	Flanders	Nano/bio
	Biotech & Society	Delft	Tempe	Microbiology

STIR activities have been research-, education- and outreach-intensive. Previously, we reported on the four STIR workshops Fisher organized in the US, Norway and Japan. In total, these workshops included the participation of nearly 100 faculty members, graduate students, private sector managers, policy actors and others spanning the natural sciences, engineering, social sciences and humanities from a dozen nations. In addition to the four workshops, Fisher has conducted: regular lab meetings with doctoral investigators; regular mentoring sessions with all project investigators; and 10 research site visits in 6 countries (Belgium, Canada, the Netherlands, Switzerland, the UK, and the US), not including the 7 ASU sites. Fisher has further collaborated with several project participants on the development of publications, panels and presentations.

STIR has to date produced 36 publications, including 14 journal publications, 7 book chapters and 3 dissertations. In YR 7, these publications included articles in *Conservation Biology*, *Current Pharmacogenomics and Personalized Medicine*, and *Science and Engineering Ethics.* In YR 7 both Zhu and van Oudhesuden successfully defended their dissertations. Several more journal publications are in preparation or under peer review. Drafts of six chapters have so far been received for an edited volume on STIR. The project has produced more than 60 professional presentations and conference papers. YR 7 activity in this area included papers at the annual meetings of the Society for the Study of Nanoscience and Emerging Technologies (S.NET), the Society for Social Study of Science (4S), the Society for Philosophy and Technology and the Empirical Philosophy of Science Conference, among others.

The findings of the STIR project are potentially relevant for informing and perhaps even guiding policy aspirations for "responsible development" and "responsible innovation." STIR findings and project participants have been circulating in a number of professional research and science policy contexts. In YR

7, project participants organized (Phelps) and presented in (Horst, Thoreau) a panel for the 2011 annual meeting of S.NET entitled "Mapping Responsible Innovation in Public and Private Sectors." Also in YR 7, Fisher was the sole American to attend and participate in workshops on "responsible research and innovation" organized by the European Commission in Brussels and on "responsible innovation" organized by the French and British governments in London.



In YR 7, thanks to a supplemental NSF SciSIP grant, Fisher and Sarewitz (PI on the original SciSIP grant) collaborated on the production of three short, humorous and informational videos meant to inform science policy analysts and program directors of "new tools for science policy." One of the three videos is devoted to the STIR project, and it has been circulated within their agencies by program officers at the NSF, Genome Canada, the Research Council of Norway (RCN) and the European Commission. Program officers at the RCN are planning to disseminate the video to laboratory scientists in an effort to inform them about and interest them in socio-technical collaborations.

The STIR project is co-funded for 3 years at $540,000 through several NSF programs: Science, Technology and Society; Biology and Society; Mathematical and Physical Sciences and Society; Science of Science and Innovation Policy; and the Office of International Science and Engineering. Additionally, through a national and international network that PI Fisher has cultivated, STIR collaborators – funded and unfunded – have contributed approximately $500,000 to support and continue the non-NSF funded aspects of the project and will likely contribute more, bringing the total project funding to over $1M.

RTTA 4/2 is also involved in the development of co-curricular activities meant to integrate societal aspects of nanotechnology into the education of NSE research students. The principal activities in the past and present reporting years, such as the DC Summer Session, are reported on in **Section 11 Education and Training**.

Research Accomplishments and Plans, RTTA 4/3.

RTTA 4/3 Integration Policy Studies characterizes, maps and assesses the integration of societal dimensions into nanotechnology policy and R&D processes in the US and Europe. Previously we reported on Fisher's NNIN award, which funded Garay to conduct fieldwork at a number of co-located

NSEC and NNIN sites, and Fisher, Slade, Anderson and Bozeman's analysis of over 1,000 NSE policy documents. In YR 7, Rodriguez, in collaboration with Fisher and Schuurbiers, submitted a manuscript to based on a large scale, systematic and interpretive analysis of hundreds of STEM research calls in European framework programs to track the pervasiveness of socio-technical integration in the European R&D system.

Continuing Integrative Outcomes

In YR 6, Schuurbiers launched a private consultancy based in large part on his work with STIR. YR 7, Schuurbiers saw this STIR spin-off grow to the point of becoming a nearly full-time effort. He reports that prospective R&D clients have contacted him to learn more about midstream modulation, which they learned about through articles he had written on the subject.

In YR 6, we reported that Fisher's research collaboration with the Lindsay laboratory beginning in 07 has generated multiple, ongoing integrative outcomes, including: the Photon project and related workshop; pieces in *Nature* and *Scientometrics*; a paper for a competitive OSTP/NSF workshop on the Science of Science Measurement; the construction of a large database of policy documents by major contributors to the NSE policy discourse; two STIR lab engagement studies; and the attendance by members of the lab at the 4th STIR workshop. In YR 7, Fisher and Lindsay invited Roop L. Mahajan (Virginia Tech) to visit ASU and give a major public talk on "interdisciplinary collaborations for sustainable innovation" based in part on Mahajan's prior and ongoing collaborations with Fisher.

Previously we reported that Selin collaborated with Johnson in the 07 Medical Diagnostics project, also affiliated with RTTA 3/1. Since then, Lucivero joined the Johnston laboratory to conduct a STIR-influenced laboratory study. In YR 7, Lucivero conducted a follow-up workshop to this study and Glerup also commenced a STIR-influenced laboratory study in the Johnston lab.

Contribution to "ensemble-ization" or other center-wide activities

RTTA 4 continues to work with RTTA 1, 2 and 3 in several projects, including the utilization of multi-level PVM findings both to understand and to justify the scope and nature of integration activities at the micro-level; interviews with STIR researchers, participating laboratory directors and cognizant science policy actors who have experience with integration from STIR and/or PVM frameworks. These interviews, several of which have been filmed, are the subject of separate research projects by doctoral students (including the STIR documentary under production – see **Section 12 Outreach and Knowledge Transfer**). To this same end, in YR 7, Theys was able to obtain sufficient funding and work with Fisher to arrange for two laboratory engagement studies that he plans to film during 2012. YR 7 also saw Fisher and MA student Radatz (now graduated) have an abstract accepted for the Public Value Consortium Biennial Workshop that builds upon work that combines RTTA 4/2 Laboratory Engagement Studies with (former) RTTA 2/2 Public Value Mapping. The planned utilization of the RTTA 4/2 database is intended to provide a policy dimension to existing RTTA 2 studies of public and natural scientist views of NSE. Finally, in a collaboration that draws on TRC 2, in YR 7 Fisher and Wiek have re-submitted a proposal to expand STIR into the urban context for nanotechnology governance. This project ("STIR City") would incorporate STIR and midstream modulation activities into field sites that are intended to link together university, private, government and NGO actors who are anticipated to be involved in the emergence of solar/nanotechnological trajectories in the Phoenix area. STIR City is also an element of ASU's subcontract to the forthcoming SRN proposal on Sustainability of Nano-enabled Products by Tom Theis of University of Illinois, Chicago.

TRC 1: Equity, Equality and Responsibility

Personnel – faculty and senior participants

Susan Cozzens, TRC 1 co-leader (GA Tech, professor, Public Policy, TPAC)
Jameson Wetmore, TRC 1 co-leader (ASU, assistant professor, Human Evolution and Social Change, CSPO)

Personnel – graduate students (3), undergraduate students (0), post-docs (1)

Goals. The goals of TRC 1 Equity, Equality and Responsibility are to study ways that NSE reflects social and economic inequalities and contributes to increasing or decreasing them in different national contexts; to identify how the concepts of equity, equality, and responsibility are being applied in the development of NSE; and to explore ways to ensure that NSE can contribute to equity, equality, and responsibility as public values. These goals include concerns about equity in the distribution of the conduct of NSE research and commercialization of NSE-enabled products as well as in the distribution of risks and benefits from consequent innovations, both domestically and in developing countries. Activities include developing options for NSE researchers to act responsibly toward such concerns.

Research Accomplishments and Plans

Since the development and publication of the second *Yearbook on Nanotechnology in Society: Nanotechnology and the Challenges of Equity, Equality and Development* (2011), TRC 1 has shifted its work to analyzing the unequal conditions and consequences of emerging nanotechnology applications in developed and developing countries. Because of limited funds, the decision was made to focus these efforts on two country case studies: the United States and South Africa. Asking these questions in the. US is an obvious responsibility of the Center. We chose South Africa as an example of a developing country with NSE programs explicitly focused on benefits for poor communities, and because of existing connections and preliminary fieldwork.

Within these countries we further focus research on water and energy applications to look closely at the fields with the highest potential to benefit marginalized communities. We have been able to add analysis of agri-food applications through a third graduate student at Georgia Tech, partially supported under the Center. Thomas Woodson has been carrying the water analysis with support from his NSF graduate fellowship.

Through the first half of 2011, the team was devoted to conducting desk research on local developments and contexts, using secondary materials to get a sense of the landscape as well as to identify laboratories, policy bodies, and civil society actors for later interviews. The Georgia Tech team created a methodology using intensive literature review to identifying relevant nanotechnology applications in each of the three areas. They applied systematic search strategies to find nanotechnology articles from the RTTA 1 database in their technology areas. In each of the three fields, the team found that since Salamanca-Buentello[1] et al.'s 2005 article about how nanotechnology could help achieve the UN's Millennium Development goals, there is a significant mismatch between what nanotechnology could have done and what has actually been explored.

[1] Salamanca-Buentello, Fabio, Deepa L. Persad, Erin B. Court, Douglas K. Martin, Abdallah S. Daar, Peter A. Singer (2005). "Nanotechnology and the Developing world," *PLoS Med* 2(5).

The South African government, however, has pledged to dedicate one branch of its nanotechnology research to developing technologies that spread its benefits more widely. A major part of the past year has been spent surveying these activities to see if there are lessons to be learned.

In Jul 11, the TRC 1 research team – including Cozzens, Wetmore, postdoc Harsh, and grad students Soumonni, Cortes, and Woodson – conducted a two-week research trip in South Africa. Over the course of the research, the team conducted more than 50 semi-structured interviews of scholars, government officials, regulators, NGO employees, and entrepreneurs who work in nanotechnology. By traveling to the offices, labs, and research centers, the team was able to put together a rich portrait of how the South African Nanotechnology Initiative contributes to the country's overall development strategy, including how it is oriented to serving poor households and communities.

The major finding of the South Africa research is that while there have been only a few isolated cases where South African researchers have explored pro-poor nanotechnologies, there have been signs in other areas that nanotechnology is being used as a way to further equity efforts in the country and beyond. First, many of the researchers we spoke with have been careful to work in areas that can further build up areas where South African corporations already have skills and experience, especially petrochemicals and mining. Building on existing strengths looks to be a way that South African researchers can more immediately contribute to the country's economy. Second, every lab that we visited included researchers from several countries across Africa. Many South African researchers are using nanotechnology as an opportunity to help build technical expertise throughout the continent.

Unfortunately, last year's plan to co-sponsor with NNIN a winter school for graduate students in science and engineering in South Africa did not come to fruition. But the team is currently working to develop an independent winter school to bring together US and South African graduate students to learn more about pro-poor research and to collaborate on developing project proposals.

In the past year, TRC 1 research has led to at least 15 professional talks, two chapters in press, and several articles being prepared for publication, including a collaborative effort with colleagues from South Africa's Council for Scientific and Industrial Research (CSIR). Cozzens and Woodson participated in a panel discussion with NNIN REU summer students on ethical and social issues. Cozzens has presented some of the findings of the TRC 1 research team in South Africa already and is returning there in Apr 12 to present a plenary talk at NanoAfrica 2012. She will also discuss plans for further cooperation at that time. The team continues to bridge the gap between Arizona and Georgia by holding bi-monthly video conference meetings.

Since completing the notes on the South Africa fieldwork, the team has been concentrating on analysis in the three focal sectors in the United States. Both publication and patent data have been mined, and interviews are beginning this month in key laboratories, agencies, NGOs, and firms.

Inspired by the S.NET challenge of developing innovative ways to disseminate research findings, in Fall 11 the team collaborated to develop a "Nano Equity" card game. The game conveys the basic lesson that the vast majority of nanotechnologies do not benefit people in developing countries, but that such populations could benefit if we focused more effort on their needs. The game has been presented numerous times and will be distributed by the Nanoscale Informal Science Education Network (NISE Net) to over 200 science and technology museums (see **Section 12 Outreach and Knowledge Transfer**).

Postdoctoral Scholars

Postdoctoral scholar Matthew Harsh has played an important role in the South African research project. His extensive work in Africa provided useful insights to help prepare the team for the trip. He worked

closely with Cortes on agri-food issues and with Woodson on mapping water applications. Harsh has also brought TRC1 activities into his teaching. He co-taught (with Bennett) a course in the "Social Implications of Research" for the Hispanic Research Center at ASU, including one class on nanotechnology, equity, and global development. He also did a special session on the topic for a 200 student class in Technology and Society.

Graduate Students

Former TRC 1 graduate student Walter Valdivia (advised by Guston) completed his dissertation – "Equity Considerations in the Assessment of the Bayh-Dole Act" in May 11. His research offers a critical analysis of several fundamental premises that have driven innovation policy in the US. Of particular interest to TRC 1 is his critique of the premise that economic growth induced by innovation trickles down to all sectors and is, in general, widely distributed. Valdivia is currently a visiting scholar at UC Berkeley.

Graduate student Ravtosh Bal (previously supported by CNS-ASU) has spent the past year completing her dissertation, which provides a detailed analysis of equity in interactions at two NCTF sites. Bal defends her dissertation in Mar 12.

Graduate student Thomas Woodson, advised by Cozzens and supported by an NSF graduate fellowship, is currently developing a dissertation that will examine the pro-poor aspects of nano-health research. Woodson has spearheaded the effort to examine nano applications related to water in South Africa and the United States.

Graduate student Rodrigo Cortes, advised by Cozzens and supported through her work at Georgia Tech, successfully defended his dissertation proposal to examine the roles of multinational corporations in the effects of agri-food applications of nanotechnology in developing countries. Cortes spearheads the work in the field of agri-food and to that end has analyzed CNS-ASU databases to produce an overview of the work being done in the area in US and South Africa as well as potential interviewees.

Graduate student Diran Soumonni has been fully supported by CNS-ASU funds over the past year. During that time he has spearheaded the energy side of the comparative nano project. Leading up to the South Africa trip he analyzed the RTTA 1 publication database to determine who the best people to contact would be. Since the trip he has been reviewing the interviews and characterizing the US private sector in nano energy based on the publication record in preparation for another round of interviews in the US.

Contribution to E2E, "ensemble-ization" or other center-wide activities.

Over the past year TRC 1 has worked extensively with RTTA 1 to determine what types of nanotechnology are being developed that could assist the developing world in dealing with water, food, and energy issues and where these technologies are being developed. Harsh has also used the data to help determine which corporations are involved in these processes. In addition, TRC 1 has been working with Wiek and Foley to strengthen the equity component in TRC 2's work in the Gateway community – including by participating in a community tour in Fall 11.

TRC 2: Urban Design, Materials, and the Built Environment ("Nano and the City")

Personnel – Faculty and senior participants

Arnim Wiek, TRC 2 leader (ASU, assistant professor, School of Sustainability)
Sander van der Leeuw, TRC 2 co-leader (ASU, professor and Dean, School of Sustainability)

David H. Guston (ASU, professor of politics and global studies; director, CNS-ASU)

Personnel – graduate students (3), undergraduate students (2)

Goals. The goal of TRC 2 Urban Design, Materials, and the Built Environment is to investigate the nano-enabled city of the future, addressing the links among NSE, the built environment, social structures, and sustainability. TRC 2 will map out the diversity of problem perceptions, future visions, value-laden sustainability appraisals, and related implementation strategies across various stakeholder groups. We will engage in deliberative research with various urban communities, including public policy makers, business people, scientists and engineers, interest groups representatives, and citizens from the Phoenix Metropolitan Area. The goal of our research is to use the deliberative and visioning capacities developed through anticipatory governance to identify points of consensus as well as contest that might foster or hamper progress towards a sustainable co-evolution of NSE, the built environment, and societal needs.

Research Accomplishments and Plans.

Nanotechnology in City Environments (NICE) Database

Continuing work begun in the previous year, two undergraduate students and one graduate student under the direction of Wiek implemented a structured data collection for the Nanotechnology in City Environments (NICE) database. The NICE database catalogues academic research, public reports, advertising materials, technical specification, and theorized implementation of nanotechnology captured in an urban context. The database is being compiled by undergraduate and graduate students and reviewed by experts with layman's terms summarizing the technological applications. The NICE database is an interactive catalogue of nanotechnology applications with particular attention being paid to functionality, mechanisms, potential benefits, potential hazards, urban domain, development stage, and substitution properties. The database has been used as a resource for CNS-ASU in a nanotechnology assessment. The website is starting to reach interested scholars, professionals, and the general public (Also see **Section 12 Outreach and Knowledge Transfer**).

Reconciling Supply of and Demand for Urban Nanotechnologies

The two workshops held in Sp 11 offered a rich dataset of urban sustainability syndromes and validated and augmented the research team's listing of nanotechnologies with high importance for urban sustainability. This research activity resulted in presentations by Guston at the 8th Annual US-Korea NanoForum on Nanotechnology for Sustainability. Additionally, co-leader Wiek and graduate student Foley presented the findings at the 3rd Annual S.NET conference in Fall 11. The results have been reported in an article, authored by Wiek, Foley, and Guston that has been submitted for publication.

The process of reconciling the supply of nanotechnology solutions with the demands of urban sustainability challenges has developed through five city-oriented engagement methods: the walking audit, the Future of Phoenix, the M52 Superfund Site, Nanotechnology Innovation in Metropolitan Phoenix, and Governance Scenarios for Cities.

Walking Audit

The research team explored a novel method for bringing together academic researchers, private sector, and community-based professionals to assess the intersection of urban sustainability syndromes and nanotechnology solutions. This multi-disciplinary, multi-actor engagement activity took a group of twenty-one social scientists, engineers, health professions, energy entrepreneurs, and community advocates on a two-hour walking audit in the Gateway Corridor in Phoenix. The group divided into three sub-groups, focused on the food-health nexus, the M52 water contamination (see below), and the energy supply-demand dynamics. These groups were each composed of one TRC 2 based researcher (Wiek, graduate student Foley, and graduate student Braden Kay), two "guides" from the community, and three or more other participants. The researchers from TRC 2 sought to facilitate dialogue, while navigating the urban terrain, and allowing spontaneous occurrences to drive conversations. The guides had been provided information on nanotechnology solutions to address the urban sustainability syndromes facing their community. The facilitators prompted the guides with leading questions to initiate conversations on the amenability of the community to such solutions. The participants quickly realized they had information to contribute, but were not the experts and readily engaged in the activity. This approach addressed problems from a place-based ("on the ground"), real-time context, while mitigating typical power asymmetries between experts and community members. The facilitators played a critical role to facilitate rich dialogue on the reconciliation between urban sustainability syndromes and nanotechnology solutions. Wiek has conducted three additional walking audits in the Gateway Corridor, Sky Harbor Neighborhood, and Roosevelt Row Community to build upon this experience and method of community engagement. A publication is in preparation that details this novel participatory approach to expert – citizen engagements.

The Future of Phoenix

The Spring 10 graduate workshop-course lead by Wiek and Selin in concert with the Phoenix City Planning Department (which approached CNS-ASU about anticipatory governance) shaped the next *Phoenix General Plan Hearing Draft* for review and consideration by the City Council. A second graduate workshop course initiated by Wiek in F 10 has continued in Sp 12. While the content was largely focusing on the demand for solutions to urban sustainability problems, it is also the case that the course developed our understanding of the most pressing urban sustainability problems, initiated the discussion about potential nanotechnology application (supply-side) to the superfund site in central Phoenix, and expanded our network of urban communities willing to further collaborate with TRC 2. More about this workshop-course, "Sustainable Solution Options for Phoenix," is reported in the **Section 11 Education and Training**. Additionally, this work has contributed to the recent $2.9M award from the Department of Housing and Urban Development (HUD) for the project, "Reinvent Phoenix: Cultivating Equity, Engagement, Economic Development and Design Excellence with Transit-Oriented Development." HUD made the award to the City of Phoenix with Wiek as the principal investigator. Results of this work were recently published in the journal *Sustainability Science*.

M52 Superfund Site

The third of these city-oriented engagement methods is a project operating at the community and metropolitan scale related to the Motorola 52nd Avenue (M52) Superfund site. The aim of this research is to connect the initial and continued engagement with community members through the TRC 2 activities with a renewed commitment to specifically address the M52 superfund site. First, we aim to significantly increase the number of community members (currently less than 10) involved in the problem-solving cycle of Superfund site remediation and mitigation, considering the possibilities of enhanced remediation capacities offered by nanotechnology. Second, we aim to involve vulnerable (low income) groups and minorities. Third, while the community is a central player, it is not the only one, and successful Superfund site remediation and mitigation require connecting the community to government agencies and the business sector in productive and goal-oriented ways that should consider nanotechnology-based remediation techniques that are novel and may confront regulatory barriers. Fourth, the projects seeks to

build the community's capacity to participate in the full problem-solving cycle of Superfund site remediation and mitigation, i.e., from problem-framing and articulation of concerns to the assessment of intervention options (including nanotechnology). All research activities are guided by the principles of anticipatory governance. The goal is to build community's capacity to create coherent and plausible future visions that can guide community development beyond remediation and mitigation to consider emerging technologies within the community, such as nanotechnology. This effort has produced an accepted conference paper titled, "Can nanotechnology decontaminate water in a morally contested context?" co-authored by Foley, Wiek, Rushforth, and Kay to be presented at the upcoming IEEE-ISSST conference. These efforts have positioned Wiek as a co-principal investigator on the $11.3M proposal for a Superfund Research Center under review by the National Institutes of Environment Health Sciences.

Nanotechnology Innovation in Metropolitan Phoenix

To conclude the year's analytical focus, we conducted a study to better understand existing and potential capacities for how different groups participate and collaborate in the governance of nanotechnology in metropolitan Phoenix. Our intent is to assess the actor network operating within the metropolitan area while documenting prominent case studies of nanotechnology diffusion into urban environments around the world. For investigating such governance structures, including distributed roles, responsibilities, and capacities for choice and action, we uses a methodology that combines actor network analysis with perception and cross-perception analysis. A series of forty-five semi-structured interviews with key stakeholders elicited perceptions and cross-perception of governance roles, responsibilities, and capacities for choice and action. The interviews led to a stakeholder workshop that explored coordinated and collaborative arrangements for nanotechnology governance in cities, focusing on Phoenix. These interviews have also provided data for dissertation work by graduate student Foley and, together with the workshop, have laid the groundwork for the "STIR City" grant proposal authored by Fisher and Wiek. The assessment will inform the upcoming scenario study detailed in the future research plan section. Two publications, one co-authored by Foley and Wiek and one co-authored by Foley, Wetmore, Bennett, Seager, Wiek, Guston stem from the interviews and are under review or in preparation.

Governance Scenarios for Cities (Phoenix)

The scenario study is based on the analysis of the urban nanotechnology innovation processes described above. Begun in Center YR 7 and integrating results from recent nanotechnology scenario studies, TRC 2, in collaboration with stakeholders, is creating socio-technical scenarios that focus on the governance of the nano-enhanced city (reference year 2035) that are diverse, plausible, and meaningful. We are involving stakeholders from the Phoenix metropolitan area in various deliberative processes. RTTA 3 will support TRC 2 with novel methods for effectively constructing, communicating, and visualizing future states and development paths. In collaboration with ASU's Herberger Institute of Design and the ARts, we will conduct a studio course that develops imaginative concepts of the nano-enhanced city, operating at the neighborhood or city level but drawing on the product level as elaborated through the Center's ongoing collaboration with InnovationSpace. The product-oriented explorations will be coordinated with urban planning and design studies into the types and scale of urban transformation. We will conduct complementary studies on the future of risk perception and social transformations as critical components to the nanotechnology innovation processes of the future. With ASU's Decision Theater, we hope to use visuals and narratives for the selected scenarios in Phoenix. In collaboration with ASU's Phoenix Urban Research Laboratory (PURL), we plan to spell out the scenarios in more detail for one neighborhood in the Phoenix metropolitan area, as localized visuals and narratives often allow people to observe, experience, interact in, and manipulate options on a level that is meaningful to them and relevant for their decisions. From this work two publications are already in preparation.

Future Research Plans

In YR 8 of the Center, the third year of our research plan, we will complete the scenario study and

conduct sustainability appraisals of the scenarios based on multi-criteria assessment (MCA) methodology, which is widely applied in studies addressing contested issues and conflicts of interest. Guided by our research question – How sustainable is the envisionsed nano-enhanced city of the future and its urban socio-technical systems? – we will use MCAs to appraise how sustainable the generated scenarios are. A differential MCA approach allows us to map out how different stakeholder groups appraise the sustainability of the nano-enhanced city differently and reveals the points of consensus as well as contest. In appraisal settings that can range from natural to quasi-experimental, stakeholders individually assess the scenarios, resulting in qualitative and quantitative value-laden statements for each. All appraisals are in part based on the same assessment criteria derived from normative guiding concepts, proposed in literature, elicited in expert interviews, or revealed in negotiation processes. Referring to the same criteria enables us to reveal, communicate, and negotiate different patterns of preferences and value conflicts. MCA identifies both desirable and unsustainable future scenarios. The sustainability appraisals are linked to TRC 1‘s interest in equity, disability and access, the distribution of risks and benefits, and responsibility and accountability in socio-technical systems, as well as RTTA 2‘s public opinion polling and RTTA 3‘s deliberative activities.

Finally, we will apply an agent network approach to explore governance arrangements and strategies for transformation toward sustainable anticipatory governance. The exploration goes into the strategies, roles, and responsibilities of the different stakeholder groups and provides important information towards the implementation of those visions of the nano-enhanced city that have been identified as sustainable and to actively avoid those identified as not sustainable. Our second research question – What governance arrangements (strategies, roles, and responsibilities of different stakeholder groups) are most likely to achieve those visions that have been identified as sustainable (and avoid those identified as not sustainable)? – will be guided by the current state analysis, future scenarios, and assessment phases in the programmatic research design. Participatory and differential analysis hopes to reveal critical constellations, such as missing stakeholders, non-fulfillment of required governance functions, non-availability of required knowledge systems, and deviations between self- and cross-perception. In collaboration with the Decision Theater, we will conduct a series of deliberative workshops with stakeholder groups that aim at specific proposals for coordinated and collaborative governance arrangements, addressing the critical constellations within the stakeholder network engaged in the nano-enhancement of the city.

Other Collaborations.

In follow-on to its YR 6 lecture series on Emerging Technologies and the Future of the City, TRC 2 is collaborating with Steven Moore (UT-Austin), who is principal investigator of an NSF-funded workshop, *Designing Climate Change Policy for Architecture: An Interdisciplinary and International Approach*, to be held at Austin in Sep 12. The workshop – partially derived from conversations Moore had with Center faculty, including Wiek, Guston, Miller and Petrucci, during his Dec 10 visit for the lecture series – will bring together researchers in architecture, design, engineering, and the social sciences to examine opportunities for creating sustainable and resilient infrastructure in the face of the challenges of climate change. Themes will include: designing and constructing “smart” buildings, achieving net zero carbon habitation, adapting infrastructure to climate change, and learning lessons from other technologies.

Contributions to “ensemble-ization” or other center-wide activities

Operating in Center-wide fashion has been a goal of TRC 2 from its inception. Between RTTA 1 and TRC 2, graduate students Sanjay Arora and Foley coordinated to co-author an academic poster at the S.NET conference. Further collaboration between Jose Lobo (RTTA 1) and Foley are revolving around issued nanotechnology patents in Arizona and qualitative narratives about innovation dynamics in Phoenix. With scenario-focused research planned for the coming academic year, initial planning meetings

between Wiek and Selin (RTTA 3) are on-going, and Foley joined Selin at *Emerge* in a workshop dedicated to scenario planning methods. In a joint effort to expand CNS's capacity in Socio-technical Integration Research and understand the dynamics of nanotechnology innovation in urban sustainability, Wiek and Fisher (RTTA 4) submitted the proposal "STIR City – Probing Urban Capacities for Governing Emerging Technologies." To integrate and develop synergies between TRC 1 and TRC 2, graduate student Foley has frequented TRC 1 planning and research strategy meetings. Wiek and Wetmore (TRC 1) are pursuing a research agenda that will result in comparable datasets between emerging urban and rural nanotechnology application in developing and developed countries. Foley has also proposed integrative research projects with CNS-Biodesign fellow Kalinowski and CNS-FSE fellow Wender.

10. NSEC Diversity Progress and Plans

Progress Toward Enhancing Diversity

Since its founding, the Center has worked to enhance the diversity of its leadership, faculty, postdoctoral, graduate, and undergraduate researchers. The Center has put significant effort into recruiting women and individuals from underrepresented groups. These efforts have included working with the ASU Hispanic Research Center to conduct workshops and courses oriented toward graduate and undergraduate students from underrepresented groups, as well as efforts to ensure appropriate advancement of faculty and postdoctoral researchers through promotion and increasing involvement in Center leadership. In the past year, as over the prior six years, the Center's diversity increased.

Center efforts have worked especially well in recruiting women into Center activities at all levels. NSECs are expected to be model programs and to meet or exceed national percentages for the inclusion of women and underrepresented groups in science and engineering. At all levels, the current percentage of women in the Center exceeds the relevant national equivalent percentage in science and engineering fields. The Center has also made progress with regard to Hispanic participation, especially in recent years. In terms of Center leadership, postdoctoral, and graduate student participation, the Center exceeds (and in some cases significantly exceeds) the national percentage for Hispanic teachers in colleges and universities. The percentage of graduate students from underrepresented groups also exceeds the percentage of doctoral degrees awarded nationally to students from under-represented groups. See Tables 4A and 4B for an overview of Center personnel. See also Tables 3A and 3B for graduate student participants in Center degree and certificate programs.

As directed by the NSEC diversity reporting requirements, we compare our data below with data from national science and engineering statistics, as provided by the National Science Foundation. For comparison, we have used data from NSF's *Women, Minorities, and Persons with Disabilities in Science and Engineering* (http://www.nsf.gov/statistics/wmpd/start.htm) updated January 2009. The data available from this report is not symmetrical with respect to women and minorities nor the social sciences and science and engineering more broadly. We have therefore used the statistics available. Thus, our comparison categories vary somewhat.

Leadership: Center leadership has transitioned from its first phase (YRs 1-5) to its renewal phase (YRs 6-10). The Center's leadership initially included two women of six principal investigators (Carlson, Schneider) and three women of eleven leaders of the six RTTA and TRC research programs (Corley, Hogle, Schneider), for a total of five of seventeen (29%). At the time of the YR 7 review, three women serve among the six renewal PIs (Corley, Meldrum, Youtie) and five women serve among twelve RTTA and TRC research program leaders (Corley, Cozzens, Lim, Selin, Youtie), for a total of six of fifteen Center leaders (40%). Of these individuals: Corley began as an assistant professor and faculty researcher and is now a tenured associate professor, research program leader, and co-PI; Cozzens began as a faculty researcher and is now a research leader; Selin began as a postdoctoral researcher and is now a tenure-track assistant professor, research program leader, and assistant director for outreach; Youtie began as a faculty researcher and is now a research program leader and co-PI. Lim is joining the Center as an assistant professor and research program leader. Meldrum joined the Center as co-PI.

Research program leaders currently also include one Hispanic (Lobo) and one Asian American (Lim), for a total of two of fifteen (13%) – an improvement over the lack of any members of underrepresented racial or ethnic groups among the original leadership team.

The percentage of women in Center leadership roles is well above the percentage of women in tenured or tenure-track faculty positions in science and engineering nationally (26%, data from 2006; no information

available on women faculty in the social sciences separately from other science and engineering fields). The Center's Hispanic leadership for the renewal period slightly exceeds the percentage of Hispanic teachers in colleges and universities nationally (4%, data from 2007; the percentage for science and engineering doctorate holders in teaching and research faculty positions is also 4%; no data available on the social sciences separately from other science and engineering fields).

Faculty and Professional Participants: From YR 1 to YR 6, the Center increased the number (and percentage) of women faculty involved in Center research and activities (non-leadership) from an initial seven (7 of 31, 23%) to forty-nine (49 of 159, 31%) active faculty and professional collaborators. YR 7 participation rates increased across the board dramatically from prior years due to large participation in three major events: the Society for the Study of Nanoscience and Emerging Technologies (S.NET) annual meeting, the Social and Ethical Implications Congress, and the *Emerge* conference. Total participation of faculty and professional participants grew in YR 7 to 507 total individuals, with 194 women (38%).

The Center has also increased the ethnic diversity of faculty and professionals involved in Center research (non-leadership). The Center faculty initially included five Asian Americans (5 of 31, 16%) and zero from underrepresented groups (0 of 31, 0%). The Center faculty and participants at the end of year six included five Asian American faculty (5 of 159, 3%), two Hispanic faculty (2 of 159, 1%), one disabled faculty member (1 of 159, 1%), and three Native Americans (3 of 159, 2%), for a total of eleven (11 of 159, 7%). In YR 7, we increased the total diversity significantly to 2 Native Americans, 3 African Americans, 39 Asians, 9 Hispanic, and 1 disabled, for a total of 54 individuals (out of 507, 11%).

The percentage of women faculty in the Center exceeds the percentage of women in tenured or tenure-track faculty positions in science and engineering nationally (26%, see notes under Center leadership). The percentage of Hispanic faculty in the Center is less than the percentage of Hispanic teachers in colleges and universities nationally (4%, see notes under Center leadership).

Postdoctoral Researchers: Since its inception, the Center has increased the diversity of women in postdoctoral research positions. Initially, the Center had one woman postdoctoral researcher (Selin) out of four (25%), who has subsequently been promoted to tenure-track assistant professor and has become a research program leader. At the end of YR 6, the Center had two active women postdoctoral researchers out of six (33%). In YR 7, we increased the percentage of women among postdocs to seven out of sixteen (44%).

Center progress in enhancing the racial and ethnic diversity of its postdoctoral researchers has been somewhat but not fully satisfactory. The Center has increased the number of Asian and Asian American postdoctoral researchers involved in the Center, from one in its initial year (1 of 4, 25%) to four in YR 7 (4 of 16, 25%), while adding two Hispanic postdocs in YR 7 (2 of 16, 13%). Unfortunately, the Center has not increased the number of African-American, Native American, or Pacific Islander postdoctoral researchers from its initial zero.

The percentage of women postdoctoral researchers in the Center equals the percentage of women in postdoctoral positions in the social sciences and exceeds the percentage for the sciences and engineering nationally (33%; data from 2006; in social science fields, the percentage is 46%).

Graduate Students: The Center has seen significant progress since its inception in improving the gender, racial, and ethnic diversity of its graduate students. At its inception, among its active graduate researchers, the Center had eight women graduate students (8 of 28, 29%) and eight Asian or Asian American graduate students (8 of 28, 29%). At the close of YR 7, the Center has seventy-one women (71 of 145, 49%), twenty-four Asian or Asian American (24 of 145, 17%), two African American (2 of 145, 1%), one Pacific Islander (1 of 145, 1%), and eleven Hispanic (11 of 145, 8%) active graduate students. In addition,

Center degree programs and certificate / training programs have involved thirty-three women (33 of 100, 33%), four African American (4 of 100, 4%), one Native American (1 of 100, 1%), twelve Asians (12 of 100, 12%), and sixteen Hispanic (16 of 100, 16%) students. Total minority participation in these programs equaled thirty-three (33 of 100, 33%), a significant increase from both initial levels and Yr 6.

The percentage of women graduate students involved in Center research exceeds the national number of science and engineering PhD degrees awarded to women nationally (45%; data from 2006; no data available for the social sciences separately from other science and engineering fields). The overall percentage of Native American, African American, and Hispanic graduate students involved in the Center (35 of 245, 14%), collectively, also exceeds the percentage of doctoral degrees awarded to students from under-represented groups nationally (10%, data from 2006; no data available for the social sciences separately from other science and engineering fields).

Undergraduates: The Center has made some progress in improving the diversity of its undergraduate researchers. At its inception, the Center had two women undergraduate students (2 of 8, 25%), three Asian or Asian American undergraduates (3 of 8, 38%), and no other students from under-represented groups. At the end of YR 7, the Center has sixteen women undergraduate students (16 of 44, 36%), four Asian (4 of 44, 9%), and one African American and five Hispanic undergraduate students (6 of 44, 14%).

Plans Going Forward
While the Center has performed strongly on diversity during its first seven years, meeting and, in many cases, exceeding relevant national percentages, we are not yet satisfied. We have therefore established a strategic plan for the renewal period on diversity that aims to further improve the Center‘s diversity profile.

Overall Objectives: The Center‘s overall objective with respect to diversity is to be a model for incorporating diversity among Center participants. To achieve this, we propose to pursue the following specific goals:

1. To maintain and continue to advance high levels of Center diversity in those areas documented above where Center diversity currently exceeds appropriate national levels;

2. To seek opportunities to recruit new Center participants, where appropriate, who will enhance the diversity of the Center in those areas where the Center is currently lower than appropriate national levels; and

3. To significantly enhance graduate and undergraduate participation among students from underrepresented racial and ethnic groups.

Center Leadership and Faculty: As noted above, the Center has strong performance in terms of gender and ethnic (Hispanic) diversity among Center leadership and faculty. The Center has had relatively little success, by contrast, in recruiting faculty participation from other underrepresented racial groups.

Our objectives for the renewal period for faculty diversity are to maintain and ideally improve our high levels of diversity in those areas where we have been successful and to seek out opportunities for increasing participation of faculty from underrepresented racial groups.

Enhancing faculty diversity is difficult. Our plan for increasing participation of faculty from underrepresented racial groups is focused this year on Native American engagement. We are beginning to explore connections with Arizona’s tribal communities around solar energy development, in partnership

with the new NSF-funded Engineering Research Center for Quantum Electronics and Sustainable Solar Technologies (which is focused on high efficiency solar photovoltaics) and the highly successful American Indian Policy Institute, which has two Native American faculty leaders. Through TRC 1 and TRC 2, the Center will approach these individuals to consider the possibility of engaging questions of nanotechnology, equity, and sustainability vis-à-vis the Native American communities of Arizona.

Postdoctoral Researchers: As among faculty, the Center has had strong success in improving the gender diversity of its postdoctoral researchers and, this year, some success with ethnic (Hispanic) diversity. Also as among faculty, the small number of individuals working in the field of nanotechnology and society from underrepresented backgrounds limits the potential for success in this arena.

Our objectives for the renewal period are to continue to have high levels of involvement in the Center among women and look for emerging opportunities to improve on our ability to hire postdoctoral researchers from diverse racial or ethnic backgrounds. Where appropriate, we will also take advantage of opportunities to promote high quality graduate students to postdoctoral positions, as we did this year for an Hispanic graduate student who was promoted to postdoctoral researcher at Georgia Tech and who has subsequently been offered a position as a postdoc at the Center for Nanotechnology in Society at UC Santa Barbara.

Our plan to enhance postdoctoral diversity will focus on efforts to attract appropriate candidates from underrepresented ethnic and racial backgrounds into our candidate pools for open postdoctoral positions. To achieve this goal, we will use the networks that we are building for recruiting undergraduate and graduate students from underrepresented backgrounds (see section below on *Networking for Diversity*) to disseminate position advertisements. We will also seek opportunities to bring people in to the Center via programs and activities like STIR, which this year involved a Hispanic postdoc in its research.

Graduate Students: The Center anticipates several efforts to enhance the diversity of graduate students participating in its research. Our objectives are to maintain the high level of gender diversity and to increase the diversity of students from underrepresented backgrounds in the Center. We will accomplish the latter via a three-pronged effort.

1. The Center has an established a relationship with the Hispanic Research Center (HRC) at Arizona State University, through which the Center has built a growing number of contacts with students from African American and Hispanic backgrounds. In YR 7, as called for in last year's strategic plan for diversity, CNS taught a 7-week course on nanotechnology in society (described in the **Outreach** section) to 12 ASU graduate students in the sciences and engineering from underrepresented backgrounds. The course was very successful, with several of the students expressing a desire to be involved in future CNS activities. We plan to continue to engage this group of students and any new students who join the Hispanic Research Center.

2. We also focused diversity planning at CNS at the graduate student level in YR 7 beyond ASU to other CNS campuses and, especially, to Georgia Tech.

3. Finally, we hope that our significant expansion of diversity in the Center leadership (Corley, Youtie, Lim, Selin, Meldrum, Lobo, Cozzens) will help us recruit and retain graduate students from diverse backgrounds.

Undergraduate Students: The Center has, to date, involved a relatively small number of undergraduate researchers as paid research interns at ASU and, occasionally, via honors thesis research. We have had some success with diversity among this group, especially among women and Hispanic students. Our

objectives remain: (1) to identify and recruit undergraduate students from underrepresented groups who are interested in CNS research topics; (2) to introduce students to the excitement and importance of CNS research; (3) to help prepare students with the skills they will need to be successful in applying to and getting in to graduate school; and (4) to encourage students to apply to graduate programs in which they can continue to pursue CNS research. This program is built on a model developed and highly successfully run by the ASU mathematics department, in conjunction with the Hispanic Research Center. Our hope is that, following this model, we can begin to provide a foundation for enhancing the diversity of not only CNS students but also, more broadly, the field of research on nanotechnology in society.

Networking for Diversity: As part of its efforts during its first five years, the Center has begun to develop significant networks of potential partners for enhancing Center diversity. We will use these networks for a variety of recruiting purposes. We have developed connections with the following programs:

- The Hispanic Research Center, Arizona State University
- The Engineering Education Outreach program, Georgia Tech
- The Humanitarian Engineering program, Colorado School of Mines
- The Ethics of the Nanoscale Nanotechnology Undergraduate Education program, Auburn University and Tuskegee University

In addition, through Gregor Wolbring, a CNS consultant, we have made initial contact with several disability studies programs that may offer potential sites for recruiting students with disabilities.

- The Rehabilitation Counseling Program, California State University, Fresno
- Department of Rehabilitation Counseling, Virginia Commonwealth University
- The Ohio STEM Ability Alliance: STEM Degrees and Careers for Ohioans with Disabilities‖ Project, Ohio State University

11. Education

CNS-ASU is involved in extensive formal and informal educational activities from undergraduate curriculum to graduate student and post-doctoral training and mentoring, and from science and engineering practitioner training to collaborations with science museums. Many of these activities are tightly integrated with research and outreach activities, and most maintain as their central focus the building of broader societal capacity for anticipatory governance. Thanks to its myriad programs, CNS-ASU is being recognized as a national leader in two emerging areas of education. First, through activities like co-sponsoring the "Congress on Teaching the Social and Ethical Implications of Research" in November 2011, CNS-ASU is developing and promoting education programs that introduce science and engineering graduate students to the social implications of their work. Second, through collaborations with the Nanoscale Informal Science Education Network (NISE Net), especially a new museum staff training program, CNS-ASU is developing and promoting new ways to make the social implications of science and technology accessible to science museum audiences.

Disseminating the CNS Education Models

CNS is increasingly being seen as a leader in educating scientists and engineers in the social implications of their work. CNS scholars and educators are increasingly being asked to present the education activities sponsored by CNS so that others can learn from and sometimes emulate them. For instance, Bennett and Wetmore had a number of conversations with Christine S. Jones, Assistant Director of the Center for Science, Mathematics and Technology Education at Colorado State University about their teacher education programs, and Bennett participated in one of their teacher training workshops in Summer 10.

Scholars have also been visiting CNS-ASU to meet with its faculty to learn more about ASU's education programs. Janet Kourany, for instance, relates that our programs are functioning as a model for similar programs being developed at the University of Notre Dame, and that the sophistication of the CNS models has caused them to reevaluate what they propose. Kathleen Eggleson, also from Notre Dame, recently did a follow up visit to further develop the efforts of the Reilly Center for Science, Technology & Values as well as the ND Nano Initiative. CNS-ASU scholars Harsh and Wetmore also collaborated on a grant proposal to the UK Economic and Social Research Council that brought two researchers, Jane Calvert and Emma Frow, from the University of Edinburgh to ASU for three weeks in Fall 10 to learn about the variety of training programs CNS-ASU has developed for graduate students in the sciences and engineering. Guston visited Edinburgh later in Fall 10 and Harsh and Wetmore visited in Su 11 to learn more about the activities in Edinburgh and further spread the education work being done at CNS-ASU. Megan Palmer, Deputy Director of Practices at the Synthetic Biology Engineering Research Center (SynBERC), has frequently consulted with CNS about ways to develop education programs for her Center and will be making an extended visit to Tempe in Apr 12 to get further immersion in CNS-ASU's education programs. Mary Sunderland, a visiting scholar at UC Berkeley's Office for History of Science and Technology who is developing Berkeley's College of Engineering ethics education program, has also consulted closely with CNS-ASU researchers on the models and strategies we have developed.

In Spring 10, Wetmore organized a panel at the annual meeting of the American Association for the Advancement of Science to showcase many of the education programs developed at CNS-ASU. The program included Bennett and former graduate student Benn as a speaker and focused on the benefits that scientists can generate when they not only talk, but also listen to policymakers and the public. In Fall 11 Wetmore also organized a panel on Teaching Social and Ethical Implications of Research to Scientists and Engineers at the Society for Social Studies of Science in Cleveland.

In Spring 12 co-leaders van der Leeuw and Wiek at Arizona State University are collaborating with six universities from Canada, Mexico, South Africa, Germany, Sweden, and Japan to disseminate the teaching and research of sustainability scientists across the globe. The seven universities are engaging in student exchanges, collaborative curriculum development, and research initiatives.

While all of these conference panels and individual consultations have been useful, ultimately CNS-ASU decided that a major event was needed to bring together the large number of scholars who work in the area, disseminate models developed at ASU, and foster further collaborations. Therefore, in Nov 11, CNS-ASU hosted with the EESE grant (Herkert, PI), the National Nanotechnology Infrastructure Network, and NISE Net a Congress on Teaching the Social and Ethical Implications of Research. The event was the first of its kind in the United States. While the original hopes were that 50 people would attend, it attracted over 100 scholars from across the country including engineers, social scientists, ethicists, graduate students, postdocs, museum professionals, and a panel of young speakers who work for nonprofits that promote SEI education. The primary goal of the Congress was to disseminate the models developed and the lessons learned on how best to encourage graduate students to consider and grapple with the broader implications of their research. To that end, the NNIN held the annual meeting of its Societal and Ethical Implications working group at the event. A number of CNS-ASU education programs were presented including: the one credit courses; the laboratory engagement program; the embedded social scientist course model; study abroad programs facilitated by CNS scholars including Harsh, Bennett, and Wetmore; the collaboration with University of Edinburgh scholars Frow and Calvert; a number of the activities co-developed with NISE Net; and the evaluation efforts conducted by the EESE project. A concluding panel composed of three graduate students who had participated extensively in CNS-ASU education programs (Tracy Niday, Kiera Reifschneider, and Jessica Corman) provided an important capstone to the Congress by demonstrating the ways in which scientists and engineers have shaped their research and career trajectories as a result of their interactions with CNS. The response by the participants was overwhelmingly positive, and it is likely that the event will be repeated, perhaps on a bi-annual basis.

Post-doctoral training and junior research scholars. CNS-ASU has put significant effort into building a cohort of talented junior scholars who are developing not only research skills but collaborative and leadership skills as well. Researchers Barben (Political Science & Sociology), Bennett (Chemistry), Conz (Sociology), Davies (Science Communication), Fisher (Environmental Studies), Harsh (STS), Selin (Knowledge & Management), and Wetmore (STS) were all initially hired at the post-doctoral level at ASU. Another postdoctoral researcher, Rodriguez-Zabaleta (Philosophy & Risk Assessment), joined ASU through an award from the Basque Government and has collaborated in Center research with Fisher. The Center has also provided training to post-doctoral fellows at the University of Georgia (Slade, under the direction of Bozeman on RTTA 1/2), Georgia Tech (Wang, under the direction of Shapira on RTTA 1/1 and Gatchair, under the direction of Cozzens on TRC 1), and Wisconsin (Delborne, under the direction of Kleinman on RTTA 3/4 and Rajagopalan, under the direction of Fujimura on former TRC 2).

These scholars have made significant advances professionally and many have taken core leadership roles in CNS initiatives:

- Seven have obtained tenure-track positions: Barben at Aachen University of Technology (Germany) in a position supported by the Association of German Engineers; Wetmore at ASU in the School of Human Evolution and Social Change; Fisher at ASU in the School of Politics and Global Affairs; Delborne at Colorado School of Mines in Science, Technology, Society and Policy; Wang at Florida International University in Public Administration; Slade at the Hull College of Business at Augusta State University with an affiliation with the Medical College of Georgia, Selin in a tenure-track position shared between ASU's School of Sustainability and the Consortium for Science, Policy and Outcomes;

- Bennett and Conz have been promoted into research faculty positions at ASU in CSPO, and Conz is also a lecturer in ASU's Bachelor of Interdisciplinary Studies program.
- Three have taken on formal leadership roles in the Center: Wetmore is currently a co-leader of TRC 1 and assistant director for education, Fisher is currently a co-leader of RTTA 4 and assistant director for international activities, and Selin is a co-leader of RTTA3 and assistant director for outreach. Others have led particular projects: Conz leads a CNS research project in RTTA 4 in collaboration with the Biodesign Institute's Tubes in the Desert Project, Davies currently leads the private sector engagement activity but will be transitioning into a research fellow position on scientific social responsibility at the University of Copenhagen this summer, Bennett leads the DC Summer Session and other educational activities, and Harsh has played an important role in TRC 1.
- Two have obtained additional external support for CNS-associated activities:
    - Fisher is PI on the $540K socio-technical integration research (STIR) award, which extends the Center's integration agenda that Fisher pioneered as a CNS-funded doctoral student at Colorado. Fisher is also PI on a National Nanotechnology Infrastructure Network (NNIN) award that seeks to "Document Integration" at several NSEC and NNIN sites.
    - Wetmore is co-PI on three grants: a $300K NSF award from the Ethics Education in Science and Engineering (EESE) program that develops, teaches, and assesses several models of micro- and macro-ethics instructional activities for graduate students; a second $300K NSF award from the EESE program to develop CITI modules that address macroethics; and a $700K NSF award to create and support a Professional Science Master's Program in Solar Energy Engineering and Commercialization that has a substantial ethics and policy curriculum.

Many of the activities encompassed by all four of these grants have roots in the Center's program. Others are active in initiating and collaborating on new research proposals as well.

- Fisher and Selin are both collaborators on an $820,000 award from the Research Council of Norway to Norwegian researcher Roger Strand that incorporates intellectual approaches in integration and foresight that they, respectively, have pioneered.
- Several have been involved in editing the Center's *Yearbook of Nanotechnology in Society*: Fisher, Selin and Wetmore (2008) edited the first volume. Wetmore edited the second volume (2011) with Cozzens, and Bennett edited the third volume with Hays, Robert and Miller (2012). Barben is editing the fourth volume with Miller.

Graduate Education and Training. CNS-ASU organizes a variety of graduate education and training activities, aimed at several audiences. The first audience is the graduate students involved in the Center's core research activities. While only some of these students have been directly supported in graduate assistantships by CNS, many others have drawn on CNS research to develop their theses, received CNS travel funds, and been involved in the Center's events. In the reporting year, the Center has been training:

- At ASU, eight doctoral students:
    - Conley (Politics and Global Affairs), who has completed her STIR research and has been working on her dissertation;
    - Gano (HSD), who will be completing her second year paper on RTTA 3- and TRC 2-related Transition Towns movement, has been collaborating with Cobb at NCSU on two follow-on manuscripts to the NCTF project, has been assisting ECAST on the World Wide Views on Biodiversity project, and who has taken a professional librarian position at Amherst College;
    - Trinidad (HSD), who has been assisting both Fisher on RTTA 4 interviews and Wetmore and Bennett on the Informal Science Communication Program;

  - Luk (HSD), who has completed her second year paper on STIR research and has begun her doctoral research;
  - Youngjae Kim (Public Affairs), who is preparing for his comprehensive exams and performing research for RTTA 2;
  - Valdivia (Public Affairs), who completed his doctoral degree in May 11 on a topic in TRC 1, "Equity Considerations in the Assessment of the Bayh-Dole Act" and is now a visiting scholar at UC Berkeley; and
  - Foley (Sustainability), who has been working with Wiek and Guston on urban level governance, will incorporate TRC 2 research into his dissertation prospectus.
- Current updates on earlier ASU students include:
  - Pirtle, who completed his undergraduate Mechanical Engineering degree in May 09 and served a Fulbright Fellowship in Mexico with Guilermo Foladori on the responsibilities of nanoscientists, is now a Presidential Management Fellow at NASA.
  - Hays, who completed his doctoral degree in Politics and Global Affairs in Dec 09, served in Washington, DC with the New America Foundation as the lynchpin of its Future Tense collaboration with ASU and Slate.com, has accepted a three-year post-doctoral fellowship at the University of Bergen, Norway.
  - Anderson (Public Affairs), completed his master's degree in May 10, has a chapter in the third volume of the *Yearbook,* co-authored a paper with Fisher related to RTTA 1 and RTTA 4 research, and is now a doctoral student at the University of Georgia working with Barry Bozeman.
  - Nulle (Global Technology and Development), who completed her master's degree in May 10, has a chapter in the third volume of the *Yearbook*.

At Wisconsin, nine doctoral students (Binder, Cacciatore, Choi, Dudo, Ho, Dalrymple, Shih, Hu, and Hillback, in Life Sciences Communication and Journalism and Mass Communication) have been working with RTTA 2 data, and several of these have received Center support through graduate research assistantships. Four of this group have secured faculty positions, including:

- Ho, who graduated in 2008 with a PhD in Journalism and Mass Communication and is now a tenure-track assistant professor at Nayang Technological University in Singapore;
- Binder, who graduated in 2010 with a PhD in Mass Communications and is now a tenure-track assistant professor at NC State University;
- Dudo, who graduated in 2011 and now holds a tenure-track position at the University of Texas at Austin; and
- Dalrymple, who also finished in 2011 and is an assistant professor at the University of Iowa.

Other doctoral students trained at Wisconsin include: Leung, who completed his PhD in Sociology (2008) using CNS data and is now an assistant professor of Health Management and Informatics at the University of Missouri School of Medicine; and Jason Gallo, graduated with a PhD from Northwestern and is now employed at the Science and Technology Policy Institute, a privately-operated FFRDC, in Washington, DC. Noel Benedetti defended her M.S. degree using RTTA 2 data in 2010 and works as a technology consultant. Researchers and graduate students at Wisconsin also regularly participate in informal science outreach efforts, including Wednesday Nite at the Lab and the Wisconsin Literacy speaker series. Several students contributed entries to the *Encyclopedia of Nanoscience and Society*. Almost all peer-reviewed publications by RTTA 2 include graduate student authors. In Summer 10, RTTA 2 researchers also spearheaded the first online course in Science, Media & Society at UW-Madison, offered exclusively through iTunesU with select lectures being publicly available to all audiences. The Holtz Center for Science and Technology Studies at WU also just accepted a proposal from Scheufele to teach a course in "Science and Society," which will be jointly offered for students in Life Sciences Communication and Science and technology Studies.

At Georgia Tech, four doctoral students (Carley, Kay, Tang, Arora), three visiting doctoral students (Tingting Ma and Wenping Wang of Beijing Institute of Technology; and Lidan Gao of the Chinese Academy of Science), one master's student (Horsley), and four undergraduates (Bidgood, Campbell, Rodriguez, Skolky) work with RTTA 1, with a focus on CNS-ASU themes, data and analyses, many toward their theses. RTTA 1 senior faculty and students meet on a regular basis (complete group meeting every Friday morning) for progress reviews, discussion of projects, publications, methods, and new ideas, mentoring, and (occasionally) hosting visiting speakers. All RTTA 1 doctoral students have participated in the initial meetings of the new Innovation Co-Laboratory (Georgia Tech, University of Manchester, and Beijing Institute of Technology), which has a focus on developing joint projects (in the nanotechnology and society domain) and doctoral training. Public Policy PhD student Yu Meng also worked with the RTTA 1 group.

Two doctoral students graduated or will graduate in Spring or Summer 11: Tang (Public Policy) has accepted an assistant professorship position in public administration and policy at the Shanghai University of Finance and Economics; and Kay (Public Policy) will assume a post-doctoral fellowship with CNS-UCSB. Tang and Meng completed research on a Robert W. Gore award ($10,000) from the Chemical Heritage Foundation to undertake case studies of nanomaterials innovation in China. Arora (and M. Harsh, TRC 1 and ASU) participated in the week-long Winter Nano School in Grenoble, France (Spring 11). Based on RTTA 1 research, Carley, Kay, Tang, Meng, and Horsley authored or co-authored one or more journal submissions, journal papers or book chapters this year. Arora has co-authored a conference paper – on graphene commercialization – which will soon be ready for journal submission. Benn (a recent CNS-ASU PhD+ at ASU) was also a co-author with members of the Georgia Tech group.

The Center supported graduate students at other institutions in the organization, conduct and analysis of the National Citizens' Technology Forum, including: Amy Barr (Sociology, University of New Hampshire), now a Visiting Assistant Professor at St. Lawrence University, Christina Ndoh (Public Administration, North Carolina State University), John Willingham (Political Science, North Carolina State University), Mark Philbrick (Environmental Science, Policy, and Management, University of California, Berkeley), and Javiera Barandiaran (Environmental Science, Policy, and Management, University of California, Berkeley). Philbrick and Barandiaran (2009) have published on their activities and have contributed multiple entries to the *Encyclopedia of Nanoscience and Society*. Philbrick is currently a AAAS fellow with the Department of Energy.

The associated STIR project, through a variety of workshops, group meetings, regular correspondence and one-on-one sessions, as well as site visits by PI Fisher, has trained and mentored the following eighteen (18) doctoral students (four of whom have received their degrees so far) and one master's student (who has graduated and since become a doctoral student): Antonio Calleja-Lopez, University of Seville; Shannon Conley, ASU; Paul Ellwood, University of Leeds; Steven Filpse, Delft Technical University; Cecilie Glerup, Copenhagen Business School; Birgitte Hansen, Copenhagen Business School; Byoungyoon Kim, Rensselaer Polytechnic Institute; Miao Liao, Tsinghua University; Federica Lucivero, University of Twente; Christine Luk, ASU; Bastien Miorin, Grenoble; Robin Phelps, University of Colorado; Daan Schuurbeirs, Delft Technical University; Anthony Stavrianakis, UC Berkeley; Frank Theys, Katholieke Universiteit Leuven; François Thoreau, University of Liège; Brenda Trinidad, ASU; Michiel Van Oudheusden, University of Antwerp; Qin Zhu, Dalian University of Technology. In addition, STIR has also involved the participation of four post-docs (one of whom has since joined the private sector): Dorothy Dankel, Ana Delgado, Hannot Rodriguez, and Daan Schuurbiers. As a result of STIR-related work, Fisher also co-advises Liao and serves on graduate committees of Calleja-Lopez, Conley, Phelps, Theys, Van Oudheusden and has provided formal feedback to the graduate advisors of Glerup, Kim, Lucivero and Miorin.

At ASU, the second graduate student audience has been NSE researchers themselves. For these students, CNS-ASU created the CNS-Biodesign Fellows program, in which CNS pays one-third of their support. These students then participate in CNS-related curricular and co-curricular activities and perform what we call the PhD+, adding societal implications material to their doctoral research. The Center has graduated three PhD+ students: Troy Benn (Environmental Engineering; Westerhoff lab); Jason Lappe (Chemistry and Biochemistry; Woodbury lab) and Quinn Spadola (Physics; Lindsay lab). This year CNS is sponsoring two Biodesign Fellows: Tomasz Kalinowski (Biodesign; Halden lab) has been working together with TRC 2 graduate student Foley on the M52 site and has begun research on his PhD+ dissertation chapter. Rebecca Allen (Biodesign, Curtiss lab) is working with RTTA 3 to conduct market research on solar energy products in order to evaluate compatibility between community demand and product availability.

Last year, CNS-ASU expanded the Fellows program to attract students from ASU's Ira A. Fulton Schools of Engineering. The Center now has two CNS-FSE Fellows who started in Fall 11: Ben Wender (Civil and Environmental Engineering, Seager Lab) and Ebraheem Azhar (Electrical Engineering, Yu Lab). In addition to integrating anticipatory approaches into his life cycle assessment, Wender has also been an active collaborator between CNS-ASU and the new QESST ERC.

The success of the PhD+ has generated a great deal of interest beyond CNS-ASU. CNS researchers Guston, Miller, Bennett, and Wetmore, have been invited to participate on a number of technical grant proposals over the past year and support for future PhD+ students was written into several of these proposals. In addition, the CNS researchers at Georgia Tech have begun to implement their own program. Currently CNS-ASU is working to turn the existing PhD+ program into a certificate open to graduate students in engineering and the natural sciences in "Responsible Research and Innovation." The certificate proposal needs to be approved by the Provost, and we anticipate it will commence in Fall 13.

A number of the education activities originally developed by CNS to help graduate student scientist and engineers understand the social and ethical implications of their work were rolled into the Ethics in Engineering and Science Education (EESE) grant, on which Wetmore is a co-PI. In one activity, Bennett participated (for a fourth year) in the Biological Design Graduate Program's core course, "Fundamentals of Biological Design II." Bennett attends every class and uses the presenter's remarks as entry points into discussions of social, ethical or political aspects of research with the class and presenter. The response by the presenters has ranged from hesitant to fully embracing the conversation. From these interactions, several potential collaborations with presenting faculty have developed. The interactions with the students in the course resulted in recruiting Kalinowski and Allen as CNS-Biodesign Fellows.

A second CNS/EESE collaboration involves laboratory engagement. During Fall 09 and Spring 10, Wetmore and McGregor worked with Steven Helms-Tillery's neuroscience lab. They worked with the lab participants to reflect on the social and ethical implications of their research including the potential military uses and issues surrounding primate research. During Fall 10 Wetmore and McGregor worked with Patrick Phelan's solar engineering lab where they discussed how different social and political changes would promote and inhibit the spread of solar power. In Fall 09 Wetmore was asked to consult on the development of a similar program at the University of Rothenburg in Germany. In Summer 10 he presented the model at the Annual Symposium of the International Research Training Group, ran the first laboratory session, and served as consultant to the program through its successful completion. This success of this activity has led to continued working relationships with PIs and students and it has been written into a handful of grants.

A third CNS/EESE collaboration is the series of one-credit courses entitled "Science Policy for Scientists and Engineers" that has been taught by Bennett, Posner, and Wetmore nearly every semester for the past four years. It is a 1-credit seminar for NSE graduate students to explore questions and issues of science

and technology policy in society that are relevant to their own research. Again this year the course was filled to capacity. The interactions with the students in the course yielded the first CNS-FSE Fellow, Moran, and it has drawn a number of other students into the Informal Science Communication Project. Because Posner left ASU this year and because of ever-increasing demands on their time, Bennett and Wetmore developed a new model for this year's course. A biochemistry graduate student, Kiera Reifschneider was so interested in ensuring that the course was taught that she served as a co-instructor, helping to determine the year's theme and facilitating much of the logistics required to keep the class running.

The evaluation data generated under the EESE is impressive. Four models were evaluated – the embedded course (Bennett in Biodesign), a stand-alone course (Posner, Wetmore and Bennett 1-credit), laboratory engagement (Wetmore and McGregor in labs of Helms-Tillery and Phelan), and a hybrid course (Ellison and Herkert). Pre- and post- tests were given to all students involved. All four models were found to have a statistically significant and positive effect in helping students be more ethically sensitive, have more knowledge of relevant standards, and have better ethical judgment. These results are not typical for traditional responsible conduct of research courses and demonstrate the valuable contributions of these education approaches. The success of this EESE grant led to a second NSF EESE grant to develop macroethics modules for the online CITI program.

In Summer 11, CNS-ASU conducted three separate sessions of "Science Outside the Lab: A Policy Dis-Orientation" for graduate students, reflecting a rapidly growing interest among NSE students and faculty. Developed and taught by Wetmore and Bennett and held in Washington, DC, the course offers graduate NSE students a chance to leave the lab for two weeks to explore the relationships among science, policy and societal outcomes. Students meet government officials, lobbyists, staffers, regulators, journalists, academics, museum curators, and others who fund, regulate, shape, critique and study science, and they engage in hands-on policy learning through tours and exercises like a mock congressional hearing where students present their ideas for new policies to congressional staffers in the House Science Committee's hearing room.

The previous success of the DC program has inspired a number of faculty to include funding for students to participate in it in their ERC, IGERT and education grant proposals. ASU currently has two Professional Science Masters programs – one in Science & Technology Policy and one in Solar Power Engineering and Commercialization – that require all of their students to participate in the DC program. The first session of Su 11 was therefore dedicated to these students and had a particular focus on energy policy. The two subsequent workshops were open to students from the natural sciences and engineering.

Bennett now leads the summer session programs, but brings in additional help to facilitate them. In Summer 11 CNS faculty Wetmore, CNS post-doctoral fellow Harsh, and former CNS post-doctoral fellow Delborne, assisted with one session each. Each session is also facilitated by a student liaison who has participated in CNS immersion projects, taken multiple courses, and been mentored by Bennett and Wetmore. In Summer 11 there were three students who had gained the skills, knowledge, and enthusiasm about the social and political implications of nanotechnology to serve as a student leaders: Estelle Robichaux (PhD student, National Resources & Environment, University of Florida), Carl Ballard (PhD student, Applied Math for Life and Social Sciences, ASU), and Kerri Stone, Mathematical and Computer Sciences, Colorado School of Mines).

In Summer 12, CNS-ASU will once again conduct three sessions of Science Outside the Lab. Because of the success of the two PSM degree programs that require participation in the program, this year there will be one session dedicated to each of them. The first session will focus on solar energy policy. The second session will be tailored to the needs of the PSM in Science and Technology Policy. And the third session

will be open to science and engineering graduate students. The programs were filled by the end of Mar 12 and prospective paying applicants have been turned away for lack of space.

In Fall 09, CNS researchers Wetmore, Bennett, and doctoral student Trinidad began to collaborate with Trevor Thornton and the ASU node of the National Nanotechnology Infrastructure Network (NNIN). The collaboration has resulted in two major programs: First, CNS-ASU now contributes the Social and Ethical Implications training required of all researchers who seek to use the ASU NNIN facilities. The training is part of the standard NNIN lab safety training that occurs at least once a month. Bennett, Wetmore, and doctoral student Trinidad have all served as instructors in the course (discussed further below).

Second, the ASU NNIN Node cosponsors with CNS-ASU the ASU Informal Science Communication Program for graduate students. The program offers training sessions every two weeks for students in how to communicate with the general public about science and engineering and then gives them the opportunity to gain important practical experience by presenting their work on the floor of the Arizona Science Center. The basic idea behind the program is to help young scientists develop valuable communication skills. The added bonuses are that the public gets to know about the cutting edge research being done at ASU and the students are asked difficult questions about the social and ethical implications of their work that they must develop good answers to. The program began in Mar 10 and students present at the museum monthly.

CNS scholars at Georgia Tech have also been helping to facilitate education in the social sciences for grants that are primarily technical in nature. Shapira, Youtie, and Porter have been collaborating with Elsa Reichmanis, Professor, Chemical and Biomolecular Engineering, Georgia Institute of Technology on a new IGERT Program entitled Nanostructured Materials for Energy Storage and Conversion and have participated in the Program's inaugural seminar series by introducing students to "Trajectories of Global Nanotechnology Commercialization."

Three years ago, CNS-ASU developed a partnership with a new degree program the Professional Science Masters in Nanoscience, led by the Department of Physics and the Department of Chemistry and Biochemistry, to offer a 2-credit graduate course in the societal aspects of nanotechnology. Bennett has taught this course for the program in each of the past three years.

Two years ago Wetmore collaborated with Patrick Phelan to develop and run a new Professional Science Masters in Solar Power Engineering and Commercialization. The curriculum of the PSM, sponsored in part by a $700K NSF PSM grant, has a significant focus on the ethical and political issues inherent in solar power. Wetmore has taught a 2-credit graduate level class on Solar Energy Policy with Mike Pasqualetti each year since the program was created. This past year Wetmore had the class evaluate and offer suggestions to the Arizona Science Center's "Solarville" exhibit. All twelve students enrolled in the program will also be participating in the first DC summer session, which will continue to be a required component of the curriculum.

The third graduate student audience at CNS-ASU consists of those students in traditional departments and schools, as well as those in interdisciplinary programs, who are interested in CNS-related coursework. CNS-ASU faculty have established twelve graduate courses at ASU:

- In Spring 12, Selin developed and taught a research studio class through the School of Arts, Media and Engineering that explored the observation, documentation, analysis and summarization of large-scale collaborative events. Students in the class will be trained either in ethnographic methods or observational media documentation and will apply their skills in the field at the *Emerge* event (see **Section 9 Research Program, Accomplishments, and Plans**,

RTTA 3). Subsequent to the event, and using the collected data, the students will then spend the remainder of the semester designing and developing a physical gallery exhibition, participating in the creation of a dynamic online media archive, and/or contributing to analysis of the *Emerge* event as a novel form of future-oriented deliberation."

- In AY 11-12, Guston developed and taught with CSPO Professor of Practice Gregg Zachary the two-semester sequence, "Science and Technology Policy" and "Advanced Science and Technology Policy," the core sequence for the STP PSM. The course achieves a novel synthesis of analytic and communication approaches and explores key tools like real-time technology assessment and anticipatory governance, as well as substantive topics like DIY biology and manufacturing, derived from the CNS agenda.
- In Spring 11, Fisher developed a new course entitled "Analysis of Scientific and Technological Innovation Systems," primarily for graduate students in the PSM in Science and Technology Policy Program. A number of HSD students have taken the course as well. The course draws on a number of Fisher's research projects within CNS.
- "Future Scenarios, Anticipatory Governance, and Sustainability – Urban Development in Phoenix" was offered by TRC 2 co-leader Wiek and RTTA 3 co-leader Selin in Sp 10. The course engaged 22 graduate students from five ASU graduate programs in systematically crafting visions of sustainability for Phoenix and developing governance strategies for transformative change. The course also integrated the theme of urban socio-technical systems and emerging technologies. As the course was embedded in a collaborative research project with the City of Phoenix to inform the adaptation of the General Plan, the course facilitated research in teams and involved faculty across ASU as well as stakeholder groups across the city. The course built capacity in anticipatory governance and attracted students to engage in subsequent research. Moreover, it created a network among stakeholders, professionals, and decision makers in Phoenix interested in "Nano and the City." In Spring 11, ASU awarded the course its President's Award for Sustainability. In Spring 12 Wiek reworked the course into "Sustainable Solutions: Options for Phoenix," to continue to engage graduate students in TRC 2 research. Three walking audits that brought together researchers, Kay and Wiek, with graduate students and community members has strengthened the novel methodology of walking audits to co-train community and academic actors on the complex, place-based urban sustainability syndromes, while seeking solutions (including nanotechnology).
- Wetmore created a new course in Spring 10 entitled: "Introduction to Analyzing Sociotechnical Systems," offered in the School of Human Evolution and Social Change. Not only were a number of nanotechnology topics covered, but students were also assigned a research project to develop a demonstration for NanoDays 2010. This class also fulfills a core requirement of the Professional Science Master's Degree program in Science and Technology Policy offered by CSPO. Wetmore taught this course again in Fall 10 and Spring 12 and attracted a number of HSD students as well.
- In AY 09-10, Boradkar developed a training program akin to InnovationSpace but for graduate students. Two students under his direction have performed additional research, design and development on nanotechnologies previously conceived by the undergraduate InnovationSpace students.
- "Nanotechnology: Law and Regulation," was taught by Marchant in the Sandra Day O'Connor School of Law in Spring 10. Several other CNS-ASU faculty participated in the course, including Guston, Robert, and Selin. As a major project the students explored potential regulatory and liability issues in the scenes developed by NanoFutures.
- "Governing Emerging Technologies," taught in Fall 08 and Fall 09 through the School of Politics and Global Studies by Guston and in Fall 10 and Spring 12 by Fisher, explores the Center's core concept of anticipatory governance and synthesizes many of the Center's findings. Students in the course were tightly integrated into the Center's activities, e.g., participating in the Oct 08 Visioning Workshop and the Nov 09 Equity Workshop. Several other CNS-ASU faculty have

participated in the course including Conz, Corley, and Selin. This class also fulfills a core requirement of the Professional Science Master's Degree program in Science and Technology Policy offered by CSPO.

- "Energy and Energy Policy," taught by Bennett in Spring 09, is a 1-credit seminar for PhD students in chemistry that explores the dynamic interplay between scientific research, technological innovation, policy development, and cultural change surrounding large-scale energy system change in the 21st century.
- "Science, Technology and Developing Areas," a one-credit course offered through the Department of Chemistry and Biochemistry and the School of Human Evolution and Social Change, was developed in F 09 by Harsh and Wetmore to work through TRC 1 topics with graduate students. The course attracted graduate students from the social sciences, natural sciences, and engineering and explored the myriad issues that must be addressed for technical assistance to truly benefit the disenfranchised.
- "Nanotechnology, the Brain, and the Future," taught in the School of Life Sciences and the School of Politics and Global Studies, is a variable-credit course offered by Miller and Robert (Fall 07, Spring 08, Fall 08) as part of the E2E project. Students and faculty used it to prepare research projects for E2E and the CNS All-Hands meeting.
- "Science, Technology & Societal Outcomes," taught in the School of Life Sciences and the School of Human Evolution and Social Change by Wetmore and Bennett was offered in Spring 06 and Spring 07.

The Center has also been an integral part of the development of a new doctoral program at ASU, the Human and Social Dimensions of Science and Technology (HSD), which was approved by the Arizona Board of Regents in Dec 07 and matriculated its first class in Aug 08. CNS Associate Director Miller directs the HSD PhD program, and Guston, Robert, Sarewitz, Corley, and Wetmore serve on its Executive Committee. Other CNS faculty, including Fisher and Selin serve as members of its Graduate Faculty. In addition to the summaries of HSD students who are working specifically with CNS-ASU provided above, numerous other HSD students have participated in CNS-related activities over the life of the Center, including the scenario-based solar-to-fuels workshop, the anticipatory governance visioning workshop, CNS-ASU All-Hands meetings, and *Emerge*.

While the vast majority of classroom-oriented activities at CNS-ASU have occurred at ASU, in Summer 10 co-PI and RTTA 2 co-leader Scheufele and his Wisconsin team created an on-line class, Science 2.0: Media, Politics, and Emerging Technologies, for both graduate and undergraduate students, offered over iTuneU. This course is the third that CNS-ASU affiliates have offered completely on-line, with Harsh's undergraduate Science and Democracy in Winter 10 and Hays' Human Enhancement and Democracy class in Summer 10.

Undergraduate Education and Training. CNS-ASU organizes a variety of undergraduate education and research training experiences. In previous years, numerous undergraduates have written honors theses with CNS faculty, and undergraduates – mostly from the W.P. Carey School of Business – also complete honors theses in conjunction with their InnovationSpace coursework. In the current year, two of the CNS-sponsored InnovationSpace students are in the honors engineering program and one is an honors student in business. It is likely that all three will complete theses through the project.

Previous honors students are also publishing their thesis research in CNS publications:

- Arielle Silverman, whose undergraduate thesis in Biology and Society surveyed a population with visual impairments about their attitudes toward nano-enabled therapies and enhancements in conjunction with TRC 2, will publish her work in the third volume of the *Yearbook*;

- Tobie Milford, whose undergraduate thesis in Religious Studies reviewed public participation in science literatures and analyzed TRC 1's Nanotechnology and Religion workshop, will publish his work in the third volume of the *Yearbook* and has written several entries for the *Encyclopedia of Nanoscience and Society*. Milford's undergraduate thesis also helped to win the Kelly Maxwell Outstanding Graduate Student Award from the Intergroup Relations Center Awards Committee and the Religious Studies award for "Outstanding Concurrent Major."

CNS has supported three undergraduate student interns since the last annual report: Catherine Hoke (Private Sector Engagement project/workshop, RTTA 3 book project, and TRC 2, Nano and the Future of the City database project), Keith Martin (Outreach support, including the videotaping and editing of all presentations and special projects), and Evan Taylor (TRC 2, Nano and the Future of the City/database development project).

In addition to the numerous undergraduate courses developed in the first five years of CNS – including "Perspectives on Nanotechnology," "Justice and the Future," "Learning Community: Nanotechnology in Society," "Human Enhancement and Democracy," "Global Environmental Politics," "Technology and Society," and "Science and Democracy" – nanotechnology and society issues were newly integrated into two other undergraduate courses. Harsh revised the "Science and Democracy" course for Winter 10 as a 3-credit online course with interactive and video-enhanced oral exam modules, and Hays (currently a lecturer at Northern Arizona University) will teach an online version of Human Enhancement and Democracy in Summer 12. In Spring 11, Miller, Bennett, Harsh, and Wetmore developed a new, 125-student undergraduate course entitled "Introduction to Science & Technology Policy," which integrated discussions about nanotechnology into each of the course's five focal topics: health, food, military, economy, and environment. The course is being offered in Spring 12 by another CSPO professor Mary Jane Parmentier.

CNS-ASU's long standing relationship with InnovationSpace continued this year. InnovationSpace is a two-semester long, transdisciplinary course collaborative among the ASU Schools of Design, Engineering, and Business. It satisfies the design or project requirements for senior majors in each school by creating cross-functional teams who use an Integrated Innovation model to research, develop and refine real-world product concepts for paying sponsors. This year, CNS teams are exploring access to clean water, emergency services, and drug abuse prevention. (See **Section 9 Research Program, Accomplishments and Plans** RTTA 3/2).

K-12 Education. In a previous reporting year, CNS-ASU described the development of a graduate course that provided in-service K-12 teachers with research experiences and also helps them develop curricular materials for their own K-12 classrooms on societal aspects of nanotechnologies. CNS did not offer a version of the course in the current reporting year. Two teachers participated in the course in Spring 09, one in-service and one who is in the nano-science professional master's degree program and does not currently teach. The value of the course is demonstrated by continuing follow-ups by in-service teachers with Bennett, who has consulted with some of those in the course about the development of curricular materials and visited classrooms at Mesa High School and its Biotech Academy. In one of these classes the in-service high school teacher from Bennett's Nanoscience in Society course had her students choose specific technologies and analyze the social, political, and cultural aspects of that technology and then promote a policy position through an oral presentation to their class and prepare a letter to a congressional representative. Bennett was also a principal in the Citizens Engagement Program with High School Students in conjunction with CSPO and ECAST (see **Section 12 Outreach and Knowledge Transfer**).

CNS-ASU has also arranged for its Science Cafés, held monthly during the academic year in conjunction with the Arizona Science Center (see below) to provide in-service teachers with continuing education credit. In addition, CNS co-director Miller served as a primary consultant to two chapters (4 and 13) in

The Big Ideas of Nanoscale Science and Engineering (Stevens et al. 2009) published by NSTA Press for K-12 science teachers. These chapters are based, in part, on a guide to nanotechnology in society education produced by CNS (Miller et al. 2007).

The relatively small scale of engagement to date is causing us to reconsider our strategy for K-12 education, and we have made contact with leaders in teacher training for K-12 formal science education at the Museum of Science, Boston, and the San Francisco Exploratorium, to help us develop a more ambitious effort. Much of the work done with NISE Net and the Arizona Science Center (see sections above and below) reaches K-12 audiences. It is also the case that one of the target audiences for the *Encyclopedia for Nanoscience and Society* (Guston 2010) is high school students and teachers.

Informal Science Education. CNS-ASU has begun to have a significant impact on informal science education nationally through its partnership with the Nanotechnology Informal Science Education Network (NISE Net) to incorporate research on the ethical and societal implications of nanotechnology into museum programs and exhibits around the country. Early in its operation, CNS produced a guide to this topic (Miller et al. 2007) that NISE Net distributes as part of its Forums Guide and NanoDays Kit. This guide has also been distributed widely to science museums at NISE Net meetings and is available on the CNS-ASU website for download. In addition, NISE Net Director Larry Bell, who has attended nearly all of the CNS All-Hands Meetings and serves on the CNS Board of Visitors, has identified anticipatory governance as a central theme for future NISE Net programming and, more broadly, as the basis for a new model for the role of science museums in informal science education (Bell 2008). Most significantly are the series of workshops currently being planned in conjunction with NISE Net to train museum staff in how to facilitate conversations about nanotechnology and society. Details of this strong collaboration can be found in **Section 12 Outreach and Knowledge Transfer**.

Practitioner Training. The Center has developed and piloted training modules in the ethical and societal implications of nanotechnology for scientists and engineers working in user facilities at the DOE Center for Integrated Nanotechnologies (CINT) and the National Nanotechnology Infrastructure Network (NNIN).

For the first few years, NNIN user facilities were strongly encouraged to use the video (created by Guston and others) and a survey was conducted to evaluate their experience. Respondents at 9 of the 11 user facility sites in the NNIN indicated that they were already using the video, and an additional site indicated that it would be doing so from this point forward. Four sites indicated that the video had been presented at a total of 117 training sessions, with the other sites indicating that users watched the video individually, with no formal records being kept. The sites indicated that approximately 1000 NSE researchers in total had watched the video. The actual use of the video varied. Some sites merely made the video URL link available. Other sites asked users to verify via a signature that they had viewed the video. Others required users to watch the video in groups. One group indicated that questions and comments sometimes follow, and one group indicated that they always follow the video with group discussion.

While the video remains on the NNIN website for use at some sites, after much deliberation NNIN has decided that face-to-face discussions of SEI issues would better engage the researchers at its user facilities. Wetmore attended a workshop in Jan 10 at Cornell University and Bennett attended a workshop in Oct 10 at Washington University in St. Louis to help inject CNS-ASU experience and knowledge into NNIN training across the country. Wetmore, Bennett and Trinidad have developed a thirty-minute module that is presented in conjunction with the health and safety training that all users of the ASU NNIN facility must successfully pass. The module introduces researchers to the practical implications and applications of CNS research and findings, while also making them aware of the support CNS can offer to young scholars in the form of PhD+ opportunities and coursework.

Wetmore and Sarewitz also participated as Faculty in the *IHEST European Summer School: Which Place for Science in the Public Debate?* at the Saline Royale d'Arc et Senans, France in Summer 10. This summer school was established in large part to help local and national French officials reflect on the protests during the government's effort to solicit input into its nanotechnology decisionmaking process. The summer school resulted in a publication that included Wetmore and Sarewitz's lectures in French.

Table 3A: Education Program Participants, Irrespective of Citizenship

		Gender		Race					Mixed-incl.	Mixed-				
Student Type	Total	Male	Female	NA	PI	AA	C	A	NA,PI,AA	C,A	Not Provided	Other Non-US	*Ethnicity Hispanic	Disabled
Enrolled in full degree programs														
Undergraduate														
Masters	44	32	12	1		1	35	7					4	
Doctoral	15	8	7				13	2					2	
Enrolled in NSEC Degree Minors														
Undergraduate														
Masters														
Doctoral														
Enrolled in NSEC Certificate Programs														
Undergraduate														
Masters	10	9	1				9	1					1	
Doctoral	31	18	13			3	26	2					9	
Practitioners taking courses														
Enrolled in NSEC Programs														
Undergraduate														
Masters														
Doctoral														
Practitioners taking courses														
K-12 (Pre-college) Education														
Teachers														
Students														
Total	100	67	33	1		4	83	12					16	

Table 3B: Education Program Participants, U.S. Citizens or Permanent Residents

		Gender		Race					Mixed-incl.	Mixed-				
Student Type	Total	Male	Female	NA	PI	AA	C	A	NA,PI,AA	C,A	Not Provided	Other Non-US	*Ethnicity Hispanic	Disabled
Enrolled in full degree programs														
Undergraduate														
Masters	40	29	11	1		1	33	5					4	
Doctoral	13	7	6				12	1					1	
Enrolled in NSEC Degree Minors														
Undergraduate														
Masters														
Doctoral														
Enrolled in NSEC Certificate Programs														
Undergraduate														
Masters	10	9	1				9	1					1	
Doctoral	30	17	13			3	26	1					9	
Practitioners taking courses														
Enrolled in NSEC Programs														
Undergraduate														
Masters														
Doctoral														
K-12 (Pre-college) Education														
Teachers														
Students														
Total	93	62	31	1		4	80	8					15	

12. Outreach and Knowledge Transfer

The outreach activities at CNS-ASU are, on one hand, tightly integrated with research and education and, on the other, governed by a strategy that aims at developing broad-based capacities among both NSE researchers and various publics. As described in the strategic research plan, CNS-ASU pursues an agenda of foresight, engagement and integration in order to advance its strategic goal of building capacities for reflexivity and anticipatory governance in the NSE enterprise in particular and in society more broadly. CNS-ASU thus has a dual-tracked outreach strategy that includes, in one track, outreach to various lay-publics (**engagement**) and, in the other track, outreach to scientists and engineers (**integration**). In addition, CNS has more traditional outreach and knowledge transfer to professional colleagues via workshops and presentations, as well as a modest technology transfer program associated with InnovationSpace. In YR 7, we have deepened our collaboration with museum professionals and held several high profile events.

COLLABORATIONS WITH THE NANOSCALE INFORMAL SCIENCE EDUCATION NETWORK (NISE NET)
"Nanotechnology is relevant to everyone's lives, and has important societal and ethical implications" is one of the original learning goals established by the Nanoscale Informal Science Education Network (NISE Net). This goal was somewhat of a departure from traditional science museum content; soon after its creation, NISE Net recognized that CNS-ASU could be a valuable partner in developing programs in this area. CNS-ASU continues to have significant and extensive collaborations with NISE Net, such that it will now be named a "core partner," a title formerly reserved for major subcontractors. Bennett, Miller, and Wetmore continue to serve on the NISE Net content committee and Miller serves on the advisory committee. Over the past year we have been asked to help different museum partners locate local experts in the social implications of nanotechnology, which has helped increase the number of museums that are able to tackle these topics successfully. What follows are descriptions of some of the key undertakings in YR 7.

Mini Nano Exhibit
Bennett and Wetmore served as consultants on the most ambitious project NISE Net embarked on last year – the Mini Nano Exhibit project. CNS scholars have provided valuable feedback and helped to evaluate the 200 square foot exhibit that NISE Net has developed and plans to produce 50 copies of to be distributed to museums across the country. Because of the collaborations NISE Net designated one of the first five exhibits produced to be sent to the Arizona Science Center to give CNS-ASU scholars easy access to the display as we develop further activities around it.

Nanoequity Card Game: "Whose Nano Is It?"
NISE Net has also been instrumental in developing the Nanoequity card game "Whose Nano is it?" Some of the NISE Net leadership were present the first time the game was introduced at the 2011 S.NET annual meeting and asked TRC 1 if they would be willing to jointly develop the game. Since Nov 11 Wetmore has collaborated with NISE Net to refine the text, develop new graphics, and review the content for consistency and accuracy. The game has been presented at three separate NISE Net activities as part of the evaluation process and has received a very positive response. NISE Net is currently committed to post the game on its website so that it can be downloaded and used by anyone and will include a hard copy of the game in its 2013 Nanodays kit that will be sent to over 200 sites across the country.

Subsequent to the original development, Wetmore and a number of S.NET colleagues have been developing variations of the game so that its basic lessons can reach an even more diverse audience. While the game was developed for adults, thus far the game has been incorporated into plans to reach at least three additional audiences. First, the game will be the opening demonstration at the Nano and Society Museum Professionalization Workshops that Wetmore and Bennett are developing through NISE Net. It will be used to demonstrate to museum professionals that productive conversations about

nanotechnology and society are possible on the museum floor and provide their first training step in how to facilitate such conversations. Second, the game has been reworked into a much simpler version called "Nano Choices" using a smaller number of cards so that it is accessible to children as young as four years old. And third, the Durham Museum of Life and Science plans to create an entire day's worth of activities around the game during their summer camp events for teenagers. They will have the students play the game several times, challenging them to develop their own visions for nanotechnologies that would benefit the characters they play.

Workshops for Museum Administrators

The major new project CNS-ASU has recently embarked on with NISE Net is the development of a series of workshops for museum administrators to help them train their staff to present the social and ethical implications of nanotechnology on the museum floor. Over the past several years CNS-ASU has developed demonstrations, presentations, posters, and film scripts for NISE Net to help introduce nano and society ideas to museum guests and have helped build up significant trust and good working relationship. In Fall 2011 NISE Net and CNS-ASU came to realize that individual programs were not enough. In order to fully realize the goal of incorporating nano and society into museum presentations, rather than just sprinkling the idea on top of existing programs.

This year instead of an annual meeting, NISE Net held seven node meetings across the country to bring together over 100 museum professionals to discuss NISE Net projects, with a specific focus on nanotechnology and society. For the most part, the museum professionals said that their staffs were hesitant to present topics in the area. Some were afraid of dealing with controversial questions, others simply preferred to focus on being "scientific experts." There was a bit more enthusiasm at the Southwest node meeting, in part because Bennett and Wetmore presented a science café on nanoparticle regulation that a number of people thought could be presented in museums. In the discussions that followed it was decided that workshops specifically designed to train museum staff in how to address the social and ethical aspects of nanotechnology could help to overcome these barriers.

Nano and Society Series

Subsequent to the node meetings, Wetmore and Bennett have worked closely with NISE Net colleagues to develop and organize a series of two-day workshops on "Nano and Society" for museum personnel. The plan is to run four workshops in Sep 12 for 100 museum staff from 50 museums across the country. These two-day workshops will introduce participants to fundamental principles in nanotechnology and society; demonstrate a handful of programs that incorporate the principles; give participants a chance to practice the programs; encourage them to develop their own programs; and provide them with a set of training materials (including games, videos, pocket science props, and lesson plans) so that they are equipped to train the staffs back at their own museums. NISE Net will help to coordinate a series of subsequent engagements including online forums, conference calls, and a follow up workshop at its annual meeting in Dec 12 in Boston to ensure continued discussion and support. In Jan 12 some of the ideas were tested at the Oregon Museum of Science & Industry with over 30 museum professional from across the US. In Mar 12 NISE Net and CNS-ASU conducted a one day pilot of the workshop as a proof of concept at the Arizona Science Center. The pilot was deemed a success by all involved and confirmed that the workshops provided valuable education and had the potential to spark significant changes in museum engagements.

Three Angry Scientists

In Jan 12, playwright Melanie Wehrmacher completed the script of a ten-minute play, "Three Angry Scientists," commissioned by the Science Museum of Minnesota (SMM) and based on an idea from Guston derived from his scholarship on the role of science in regulatory decision-making. SMM will host performances of the play in Spring 12, and Wehrmacher has now completed a new version of the play

that introduces nanotechnology, in the form of a nano-enabled drug, into the decision-making of the scientists who are debating whether or not to approve the drug as safe and effective for human use.

COLLABORATIONS WITH THE ARIZONA SCIENCE CENTER

Over the past year, the already strong collaborations CNS-ASU has had with the Arizona Science Center have strengthened considerably. The Informal Science Education Program that CNS coordinates with the ASU node of the NNIN sends a group of graduate students to present on the museum floor at least once a month throughout the academic year, including the annual Nanodays event. CNS's oldest flagship outreach activity – the Science Café – has been held monthly at the Science Center since 2007. Projects like these have built up a great deal of trust between CNS scholars and the Arizona Science Center administrators. They now see CNS as one of the first organizations they go to in order to develop joint projects. For instance, we collaborated extensively on the "Making Stuff" program the museum ran last year and this year the Bennett and Wetmore serve as the main outside consultants for a grant the Science Center recently received to develop nano podcasts for the museum.

The Science Center has also opens its doors as a place for CNS scholars to develop and do test runs of new projects. For instance, ASC allowed Wetmore to try the Nano Equity game out on an adult audience not familiar with nanotechnology for the first time at the Center's December 2011 "Adult Night" event. That test run provided valuable data and led to a number of important changes in the game's protocol. In Mar 2012, the Science Center hosted the first pilot run of the joint CNS-NISE Net "Nano and Society" training workshop program. Eight staff members took a full day off from their regular duties to participate in the pilot training and provided invaluable feedback that helped to validate the proof of concept.

Finally, the Science Center and CNS are jointly developing a few new projects. Two members of the Center staff saw Bennett and Wetmore present a science café on nanosilver particles in the fall. They decided the program should be adapted for their museum floor, and we have worked with them to refine the presentation so that it can be given by museum staff as a stage show. By the end of Spring 2012 the presentation should be finished, evaluated, and ultimately distributed to other science museums across the US through NISE Net.

The other major joint project has been focused on the Center's Solarville exhibit. The Center's staff members have been disappointed by the design of the exhibit and how it has been received by the public. To assist in the assessment of the exhibit, Wetmore coordinated a project that brought fifteen students and faculty who study solar and renewable energy to meet with Center staff, evaluate the displays, and provide individual written reports on small tweaks, new exhibits, new programs, and revised framing that could increase the effectiveness of the exhibit. One student with an extensive background in the solar industry may serve as an ongoing consultant for the exhibit.

Science Cafes

The successful CNS-ASU Science Café series continued, hosted one Friday each month during the academic year by the Arizona Science Center in downtown Phoenix. Several Fall cafes attracted over 100 people, but numbers dropped noticeably with a change of time for the café (from 5:30pm to 7:00pm). The cafes continued to use their format innovation – pairing a social scientist or humanist with a natural scientist or engineer.

CNS has drawn large crowds to cafes that focus on issues of contemporary concern. For example, in YR 7 cafes were held on science and religion, climate change and novel vaccines. Noteworthy cafes include the holiday-themed café on the environmental impacts of products, *Will our products last? Or is it just a thing of the past*? with CNS collaborator Tom Seager of the

School of Sustainable Engineering and the Built Environment. A popular café in January *What's in Our Skincare?* with CNS ASU Wetmore and a skin care executive was well received. The closing café of the season in May will deal with traffic noise pollution. In addition to outreach and informal education opportunities, the Science Cafes operated by CNS-ASU provide continuing education credits to in-service teachers.

NanoDays 2012

As in previous years, CNS-ASU is participating in NanoDays by adding the societal "so what?" twist on the information and materials provided by NISE Net. In coordination with the NanoDays national program, CNS-ASU sponsors three days of demonstrations about phenomena at the nano-scale. Twenty-four students from graduate and undergraduate classes taught by Bennett and by Wetmore and Thornton, as well as students newly active Informal Science Communication Program participated in public displays at the Tempe Festival of the Arts, a street art fair that attracted upwards of 250,000 visitors and in the official NanoDays event hosted at the Arizona Science Center.

Speed-dating with Scientists

Wetmore (with the help of grad student Kiera Reifschneider) will be organizing a "speed dating with scientists" program at the Science Center's Spring STEMFest event. The event will give museum guests a chance to sit at a table and interact with a scientist. After five to seven minutes the buzzer rings, the guests stands up, finds a new scientist at a table, and gets another five to seven minutes to ask questions to get to know the scientist and his or her work. The goal is to create a casual atmosphere where museum visitors and ASU scientists can get to know each other, break down some of the communication barriers that exist, and perhaps lead to future conversations.

COLLABORATIONS WITH OTHER SCIENCE MUSEUM

Partnership for Education on Climate Change, Engineered Systems, and Society (CCEP)

In YR 6, Miller (co-PI) received a CCEP award (NSF #1043289) to establish a coordinated national network of regionally- or thematically-based partnerships devoted to increasing the adoption of effective, high quality educational programs and resources related to the science of climate change and its impacts. This award to the US National Academy of Engineering (Rachelle Hollander, PI) establishes a Phase I CCEP in collaboration with ASU, the Museum of Science-Boston, the University of Virginia, the Colorado School of Mines, and the Phoenix Union High School District. It focuses on the impacts of climate change for engineered systems, and its goal is to catalyze and transform engineering education in science museums, cities, and undergraduate programs to prepare current and future engineers, policymakers, and the public to meet these challenges.

In YR 7, this partnership developed a comprehensive vision and strategic plan focused on climate impacts on engineered systems and their adaptation. Cutting across themes examine challenges of: (1) governance; (2) justice; (3) sustainability; and (4) public engagement and trust. In addition, the partnership expanded its network to include 13 core institutions and a growing number of informal and formal educational institutions as network partners. The partnership and its strategic plan are represented by a Phase II proposal, with Miller as the lead PI, now under review at NSF.

Climate of Uncertainty: Civic Deliberation and Anticipation

In YR 6, Selin, Miller and Sarewitz collaborated with The Science Museum of Minnesota (SMM), the Institute on the Environment (IonE) at the University of Minnesota, and the Institute for the Future (IFTF) on a proposal to NSF a three-year, full-scale development project to create Climate of Uncertainty – a 5,000-square-foot traveling exhibition, innovative online activities and youth engagement programs about both the fundamentals of climate science and a key element of the social and political context of climate change science: the uncertainty inherent in projecting climate changes into the future. While this project

was rejected by NSF-ISE, in YR 7 key partners continue their collaboration to develop novel ways to engage citizens in discussions about uncertainty and science. In Oct 11, working with the City of St. Paul, Selin and SMM partners designed and organized a civic engagement about climate change adaptation. The aim of the 3-day workshop was to develop scenarios with a diverse range of stakeholders to help them think through the varied, plausible implications of climate change. More details on the research objectives in the RTTA 3 section.

BROADER ENGAGEMENT PROGRAMS AND ACTIVITIES

New Tools for Science Policy

CNS-ASU is leveraging the CSPO DC office to reach out to policy audiences. In YR 7, several CNS researchers presented at CSPO's New Tools for Science Policy series which asks: How do we know what science is "the right science" to do? How can we effectively orient the vast research enterprise to make real progress toward societal goals? Since its inception, CSPO and its network of researchers have been developing models, tools, and methods to help address fundamental questions in science policy. CNS researchers met DC policy audiences to catalyze discussions and collaborations between science policy researchers and decision makers about new ideas and approaches for improving the social value of science and technology. YR 7 CNS researchers include: Lim on *Bytes and Bodies: Social Media and Political Changes*; Fisher on *Self-Critical Public Science: How to Integrate Creativity and Responsibility*; Selin on *Climate of Uncertainty: Civic Scenarios for Decision Making*; and Wetmore on *The Challenge of Path Dependency and the Need for Anticipatory Governance*.

Responsible Innovation: A UK-US Dialogue

On 23-24 Jan 11 CNS-ASU hosted in the ASU Washington Center "Responsible Innovation: A UK-US Dialogue," co-sponsored by the UK Consulate. Attendees from the UK side included Richard Owen (Exeter), Jack Stilgoe (Exeter), and Phil Macnaghten (Durham). Attendees from the US side included CNS researchers Guston, Fisher, Sarewitz, and Davies, as well as Rochelle Hollander (NAE), Michael Gorman (Virginia), and Chris Newfield (UCSB). The two-day dialogue included a two-hour discussion with roughly 20 US program officers and other science policy professionals. Outputs will include a report to be distributed through CNS-ASU, Exeter, and other channels, as well as a multi-authored chapter for a volume that Owen is editing on responsible innovation.

Informal Science Communication Program

During YR 7, CNS-ASU and ASU's node of the National Nanotechnology Infrastructure Network (NNIN) continued a program in informal science communication in cooperation with the Arizona Science Center. Graduate students interested in working with the public to promote a broader understanding of science and technology receive training in methods and techniques to engage with diverse audiences. These "Science Liaisons" then have the opportunity to work on the floor of the Arizona Science Center once or twice a month during the semester. Students of all disciplines were invited to apply. Faculty leads Thornton, Wetmore, Bennett, Harsh, and student leader Trinidad provide ongoing support and mentorship through informal monthly group meetings and an online organizational space in the university's courseware system, Blackboard. A set of informal and formal science educational resources, training materials, and a collaboratively-edited Google calendar schedule are accessible through the community site. Thirty-five students are now members of the online group and receive regular announcements about program activities; ten students have completed the training and are active volunteers. The program has significantly strengthened the relationship between CNS-ASU and the Arizona Science Center.

ECAST

In Apr 10, the Woodrow Wilson International Center for Scholars (WWIC) released the report *Reinventing Technology Assessment: A 21st Century Model* by Richard Sclove, founder and senior member of the Loka Institute, a non-profit research and advocacy organization concerned with the social,

political, and environmental repercussions of research, science and technology. The report gives an overview of participatory technology assessment, reviews its applications in Europe and some prototypes in the US, and forwards a proposal to create the ECAST network – Experts and Citizen Assessment of Science and Technology (www.ecastnetwork.org) – a consortium of NGOs, non-profits and universities that administer public engagement events on scientific and technological topics relevant to policy makers. Guston and a network of partners at WWIC, Loka, Museum of Science Boston, Pomona College, CSPO and others discuss projects, funding mechanisms and network governance in bi-weekly conference calls.

Since the release of the report, ECAST partners have conducted several small-scale demonstration citizen engagement projects at several home institutions about emerging technologies including geoengineering, nanotechnology, and synthetic biology. ECAST has been instrumental in coordinating the participation of US sites in the Danish Board on Technology's World Wide Views (WWV) on Global Warming (which overlapped substantially with NCTF sites) and its upcoming WWV on Biodiversity. ECAST is also represented on a Sustainability Research Network proposal that Miller is part of, led by Golden (Duke). The nature of ECAST and CNS-ASU's involvement with it are directly derived from the partnership between CNS-ASU and NISE Net. ECAST manifests anticipatory governance activities and represents the building of a distributed capability among a network of organizations to extend and broaden learning about engagement techniques around nanotechnology to other emerging technologies.

Sustainable Anticipatory Governance in China
In YR 7, TRC 2 co-leader Wiek was invited to present to visiting urban planners from China about bringing anticipatory governance, sustainability, and planning together. The presentation and dialogue occurred at ASU's downtown campus in the Planning and Urban Research Laboratory (PURL) building. Wiek was joined by City of Phoenix planners to engage 35 Chinese planners for a half-day session.

Presentations to Public Audiences
CNS-ASU researchers have made numerous presentations to public audiences, including some 60 cumulatively to specifically policy audiences and 61 to lay audiences. Beyond those mentioned above, highlights in YR 7 include:

- In Mar 12, Wetmore presented "A Users Guide to Everyday Technology." Keynote Speech. Issue Day, Maumee Valley Country Day School, Toledo, OH.
- Bennett and Wetmore (Sep 11) presented "Science and Regulatory Challenges of Commercial Nanoparticles" at a Science Café in Berkeley, CA.
- Guston presented "The Role of Nanotechnologies in our Future" to the Humanist Society of Greater Phoenix (May 11).

Presentations to Policy and Professional Audiences
- Selin (July 11) was invited to present "Urban Foresight: Rethinking Technology in Complex Systems" at the Joint Research Centre (Ispra, Italy).
- Youtie, Porter, and Newman presented Panel on Nanotechnology, Innovation, and Commercialization: Learning about a Technology Cycle through Patent Data to the USPTO's Patent Statistics for Decision Makers (Alexandria, VA) November 16-17, 2011.
- Corley & Scheufele (Jul 11) presented at the National Nanotechnology Initiative, Strategic Stakeholder Workshop, Washington, DC

INTEGRATION PROGRAMS AND ACTIVITIES

National Nanotechnology Infrastructure Network
In addition to the Informal Science Education Training program for graduate students mentioned

previously, the CNS-ASU continues broader discussions about integrating SEI issues in the NNIN. In Nov 11, Bennett attended the annual NNIN SEI Coordinators meeting at George Washington University where he presented such CNS-ASU programs such as the DC summer session and the 1-credit course for scientists and engineers. Wetmore and Bennett have developed with Thornton, leader of the ASU NNIN node, a twenty-minute module on SEI issues that is currently presented monthly in conjunction with the health and safety training that all users of the ASU NNIN facility must successfully pass. We use this orientation as a means to introduce researchers to the practical implications and applications of CNS research and findings, while also making them aware of the support CNS can offer to young scholars in the form of PhD+ opportunities and coursework.

In Nov 11, CNS-ASU co-hosted along with the EESE grant, the National Nanotechnology Infrastructure Network, and NISE Net a Congress on Teaching the Social and Ethical Implications of Research. The event was the first of its kind in the United States and attracted over 100 scholars from across the country including engineers, social scientists, ethicists, graduate students, postdocs, museum professionals, and a panel of young speakers who work for nonprofits that promote SEI education. The primary goal of the Congress was to disseminate the models developed and the lessons learned on how to best get graduate students to consider and grapple with the broader implications of their research. The NNIN held the annual meeting of its Societal and Ethical Implications working group at the event. The response by the participants was overwhelmingly positive and it is likely that the event will be repeated, perhaps on a bi-annual basis.

Hispanic Research Center

CNS-ASU continues its productive partnership with the Hispanic Research Center. Bennett and Harsh offered another 7-week short course entitled "Introduction to Making STEM Research Socially Relevant," in Fa 11. HRC funded two students in Jun 11 to attend the DC summer session and Carl Ballard, a student that first engaged with CNS-ASU in the previous iteration of the short course and subsequently attended the DC summer session served as a student liaison for the second DC summer session in Su 11.

Research Integration Presentations

CNS-ASU researchers have made a cumulative 64 presentations to audiences with a specifically technical orientation. Beyond those mentioned above, highlights in YR 7 include:

- Guston (April 11) presented "Nano and the City: Anticipatory Governance and Urban Sustainability" at the 8th Annual U.S. - Korea Forum on N. California Technical Institute, Pasadena, CA.
- Shapira, Youtie and Porter presented in Nov 11 "Trajectories of Global Nanotechnology Commercialization" at an IGERT Seminar, Georgia Institute of Technology, Atlanta, GA.
- Cozzens (July 11) presented "Equity, Equality, and Nanotechnology" at the Tshwane University of Technology, Pretoria, South Africa

COLLABORATIONS WITH ACADEMIC COLLEAGUES

Society for the Study of Nanoscience and Emerging Technologies (S.NET)

In Nov 11, CNS-ASU and CNS-UCSB collaborated to jointly host the third annual meeting of S.NET, the Society for the Study of Nanoscience and Emerging Technologies, a young international professional society created in part out of NSF's Nanotechnology in Society Network. The meeting was hosted physically in Tempe, AZ by CNS-ASU and virtually by CNS-UCSB (http://www.cns.ucsb.edu/snet2011), and ASU's Guston and UCSB's Herr Harthorn chaired the program committee. The meeting drew more than 200 registrants from more than 20 countries and presented more than forty-five panels and other activities. Keynote speakers included Steve Rayner (Oxford, UK), Nicholas Pidgeon (Cardiff, UK), Noela Invernizzi (FU Parana, Brazil), Geri Augusto (Brown, USA), Ann

Bostrom (Washington, USA), and a plenary panel on "Immigration and Emerging Technologies" included Darren Petrucci (ASU), Ricardo Dominguez (UCSD), and Simone Brown (UT Austin). The program also featured emerging technology-themed walking tours of Tempe and Phoenix, short theatrical performances by NISE Net, a poster session with table-top demonstrations and videos, and student-organized activities. The conference provided ample evidence of a flourishing international community of scholars dedicating effort to describing, theorizing, and debating the societal implications of new [nano]technologies. Full participation by the rising generation of nano and new technology ELSI scholars was supported by a NSF supplement to CNS-ASU and by CNS-ASU and CNS-UCSB.

Emerge

Over the course of three days the *Emerge* event (described in detail in RTTA 3 section) engaged more than 700 faculty, students, professionals and members of the local community in an exploration of the future of technology and society. Participants included:

- More than 150 faculty and students from the diverse disciplinary backgrounds participating in workshops;
- Scores of faculty and students who lent their time and intelligence in the creating installations, exhibits and the Immerge performance;
- Workshop leads from School of Art, Interdisciplinary Studies, Education Leadership and Innovation, CSPO, ASU Lightworks, NOAA, and private sector organizations;
- Keynote speakers: Stewart Brand, Sherry Turkle, Bruce Mau, Bruce Sterling and ASU President Michael Crow; and
- Special (self-financed) guests from Shell Gamechangers, the Gates Foundation, Microsoft Research, Intel, American Museum of Natural History and Global Business Network.

The ideas behind *Emerge* were broadly publicized in *Wired*, *Slate* and on numerous blogs. Advertisement for the event appeared on the *Science* website as a banner, in an insert in the *New York Times*, local papers, and on prominent signage around campus. Selin, Rikakis and Garreau appeared on a local PBS station to promote the *Emerge* event (https://asunews.asu.edu/20120229_video_emerge). There were more than 1000 tweets tweeted about the event.

Presentations to academic and professional audiences

CNS-ASU researchers have made 353 cumulative presentations to collegial academic and professional audiences. Beyond those mentioned above, highlights in YR 7 include:

- Youtie (Presenter), Shapira, and Kay presented at the annual Technology Transfer Society Conference Augsburg, Germany (Sept 11).
- In Nov 11, Harsh presented "'Issues Facing STS Research on the Governance of Emerging Technologies in sub-Saharan Africa," *Annual Meeting of the Society for the History of Technology*, (Cleveland, OH)
- Porter, Guo and Huang presented "Empirically informing a technology delivery system model for an emerging technology: Illustrated for dye-sensitized solar cells" at the 4th International Seville Conference on "Future-oriented Technology Analysis (FTA) in Seville, Spain (May 2011)
- Cozzens presented "Environmental Health and Safety in Nanotechnology: A Critical Interface with the Public," NanoAfrica 2012, University of Freestate, South Africa, (Apr 12).
- In April 11, Corley presented "Soft Law Mechanisms for Nanotechnology Governance" At the Workshop on Soft Law Oversight Mechanisms for Nanotechnology, Scottsdale, AZ.

COLLABORATIONS/INTERACTIONS WITH INDUSTRY AND OTHER SECTORS

CNS Private Sector Engagement

Given that private sector research and development is key to how nanotechnology will be understood, applied and regulated in the US over the coming years, this has been a priority area for CNS-ASU activities (with private sector nanotechnology understood as inclusive of all nano-related activity not publically funded, including business, law, private policy research, computing and high-tech industry, housing and architecture, and NGOs and civil society organizations). The coordination of CNS-ASU's private sector outreach, which in YR 6 was funded through a supplemental grant, is now being run through the Center's core activities. As a result over the last year this work has focused on the consolidation and maintenance of private sector contact building and collaboration. Based on the inventory and on the contacts made over the last years, an updatable and searchable database has been developed for internal CNS-ASU use. In YR 7, there have been three main foci within this outreach program.

The CNS-ASU workshop "Nanotechnology, Business and Anticipatory Governance" was convened as a part of this program of activities, and was an opportunity for participants – who were drawn from nanotechnology-oriented business, law, NGOs and policy – to inform the research that CNS-ASU carries out, as well as to hear about some of the relevant work CNS does in researching, communicating and discussing the societal dimensions of nanotechnology. Held in May 11, it covered four key areas: mapping nanotech's development; decision support; futuring and foresight in nanotechnology; and public perceptions of nanotechnology. The discussions led to agreement on a number of key synergies between CNS-ASU research and private sector interests; these included the need for research on international development of the technology and the potential for developing new user groups for our research. Overall, the workshop covered a wide range of topics and was seen as a positive move by participants. Contacts were built both between CNS and those involved in different sites of private sector nanotechnology, and between individual participants. New learning was developed around the research needs, interests, and priorities of those working in the private sector. Future activities are likely to build on these successes by continuing to focus on building relationships and enhancing communication between different actors with interests in the societal implications of private sector nanotechnology. Additional details are available in the workshop report (Davies 2011).

A number of these relationships have been developed and extended. For instance, continued interaction has occurred with the Institute for the Future, who have collaborated on joint research proposals with CNS-ASU researchers, and a number of local nano-oriented businesses, with key actors having been interviewed for CNS-ASU research. These short interviews with a number of workshop participants around private sector perspectives on responsible development and anticipatory governance have been video recorded and produced for the CNS-ASU website.

A key feature of these relationships is that they are increasingly distributed throughout CNS-ASU rather than focused in the person of the private sector liaison. In particular, contacts made at the May 11 workshop or through 2010-11 have been taken up and used by those working on TRC 2, RTTA 1, and RTTA 3 research. TRC 2 in particular conducted 45 interviews with private sector actors to characterize the nanotechnology innovation system in Phoenix drawing from CNS-ASU's network.

The second focus area has been a continued consolidation of the 2010-11 private sector engagement activities, as understood as a research enterprise. CNS-ASU researcher Davies has continued to collaborate with other scholars who work on the societal aspects of private sector nanotechnology in order to analyze industrial dynamics around nanotechnology, responsibility, and anticipatory governance. Her research activities have included an international conference presentation, the organization of a panel at the 2011 SNET Meeting, editing a special issue of the *Journal of Nanotechnology Law and Business* (to be published in late 2012), and two collaborative manuscripts.

The final area has been CNS-ASU's involvement in the *Emerge* conference. This event (held 1-3 Mar 12) brought together artists, scientists, engineers, students, and educators from ASU and beyond in an effort to "redesign the future." Taking ASU research in areas such as environmental biotechnology and smart computing as its inspiration, the workshop enabled small groups of participants to interrogate the directions such technologies are taking. *Emerge* drew in a number of key private sector players in future studies, including experts from Intel, the Institute for the Future, the Near Future Laboratory, and LightWorks, enabling CNS-ASU researchers to develop new connections and partnerships around common interests and synergies.

InnovationSpace

CNS-ASU has a modest technology transfer program through its support of InnovationSpace (ISpace). One important output of ISpace is an invention disclosure by each of the cross-functional undergraduate teams. ISpace teams working with CNS have disclosed 12 inventions to ASU's technology transfer arm, Arizona Technology Enterprises (AZTE) and at the end of the year will submit 3 additional invention disclosures. These disclosures have generally been the endpoint of technology development from ISpace, as neither it nor CNS-ASU has had the resources to perform follow-up research and development – although ISpace faculty leader Boradkar and Guston are attempting to cultivate potential sources of support.

Nanotechnology Innovation in Metropolitan Phoenix

In Oct 11, TRC-2 conducted a "Synthesis Workshop of Interview Outcomes" workshop with representatives from the Arizona Commerce Authority (ACA), Arizona Corporation Commission (ACC), Arizona Nanotechnology Cluster (ANC), Arizona Biotechnology Association (ABA), Arizona Technology Council (AzTC), Science Foundation Arizona (SFA), Arizona State University (ASU), and Greater Phoenix Economic Council (GPEC). Additionally, representatives from small business entrepreneurs, business consultants, and patent attorneys were in attendance. Additional details are available in the workshop report (Wiek and Foley 2011).

Presentations to private sector/industrial audiences

CNS-ASU researchers have made a cumulative 40 presentations to audiences with a specifically private sector/industrial orientation. Beyond those mentioned above, highlights in YR 7 include:

- Youtie, Newman, Porter (Nov 11) delivered presentations as part of the "Panel on Nanotechnology, Innovation, and Commercialization: Learning about a Technology Cycle through Patent Data," at the USPTO's Patent Statistics for Decision Makers, Alexandria, VA.
- Davies conducted a "NanoEthics: Responsibility, Risk, and Responsible Innovation" Training Session for the SESHA (ESH for High Technology) Annual Symposium (May 12), Scottsdale AZ.

DOCUMENTARY AND VIDEO/MEDIA PROJECTS

CNS-ASU's media initiative recognizes that interdisciplinary and integrated communications about the societal dimensions of nanotechnology require a diverse outreach strategy. CNS-ASU thus continues to develop its new media project to infrastructure, workflows, and capacities. The goal of the project is to expand the reach of the Center's regular research and engagements through a variety of media. The Center is in the process of redesigning its website, in part to make video and other material more prominent and accessible.

Nano-Vods

CNS's Occasional Speaker and Science Café Series continue to be produced on an ongoing basis. In YR 7, CNS hosted many international visitors whose talks are recorded and edited and made available on the

CNS-ASU homepage and available through YouTube. The Science Café Nano-Vods also appear in a playlist associated with the Science Café online events list (http://phoenixsciencecafe.wordpress.com/).

CNS Project Documentaries

In addition to capturing regular live events, CNS-ASU produces occasional, thematically-based video pieces to communicate research ideas generated at the Center in multiple media formats. One such piece, linked to the Fall 09 Plausibility Project workshop, has been added. Another piece featuring interviews with the authors contributing to the second volume of the *Yearbook* premiered during Summer 10 and is also available through the publisher, Springer. In YR 7, many of the talks at the SEI conference were captured and are available. As with the CNS-ASU website content, the digital video pieces will be discoverable through Google and other web search engines; they are also available through YouTube.

STIR Documentary: Lab Life

In YR 7 Frank Theys has begun making plans with Fisher to begin training two "embedded humanists" that Theys hopes to film working in laboratories for his planned documentary entitled Lab-Life. This is a documentary directed by Theys and produced by Savage Films (Belgium) and Cobos Films (The Netherlands) in a coproduction with the public broadcaster ZDF/ARTE (Germany/France), supported by the Flemish and the Dutch Film Funds, the European MEDIA program and the CERA Art Foundation. The film will have a cinema release (90 min.) and a 60 min. or series version for television and will be distributed by Autlook Films (Austria).

InnovationSpace Everwell Video

In YR 5, CNS-ASU started production on a documentary featuring the product innovations and educational experiences occurring in the InnovationSpace program. The film, directed by KAET-TV executive producer Melody Cavanary, highlights a CNS-ASU InnovationSpace project from YR 4, Everwell. Everwell is a nano-enabled condensation device that extracts water from air potentially enabling a clean, convenient, off-the-grid solution designed for Arizona's Native American communities. The video is now available in the CNS-ASU video stream.

Nano in Everyday Life Film

With filmmaker and architect Alex Gino, in YR 7, Selin finalized a film oriented around exploring the potential risk and benefits of nanotechnology in the city. The film highlights how nanotechnology, while "invisible," shows up in a variety of mundane household products today while also promising to be relevant for more substantial urban infrastructures (e.g. water filtration systems, energy grids, etc.). The 3-minute film poses the question, "Where is your nano?" to viewers, inviting them to reflect on the trade-offs and path dependencies latent in technological progress. The Center has used the film at conferences and in the classroom and is exploring how to use the video to engage citizens to find out "Where is your nano?"

13. Shared and other Experimental Facilities

While CNS-ASU has no physical science or engineering experimental facilities as such, it has created a nexus of exciting, cutting-edge inquiry that has drawn large numbers of scholars, many of them international, to visit and collaborate with us in a variety of capacities. The Center has a physically coherent space – integral with its parent center, the Consortium for Science, Policy and Outcomes (CSPO) – and sufficient capacity and flexibility to host visitors. Since beginning operation in Oct 05, and according to rigorous selection criteria, CNS-ASU has hosted numerous visitors including some eighty-three international scholars, students, and policy practitioners from more than twenty countries. This section reports on the interactions that CNS-ASU has generated, which in turn point to the Center's value as a destination for visiting international scholars and its role as the central node in a widening international network.

To provide meaningful structure for our reporting on these visits, we limit our account here to include only a subset of these interactions, based on three rigorous selection criteria. First, we only report on visitors who come from outside the US to CNS-ASU or one of its nodes. Thus, in past years, we have not counted Bowman (Northern Ireland) or twelve other international visitors who attended the fourth STIR project workshop because it was held in Washington DC. Second, we only report on visitors who have no formal positions within US institutions, whether at ASU or elsewhere. Thus, in past years, we have not counted international students such as Calleja-Lopez (Spain), who had a Fulbright scholarship to attend ASU; Bal, Gatchair and Kay (who received assistantships from Georgia Tech); Hu (Taiwan), Kim (Korea), Luk (Hong Kong), Stavrianakis (UK) and Zhu (China), who currently have or have had appointments either at ASU or another US institution; or international post-doctoral scholars such as Davies (UK) or Rodriguez (Basque Country) who have appointments at ASU. Third, we only count one member of each group of two or more visitors from the same institution or country (except in cases where members engaged in separate Center interactions that did not involve the group as such). We thus have counted Naranjo (Ecuador) and Hosono (Japan), but not the other five scholar-practitioners who comprised the same South American and Japanese delegations, respectively.

In YRs 1-6, CNS-ASU was visited by sixty-six international visitors who fit these criteria. Visits from these people varied in length of stay, ranging from a few days to several months, but in nearly every case the visitor provided a lecture or seminar on his or her work related to nanotechnology in society and met intensively with CNS-ASU researchers. These visitors included faculty, students, and policy practitioners.

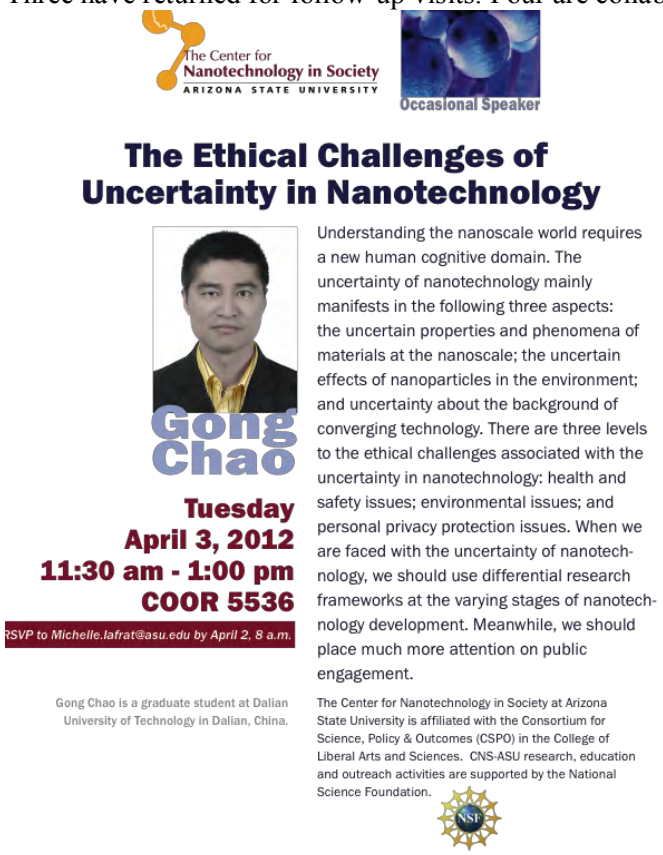
In YR 7, seventeen visitors who fit the three criteria specified visited CNS-ASU, including:

1. Greg Adamson – University of Melbourne, Australia
2. Maj Munch Anderson – Technical University of Denmark
3. Philip Brey – University of Twente, The Netherlands
4. Gong Chao – Dalian University of Technology, China
5. Patrick Feng – University of Calgary, Canada (visit both CSPO and CNS)
6. Torsten Fleischer – Institute for Technical Assessment and Systems Analysis, Germany
7. Cecilie Glerup – Copehagen Business School, Denmark
8. Raffael Himmelsback – Universit de Lausanue, Switzerland (visiting both CSPO and CNS)
9. Maja Horst – Copenhagen University
10. Denisa Kera – National University of Singapore
11. Shinichi Kobayashi – Nagoya University, Japan (visiting both CSPO and CNS)
12. Melian Liao – Tsinghua University, China
13. Federica Lucivero – University of Twente, The Netherlands
14. Gerd Scholl – Institute for Ecological Economy Research, Germany
15. Jeong Yim Seo – Ehwa Women's University, Korea

16. Jianying Wen – University of Jiangsu, China (visiting both CSPO and CNS)
17. Gregor Wolbring – University of Calgary, Canada

Also in YR 7, fifty-four (54) international visitors came to the Center in conjunction with the S.Net Conference, not including at least some of those listed above.

YR 7 CNS-ASU visitors consist of faculty, students and policy practitioners who come from ten countries. Several YR 7 visitors are developing articles that grow out of their interactions with the Center. Three have returned for follow-up visits. Four are collaborators on the separately-funded STIR project.



Several of our YR 7 visitors were students, three of whom are involved in the STIR project. In general, all visiting graduate students receive mentorship from CNS-ASU researchers and have opportunities to present and to publish. One YR 7 international visitor to the Center was a policy practitioner working for a publicly funded technology assessment institution.

This year we also separately report on YR 7 international visitors to Georgia Tech in connection to RTTA 1. These thirteen visitors (which are not tallied in the above numbers) include:

1. Donghua Zhu – Beijing Institute of Technology, China (Professor)
2. Abdullah Gok – University of Manchester, UK (Senior researcher)
3. Evgeny Klochikhin – University of Manchester, UK (Student)
4. Sean Rothman – University of Manchester, UK (Professional)
5. Scott Cunningham – TU Delft, Netherlands (Professor)
6. Ismael Rafols – University of Sussex, UK (Professor)
7. Zhengyin Hu – Chinese Academy of Sciences, China (Professional)

8. Yi Zhang – Beijing Institute of Technology, China (Student)
9. Tingting Ma – Beijing Institute of Technology, China (Student)
10. Soon Cheon Byeon – Korea Institute of Science and Technology Evaluation and Planning, Seoul, Korea (Senior Researcher))
11. Fan Wei – Beijing Institute of Technology, China (Student)
12. Diego Chavarro - University of Sussex, UK (Student)
13. Mario Coccia - Italian National Research Council, Turin Italy (Senior researcher)

Sample publications or publishing activity in YR 7 by international visitors to the Center that stemmed from or were shaped by their interactions with CNS-ASU include the following articles and commentary pieces that were published in a special issue of *Science and Engineering Ethics* that was guest-edited by Fisher:

1. Horst, M. 2011. "Taking Our Own Medicine: On an Experiment in Science Communication." *Science and Engineering Ethics* 17(4):801-16.
2. Laurent, B. 2011. "Scholarly intervention in public engagement: The example of nanotechnology policy in France." *Science and Engineering Ethics* 17(4):649-66.
3. Mohr, A. 2011. "Publics in the Making: Mediating Different Methods of Engagement and the Publics These Construct Commentary on: "Technologies of Democracy: Experiments and Demonstrations." *Science and Engineering Ethics* 17(4):667-72.
4. Schuurbiers, D. 2011. "What Happens in the Lab Does not Stay in the Lab: Applying Midstream Modulation to Enhance Socio-Ethical Reflection in the Laboratory." *Science and Engineering Ethics* 17(4):769-88.
5. te Kulve, H. and A. Rip. 2011. Constructing Productive Engagement: Pre-engagement Tools for Emerging Technologies. *Science and Engineering Ethics* 17(4):699-714.
6. van Est, R. 2011. "The Broad Challenge of Public Engagement in Science Commentary on: "Constitutional Moments in Governing Science and Technology." *Science and Engineering Ethics* 17(4):639-48.
7. Van Oudheusden, M. 2011. Questioning "Participation": A Critical Appraisal of its Construction in a Flemish Participatory Technology Assessment. *Science and Engineering Ethics* 17(4):673-90.
8. Wynne, B. 2011. "Lab-Work Goes Social, and Vice-Versa: Strategising Public Engagement Processes. Commentary on: "What Happens in the Lab Does Not Stay in the Lab: Applying Midstream Modulation to Enhance Reflection in the Laboratory"." *Science and Engineering Ethics* 17(4):791-800.
9. Von Schomberg, R. 2011. "On Identifying Plausibility and Deliberative Public Policy. Commentary on "Negotiating Plausibility: Intervening in the Future of Nanotechnology"." *Science and Engineering Ethics* 17(4):739-42.

YR 7 visits also led to or coincided with several instances of knowledge transfer, dissemination, and application. STIR project alumnus Daan Schuurbiers has started a private consultancy called "The Pilot Project" in the Netherlands that draws heavily on his experience in the STIR project and his knowledge of midstream modulation. Rune Nydal and Astrid Lagreid are currently working with a postdoc at the Norwegian University of Science and Technology to conduct an extended STIR-inspired laboratory engagement study. In YR 7, after several visits to the US, Frank Theys has begun making plans with Fisher to begin training two "embedded humanists" that Theys hopes to film working in laboratories for his planned documentary entitled *Lab-Life*. This is a documentary directed by Theys and produced by Savage Films (Belgium) and Cobos Films (The Netherlands) in a coproduction with the public broadcaster ZDF/ARTE (Germany/France), supported by the Flemish and the Dutch Film Funds, the European MEDIA program and the CERA Art Foundation. The film will have a cinema release (90 min.) and a 60 min. or series version for television and will be distributed by Autlook Films (Austria).

These activities and capacities have enabled CNS-ASU to become increasingly involved in arranging and participating in international events that take place outside of our physical space proper and that extend the reach and vibrancy of our network of partners and collaborators. Over the course of its four workshops, the STIR project has worked with dozens of students, faculty and policy practitioners from over a dozen countries.

14. Personnel

The Center is managed by a Director (Guston), an Associate Director (Miller), and an Executive Committee composed of the Center's team leaders and institutional PIs. In addition to Guston (ASU) and Miller (ASU), Center co-PIs are Elizabeth Corley (ASU), to recognize her work across RTTAs, Dietram Scheufele (Wisconsin) and Jan Youtie (GA Tech) – to recognize the deep partnership with those subcontracting institutions – Deirdre Meldrum (ASU), recently Dean of the Ira A. Fulton Schools of Engineering and now advisor to President Crow on special projects, to acknowledge our shifting agenda to include greater collaboration with engineering faculty.

The Center also relies on three assistant directors: Fisher, assistant director for international activities and is the team leader for RTTA 4, Selin, assistant director for outreach and is team leader for RTTA 3, and Wetmore, assistant director for education and is team leader for TRC 1.

CNS-ASU has three full-time staff: Regina Sanborn, promoted in the current year from Program Manager to Assistant Director, who reports to the Director; Michelle Iafrat, promoted from Administrative Associate to Program Coordinator, who reports to the Assistant Director; and a Program Coordinator position for communication that reports to the Assistant Director. In Jul 11, the Center hired Elizabeth Curran as the Communication Coordinator, but she left the position in Jan 12. We are currently using some of the resources from this line to hire a university-approved web developer, and the Center will soon open a new search for this line.

CNS-ASU has a set of team leaders for each of its major RTTA and TRC research programs. These leaders are spread across the Center's participating institutions and in some instances overlap with institutional leaders (see below). The team leaders currently are:

RTTA 1: Jan Youtie, GA Tech; Jose Lobo, ASU
RTTA 2: Elizabeth Corley, ASU; Dietram Scheufele, Wisconsin
RTTA 3: Cynthia Selin, ASU; Merlyna Lim, ASU
RTTA 4: Erik Fisher, ASU; Elizabeth Corley, ASU

TRC 1: Jameson Wetmore, ASU; Susan Cozzens, GA Tech
TRC 2: Arnim Wiek, ASU; Sander van der Leeuw, ASU

This group convenes monthly in a telephone call as the Executive Committee. CNS-ASU also communicates internally through a regular lab meeting, held every other week, for personnel at ASU, and regular lab meetings held at similar intervals among the Wisconsin and GA Tech groups, as well as between GA Tech and ASU for TRC 1. A listserv dedicated to CNS-ASU affiliated personnel at all its institutions also facilitates communication.

Much of the interaction among CNS personnel is driven by both the preparation for and the consequences of the All-Hands meeting. The first All-Hands meeting, held 19-21 April 2007, involved more than fifty faculty and student researchers from the several universities involved in CNS-ASU, plus about one dozen specially selected nano-in-society scholars from outside of CNS. CNS-ASU held its second All-Hands meeting 23-25 Apr 08.

CNS-ASU held a Visioning Workshop in Oct 08 to engage in reflexive scrutiny of our future visions of anticipatory governance and RTTA. It included CNS-ASU research, education, and outreach leadership, as well as a few select outsiders and several of our NSE research collaborators. The meeting helped feed into the Center's strategic planning process and prepared for the All Hands meeting.

CNS held its third All-Hands meeting on 14-16 Jan 09, the major focus of which was preparing for the renewal effort. Seventy individuals were in attendance representing ASU (researchers, students and staff), CNS-affiliated universities (researchers and students), and others in the nano-in-society field. Our fourth All-Hands meeting was held 11-13 Jan 10, with sixty-four in attendance representing ASU (researchers, students and staff), CNS-affiliated universities (researchers and students), and several representatives from NISE Net. Our fifth All-Hands Meeting was held on 10-12 Jan 11, with fifty-seven in attendance representing ASU, CNS-affiliated researchers at other universities, several representatives from NISE Net, and a newly constituted Board of Visitors.

In the reporting year, CNS-ASU held its All-Hands meeting – with 51 in attendance including its Board of Visitors – in conjunction with the 3rd Annual Meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET), co-hosted by CNS-ASU and CNS-UCSB in Tempe, AZ on 7-10 Nov 11.

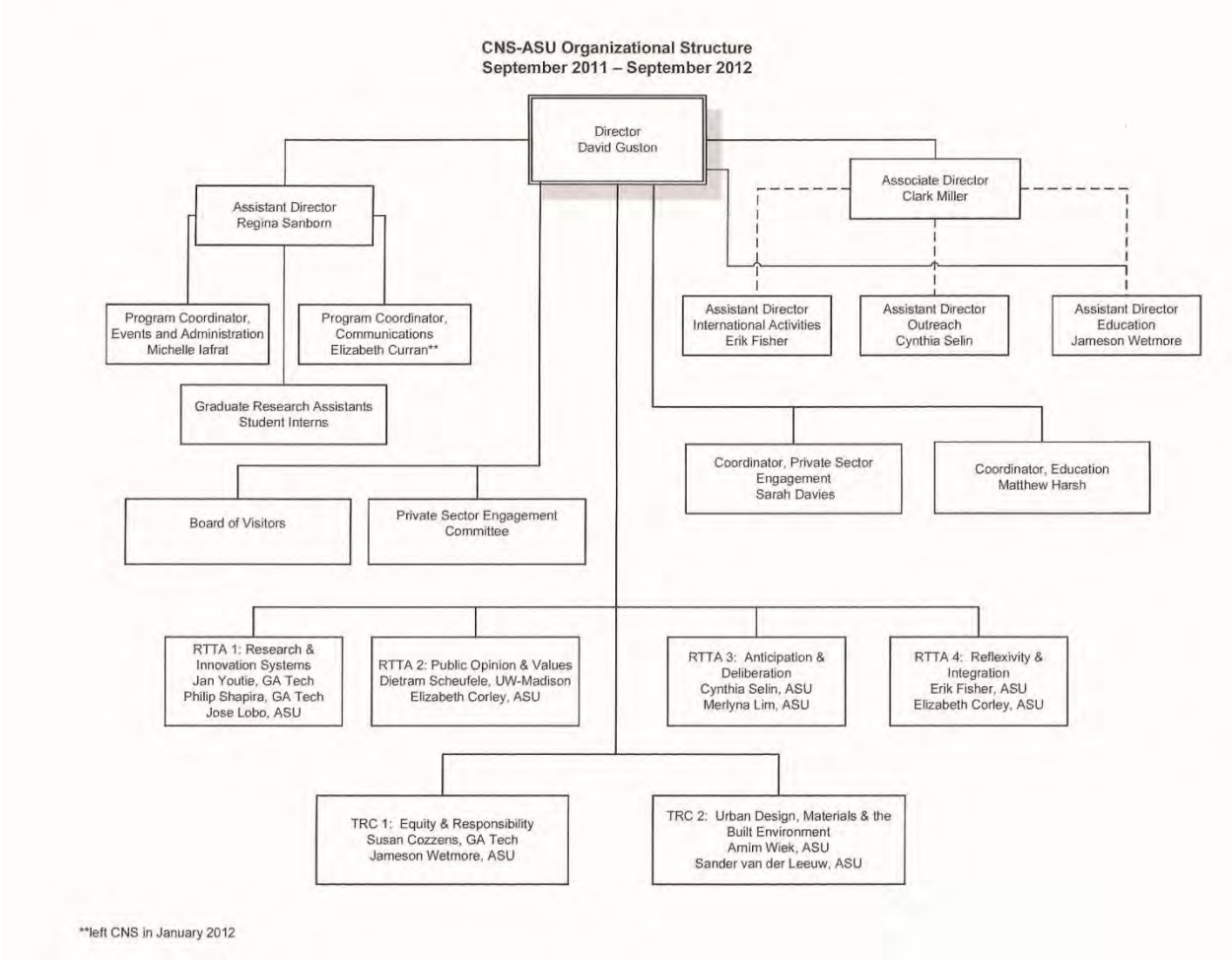


Table 4A: NSEC Personnel, Irrespective of Citizenship

							Citizenship Status												
							U.S. Citizen or Permanent Resident												
					Gender		Race					Mixed-incl.	Mixed						
Personnel Type				Total	Male	Female	NA	PI	AA	C	A	NA,PI,AA	C,A	Not Provided	Other Non-US	*Ethnicity Hispanic	Disabled	% NSEC Dollars
Director				1	1					1								0%
Asc. Dir.				1	1					1								0%
Team Leaders				12	7	5	0	0	0	11	1					1		50%
Staff				3	0	3				3								75%
Collaborators				507	313	194	2	0	3	462	39					9	1	0%
Research																		
	Post Docs			16	9	7	0	0	0	12	4					2	0	50%
	Doc/Mas. Students			145	74	71	0	1	2	118	24					11	0	50%
	Undergraduate Students			44	28	16	0	0	1	39	4					5	0	100%
Curriculum Development and Outreach																		
	Senior Faculty																	
	Junior Faculty																	
	Research Staff																	
	Visiting Faculty																	
	Industry Researchers																	
	Post Docs																	
	Doctoral Students																	
	Masters Students																	
	Undergraduate Students																	
REU Student, if applicable																		
	NSF REU Program																	
	NSF/NSEC Program REU																	
	NSEC's Own REU																	
Other Visiting College Students																		
Pre-college (K-12)																		
	Students																	
	Teachers - RET																	
	Teachers - non-RET																	
TOTALS				**729**	**433**	**296**	**2**	**1**	**6**	**647**	**72**				**0**	**28**	**1**	

Table 4B: NSEC Personnel, U.S. Citizen or Permanent Resident

					Gender		Race					Mixed-incl.	Mixed					
Personnel Type				Total	Male	Female	NA	PI	AA	C	A	NA,PI,AA	C,A	Not Provided	Other Non-US	*Ethnicity Hispanic	Disabled	% NSEC Dollars
Director				1	1					1								0%
Asc. Dir.				1	1					1								0%
Team Leaders				7	3	4				7								50%
Staff				3		3				3								75%
Collaborators				409	247	162	1		3	396	9					6		0%
Research																		
	Post Docs			9	7	2				9						2		50%
	Doc/Mas. Students			101	48	53			2	95	4					4		50%
	Undergraduate Students			37	24	13			1	35	1					2		100%
Curriculum Development and Outreach																		
	Senior Faculty																	
	Junior Faculty																	
	Research Staff																	
	Visiting Faculty																	
	Industry Researchers																	
	Post Docs																	
	Doctoral Students																	
	Masters Students																	
	Undergraduate Students																	
REU Student, if applicable																		
	NSF REU Program																	
	NSF/NSEC Program REU																	
	NSEC's Own REU																	
Other Visiting College Students																		
Pre-college (K-12)																		
	Students																	
	Teachers - RET																	
	Teachers - non-RET																	
Totals				**568**	**331**	**237**	**1**	**0**	**6**	**547**	**14**				**0**	**14**	**0**	

15. Publications, Patents and Press

Primary NSEC support indicated by (‡) *symbol. Partial NSEC support for all others.*

Faculty level participants indicated in boldface.

Books

1. **Allenby, Braden** and **Daniel Sarewitz**. 2011. *The Techno-Human Condition*. Cambridge, MA: MIT Press.

2. **Campbell, Heather E.** and **Elizabeth A. Corley**. 2012. *Urban Environmental Policy Analysis: Toward Sustainability*. Armonk, NY: M. E. Sharpe, Inc.

3. ‡**Cozzens, Susan** and **Jameson Wetmore** (eds.). 2011. *Yearbook of Nanotechnology in Society, Volume II: Nanotechnology and the Challenges of Equity, Equality, and Development*. New York, NY: Springer.

4. ‡**Fisher, Erik, Cynthia Selin** and **Jameson Wetmore** (eds.). 2008. *Yearbook of Nanotechnology in Society, Volume I: Presenting Futures*. New York, NY: Springer.

5. **Gorman, Michael E.** (ed.). 2010. *Trading Zones and Interactional Expertise: Creating New Kinds of Collaboration*. Cambridge, MA: MIT Press.

6. ‡**Guston, David H.** (ed.). 2010. *Encyclopedia of Nanoscience and Society (two volumes)*. Thousand Oaks, CA: SAGE Publications.

7. ‡Hays, Sean, **Jason S. Robert**, **Clark A. Miller** and **Ira Bennett** (ed.). In press, 2012. *Yearbook of Nanotechnology in Society, Volume III: Nanotechnology, the Brain, and the Future*. New York, NY: Springer.

8. ‡**Miller, Clark A.**, **Daniel Barben,** and Emily Molfino (eds.). In preparation, 2012. *Yearbook of Nanotechnology in Society, Volume IV: Nanotechnology and Democracy*. New York, NY: Springer.

9. **Robert, Jason S.** Under review. *Chimeras, Cyborgs, and the Moral Limits of Science*. Prescott, AZ: One World Press.

10. **Smits, Ruud**, **Stefan Kuhlmann** and **Philip Shapira** (eds.). 2010. *The Theory and Practice of Innovation Policy. An International Research Handbook*. Edward Elgar Publishing.

11. **Wetmore, Jameson** and **Deborah G. Johnson** (eds.). 2009. *Technology and Society: Building our Sociotechnical Future*. Cambridge, MA: MIT Press.

Book Chapters

1. ‡Bal, Ravtosh. 2011. "Public Perceptions of Fairness in NBIC Technologies." *Yearbook of Nanotechnology in Society, Volume II: The Challenges of Equity, Equality, and Development*, eds. Jameson Wetmore and Susan Cozzens. New York, NY: Springer.

2. ‡**Barben, Daniel**, **Erik Fisher**, **Cynthia Selin** and **David H. Guston**. 2008. "Anticipatory Governance of Nanotechnology: Foresight, Engagement, and Integration." *The Handbook of Science and Technology Studies, Third Edition*, eds. Edward J. Hackett, Olga Amsterdamska, Michael Lynch and Judy Wajcman, 979-1000. Cambridge, MA: MIT Press.

3. ‡Bennett, Ira**.** 2008. "Developing Plausible Nano-Enabled Products." *Yearbook of Nanotechnology in Society, Volume 1*, eds. Erik Fisher, Cynthia Selin and Jameson Wetmore, 149-156. New York, NY: Springer.

4. ‡**Boardman, Craig, Catherine Slade** and **Barry Bozeman**. 2012. "A Retrospective of the U.S. National Nanotechnology Initiative (NNI): Lessons Learned for Coordination of Federal Scientific and Technical Work at the Nanoscale." *Making it to the Forefront: Nanotechnology-A Developing Country Perspective*, ed. N. A. Duda. Springer.

5. ‡Choi, Doo-Hun, Anthony D. Dudo and **Dietram A. Scheufele**. 2012. "U.S. news coverage of neuroscience nanotechnology: How U.S. newspapers have covered neuroscience nanotechnology during the last decade." *Yearbook of Nanotechnology in Society, Volume III: Nanotechnology, the Brain, and the Future*, eds. Sean Hays, Jason S. Robert, Clark A. Miller and Ira Bennett. New York, NY: Springer. In press.

6. ‡**Cobb, Michael**. 2012. "Lessons Learned from the First National Citizens' Technology Conference." *Nanotechnology and the Public: Risk Perception and Risk Communication*, ed. Susanna Hornig Priest, 93-103. Boca Raton, FL: CRC Press (Taylor and Francis).

7. ‡**Cobb, Michael**. Forthcoming, "Deliberative Fears: Citizen Deliberation about Science in a National Consensus Conference." *Thinking through Technology with Publics*, eds. Kieran O'Doherty and Edna Einsiedel. Vancouver, Canada: University of British Columbia Press.

8. ‡Cortes Lobos, Rodrigo. 2012. "Nanotecnologa en Chile, Qu tan preparado se encuentra el pas para desarrollar esta disciplina?" *Perspectivas sobre el desarrollo de las nanotecnologas en Amrica Latina*, eds. Guillermo Foladori, Edgar Zayago Lau and Noela Invernizzi. 85-101. Miguel Angel Porrua, Mexico.

9. ‡**Cozzens, Susan**. Forthcoming, 2012. "The Distinctive Dynamics of Nanotechnology in Developing Nations." *Making it to the Forefront: Nanotechnology-A Developing Country Perspective*, ed. N. A. Duda. Springer.

10. ‡**Cozzens, Susan**. 2011. "Building Equity and Equality into Nanotechnology." *Yearbook of Nanotechnology in Society, Volume II: The Challenges of Equity, Equality, and Development*, eds. Susan Cozzens and Jameson Wetmore, 433-457. New York, NY: Springer.

11. ‡**Cozzens, Susan** and **Jameson Wetmore**. 2011. "Introduction." *The Yearbook of Nanotechnology in Society, Volume II: Nanotechnology and the Challenges of Equity, Equality, and Development*, eds. Susan Cozzens and Jameson Wetmore, vii-ix. New York, NY: Springer.

12. ‡Davies, Sarah R. 2011. "Of insects and armies." *Lemistry: A Celebration of the Work of Stanislaw Lem*, eds. Ra Page and Magda Raczynska. Manchester, United Kingdom: Comma Press, Co-commissioned by the Polish Cultural Institute in London with support from the Polish Book Institute.

13. ‡Davies, Sarah R. 2010. "The Exhibition and Beyond: New and Controversial Science in the Museum." *The Science Exhibition: Curation and Design*, eds. A. Filippoupoliti and G. Farnell. MuseumsEtc.

14. ‡Davies, Sarah R. and **Phil Macnaghten**. 2010. "Narrative and Public Engagement: Some Findings from the DEEPEN Project." *Understanding Public Debate on Nanotechnologies: Options for Framing Public Policies*, eds. Rene von Schomberg and Sarah R. Davies, 13-30. Brussels: European Commission.

15. Ellwood, Paul, **Erik Fisher** and **Krsto Pandza**. 2012. "Organizational Capability Life Cycles for Responsible Innovation." *Emerging Technologies: Socio-Behavioral Life Cycle Approaches*, eds. Michael E. Gorman, N. Savage and A. Street. Singapore: Pan Stanford.

16. ‡**Fisher, Erik.** 2009. "Legislative and Regulatory Framework." *Nanotechnology and FDA-Regulated Products: The Essential Guide*. Washington, DC: Food and Drug Law Library.

17. ‡**Fisher, Erik.** 2007. "The Convergence of Nanotechnology, Policy, and Ethics." *Advances in Computers 71: Nanotechnology*, ed. M. Zelkowitz, 274-296. London, England: Academic Press (Elsevier).

18. ‡**Fisher, Erik** and **Clark A. Miller**. 2009. "Contextualizing the Engineering Laboratory." *Engineering in Context*, eds. S.H. Christensen, M. Meganck and B. Delahousse, 369-381. Palo Alto, CA: Academica Press.

19. ‡**Fisher, Erik** and **Roop L. Mahajan**. 2010. "Embedding the Humanities in Engineering: Art, Dialogue, and a Laboratory." *Creating New Kinds of Collaboration: Trading Zones and Interactional Expertise*, eds. M.E. Gorman and R. Evans. Cambridge, MA: MIT Press.

20. ‡**Fujimura, Joan H.** 2010. "Technobiological Imaginaries: How Do We Know Nature?." *The Politics of Divergent (Interdisciplinary) Framings of Nature and Evolving Ecologies*, eds. Mara Goldman, Matthew Turner and Paul Nadasdy. Durham, NC: Duke University Press.

21. ‡Gallo, Jason. 2009. "Doing Archival Research: How to Find a Needle in a Haystack." *Research Confidential: Solutions to Problems Most Social Scientists Pretend They Never Have*, ed. E. Hargittai, 262-286. Ann Arbor, MI: University of Michigan Press.

22. ‡Gatchair, Sonia. 2011. "Potential Implications for Equity in the Nanotechnology Workforce in the U.S." *Yearbook of Nanotechnology in Society, Volume II: The Challenges of Equity, Equality, and Development*, eds. Susan Cozzens and Jameson Wetmore. New York, NY: Springer.

23. ‡Guo, Ying, Tingting Ma and **Alan L. Porter**. 2012. "Innovation Risk Path Assessing for a Newly Emerging Science and Technology: Illustrated for Dye-Sensitized Solar Cells." *Disruptive Technologies, Innovation and Global Redesign: Emerging Implications*, eds. Ndubuisi Ekekwe and Nazrul Islam, 12-26. Hershey, PA: IGI Global.

24. ‡**Guston, David H.** 2007. "The Center for Nanotechnology in Society at Arizona State University and the Prospects for Anticipatory Governance." *Nanoscale: Issues and Perspectives for the Nano Century*, eds. N. Cameron and M.E. Mitchell, 377-92. New York, NY: John Wiley and Sons.

25. **Guston, David H.** 2007. "Toward Centres for Responsible Innovation in the Commercialized University." *Public Science in Liberal Democracy: The Challenge to Science and Democracy*, eds. P.W.B. Phillips and J. Porter, 295-312. Toronto, Canada: University of Toronto Press.

26. ‡**Guston, David H.**, John Parsi and Justin Tosi. 2007. "Anticipating the Political and Ethical Challenges of Human Nanotechnologies." *Nanoethics: The Ethical and Social Implications of Nanotechnology*, eds. Fritz Allhoff, Patrick Lin, James Moor and John Weckert, 185-97. New York, NY: John Wiley and Sons.

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4. Arora, Sanjay. May, 2012. "Website Indicators for the Strategic Management of Emerging Technologies." Poster Session. International Conference on Innovative Methods for Innovation Management and Policy, Beijing, China.

5. Arora, Sanjay, et al. February, 2012. "Commercialization of New and Emerging Technologies: A Cross Country Comparison of Graphene Firms." Poster Session. Georgia Tech Research and Innovation Conference, Atlanta, GA.

6. Arora, Sanjay, Rider W. Foley, P. Shapiro and **Arnim Wiek**. November, 2011. "Nanotechnology in Building Construction - an Industry Study of Innovation." Poster Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

7. **Askland, Andrew** and **James Elser**. October 15, 2010. "A Weak Link: Phosphorous Scarcity and Our Food Chain." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

8. **Barben, Daniel**. July 18, 2009. "Was ist "neu" an neuen Technologien? Die vergangene und gegenwaertige Zukunft der Biotechnologie in soziologischer Perspektive." Talk. Deutsches Museum, Neue Technologien im Spannungsfeld von Wissenschaft, Politik, Oeffentlichkeit und Wirtschaft, Munich, Germany.

9. **Barben, Daniel**. June 05, 2009. "Reflexive Governance toward Sustainable Development: Combining Deliberation, Anticipation, and Transformation." Talk. 1st European Conference on Sustainability Transitions: Dynamics and Governance of Transitions to Sustainability, Amsterdam, the Netherlands.

10. **Barben, Daniel**. May 23, 2009. "Antizipatorische Governance von Zukunftstechnologien: Kapazitaetsbildung im Spannungsfeld von Technikgestaltung und Akzeptanzpolitik." Talk. German

Political Science Association (DVPW), Section on Politics und Technology, Berlin University of Technology: Governance von Zukunftstechnologien, Berlin, Germany.

11. **Barben, Daniel**. June 16, 2008. "Biotechnologieregime im Gesellschaftsvergleich. Zur Soziologie neuer Wissenschaft und Technik." Guest lecture. Institute for Science and Technology Studies, University of Bielefeld, Bielefeld, Germany.

12. **Barben, Daniel**. April 16, 2007. "Innovation Regimes and Institutional Reflexivity in Comparative Perspective." Talk. Swiss Federal Institute of Technology, EAWAG: Innovation, Institutions and Path Dependency: The Management of Variation and Diversity in Innovation Systems, Zurich, Switzerland.

13. Barben, Daniel. August, 2006. "Visions of Nanotechnology in a Divided World: The Acceptance Politics of a Future Key Technology." Panel Series on Social Studies of Nanotechnology. Conference of the European Association for the Study of Science Technology (EASST), University of Lausanne, Lausanne, Switzerland.

14. Barben, Daniel and **Frank Laird**. June, 2006. "Acceptance Politics of Contested Technologies: A Comparison between Nuclear Power, Biotechnology, and Nanotechnology." Annual Meeting of the Science and Democracy Network, Kennedy School of Government, Harvard University, Cambridge, MA.

15. Benn, Troy. November, 2008. "The Transport of Nanomaterials in Various Environments." Workshop on Nanotechnology, Equity and Equality. Center for Nanotechnology in Society at Arizona State University and Project Resultar at the Technology Policy and Assessment Center, Georgia Institute of Technology, Tempe, AZ.

16. Benn, Troy, **Jameson Wetmore** and Ira Bennett. July, 2008. "Nanosilver from Socks into Wastewater." Experiment demonstration. Arizona Science Center, Triple Play Days, Phoenix, AZ.

17. **Bennett, Ira**. March, 2010. "Visions for Future Innovation and Implications." Presentation. Atlanta Transatlantic Workshop on Nanotechnology Innovation and Policy. Georgia Tech, Atlanta, GA.

18. **Bennett, Ira**. February, 2010. "Lessons of Engagement: Learning from Policymakers and the Public." Presentation. Annual Meeting of the American Association for the Advancement of Science, San Diego, CA.

19. **Bennett, Ira**. March, 2009. "Anticipatory Governance of Emerging Nanotechnologies." American Chemical Society, Salt Lake City, UT.

20. **Bennett, Ira**. 2009. “Thinking Longer Term about Technologies: is there Value in Science Fiction-Inspired Approaches to Constructing Futures?” Publics and Emerging Technologies, Banff, Canada.

21. Bennett, Ira. 2007. "Frozen in Time: A Tour of Alcor Life Extension Foundation." Tour. Spirit of the Senses, Scottsdale, AZ.

22. Bennett, Ira. 2007. "What if I Dont Want My Advisors Job: Careers Outside (gasp) the Academic Laboratory." Talk. Association of Women in Science Central Arizona Chapter, Tempe, AZ.

23. Bennett, Ira. 2006. "Emerging Technologies." Talk. Spirit of the Senses, Phoenix, AZ.

24. **Bennett, Ira** and **Jameson Wetmore**. September 12, 2011. "Science and Regulatory Challenges of Commercial Nanoparticles." Presentation. Science Cafe', Berkeley, CA.

25. Binder, Andrew R., Michael A. Cacciatore, **Dietram A. Scheufele**, Bret R. Shaw and **Elizabeth A. Corley**. August, 2010. "Measuring Perceptions of Emerging Technologies: Errors in Survey Self-Reports and their Potential Impact on Communication of Public Opinion Toward Science." Presentation. Annual Convention of the Association for Education Journalism and Mass Communication, Denver, CO.

26. **Bowditch, Rachel**, Matt Watkins and **Karin D. Ellison**. October 16, 2009. "Bone Portraits: Scenes from a Play about the Invention of the X-Ray." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

27. **Brossard, Dominique** E., Eunkyung Kim and **Dietram A. Scheufele**. May, 2007. "The Politics of Nanotech: Communication and Opinion Formation about Scientific Issues and Policies." Paper presentation. Annual convention of the International Communication Association, San Francisco, CA.

28. **Brune, Daniel C.** and **David Conz**. October 29, 2006. "Alternative Fuels: What We Can Do (and Cant Do) to Make Our Skies Blue Again." Public talk. CNS-ASU Science Cafe, Changing Hands Bookstore, Tempe, AZ.

29. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley**. August, 2011. "Institutional Trust, Risk Information Processing and Support for an Emerging Technology." Paper Presentation. Annual Convention of the Association for Education in Journalism & Mass Communication, St. Louis, MO.

30. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley**. January, 2011. "Re-examining Science Knowledge Acquisition: Exploring the Internet as a Leveler of Education-Based Nanotechnology Knowledge Gaps." Paper Presentation. All Hands Meeting for the Center for Nanotechnology in Society at ASU, Tempe, AZ.

31. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley.** August, 2010. "A New (Methodological) Look at Science Knowledge Gaps: Merging Trend-Data to Examine Widening Nanotechnology Knowledge Gaps." Presentation. Annual Convention of the Association for Education in Journalism and Mass Communication, Denver, CO.

32. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley**. May, 2010. "The Emergence of Nanotechnology Knowledge Gaps: Differences in Knowledge Across Education Levels and Media Exposure." Presentation. Annual Convention of the American Association for Public Opinion Research, Chicago, IL.

33. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley**. May, 2010. "From Enabling Technology to Applications: The Evolution of Risk Perceptions about Nanotechnology." Paper Presentation. National Science Foundation Site Visit for the Center for Nanotechnology in Society at ASU, Tempe, AZ.

34. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley**. November, 2009. "In God we Trust? Exploring the Link between Religiosity and Risk Perceptions in Nanotechnology Attitude Formation." Presentation. Annual Convention of the Midwest Association for Public Opinion Research, Chicago, IL.

35. Cacciatore, Michael A., **Dietram A. Scheufele** and **Elizabeth A. Corley**. August, 2009. "It depends on what you have heard: Exploring the Link between Risk Perception and Attitudes across different Applications of Nanotechnology." Presentation. Annual Convention of the Association for Education in Journalism and Mass Communication, Boston, MA.

36. Cacciatore, Michael A., **Dietram A. Scheufele**, **Elizabeth A. Corley**, **Philip Shapira** and **Jan Youtie**. Forthcoming, April, 2012. "Practicing what they Preach? Comparing Self-Reported Attitudes of Nanoscientists with their EHS Publication Records." Paper presentation. 12th International Public Communication of Science and Technology Conference, Florence, Italy.

37. Cacciatore, Michael A., **Dietram A. Scheufele**, **Elizabeth A. Corley**, **Philip Shapira** and **Jan Youtie**. December, 2011. "Do Leading U.S. Nanoscientists Practice what they Preach? Using Publication Records as a Predictor of Scientists' Attitutudes toward the Regulation and Communication of Nanoscience." Paper Presentation. Annual Convention of the Society for Risk Analysis, Charleston, SC.

38. Cacciatore, Michael A., Doo-Hun Choi, **Dietram A. Scheufele** and **Elizabeth A. Corley**. November, 2011. "Unpacking the Relationships between Religiosity, Deference to Scientific Authority and Support for Nanotechnology: A Structural Equation Modeling Approach." Paper Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

39. Cacciatore, Michael A., Doo-Hun Choi, **Dietram A. Scheufele** and **Elizabeth A. Corley**. August, 2011. "Support for Emerging Technologies: Disentagling the Predispositional, Affective and Cognitive Pathways." Paper Presentation. Annual Convention of the Association for Education in Journalism & Mass Communication, St. Louis, MO.

40. Cacciatore, Michael A., Doo-Hun Choi, **Dietram A. Scheufele** and **Elizabeth A. Corley**. Under review, "Religiosity, Deference to Scientific Authority and Support for Nanotechnology: A Structural Equation Modeling Approach." Paper submission. Annual meeting of the Association for Education in Journalism and Mass Communication, St. Louis, MO.

41. Calleja López, Antonio and **Erik Fisher**. 2009. "Dialogues from the Lab: Contemporary Maieutics for Socio-Technical Inquiry." *Converging Technologies, Changing Societies. Proceedings of Society for Philosophy and Technology*. University of Twente, the Netherlands. July 7-10.

42. Carley, Stephen. October 19, 2007. ""Nano Research Profiling on Demand" on nanotechnology datamining techniques and applications." Poster Presentation. Atlanta Conference on Science, Technology, and Innovation Policy, Atlanta, GA.

43. Carley, Stephen and **Alan L. Porter**. November 05, 2011. "A New Measure of Knowledge Diffusion." Session. Measuring Research Interdisciplinarity and Knowledge Diffusion, American Evaluation Association.

44. Carley, Stephen, **Alan L. Porter** and Li Tang. November, 2011. "Testing for Nano EHS Convergence at the State Level." Poster Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

45. **Carlson, Marilyn P**. April, 2006. "An Overview of a Project to Improve Mathematics and Science Education for a Technical Society: Cognitive Research Informs Curriculum Development and Instructional Support." Presentation. Materials Research Society Symposium on Education in Nanoscience and Engineering, San Francisco, CA.

46. Choi, Doo-Hun, Anthony D. Dudo and **Dietram A. Scheufele**. November, 2011. "U.S. Newspaper Coverage of Neuroscience Nanotechnology." Paper Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

47. Choi, Doo-Hun, Anthony D. Dudo and **Dietram A. Scheufele**. January, 2011. "Food Nanotechnology in the News: Coverage Patterns and Thematic Emphases During the Last Decade." Paper Presentation. All Hands Meeting for the Center for Nanotechnology in Society at ASU, Tempe, AZ.

48. Choi, Doo-Hun, Michael A. Cacciatore, **Dietram A. Scheufele** and **Elizabeth A. Corley**. November, 2011. "Nanotechnology and Talk: Incorporating the Differential Gains Model for an Emerging Technology." Paper Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

49. Choi, Doo-Hun, Michael A. Cacciatore, **Dietram A. Scheufele** and **Elizabeth A. Corley**. August, 2011. "Connecting Interpersonal Discussion and the Internet: How Interpersonal Discussion Moderates the Effect of the Internet on being Informed about Nanotechnology." Paper Presentation. Annual Convention of the Association for Education in Journalism & Mass Communication, St. Louis, MO.

50. Choi, Doo-Hun, Michael A. Cacciatore, **Dominique E. Brossard** and Michael A. Xenos. Forthcoming, May, 2012. "Disentangling Public Opinion of Nanotechnology: Exploring the Interactive Effects of News Media, Values, and Information Processing on Opinion Formation." Paper Presentation. Annual Convention of the American Association for Public Opinion Research, Orlando, FL.

51. Choi, Doo-Hun, Michael A. Cacciatore, Michael A. Xenos, **Dietram A. Scheufele** and **Dominique E. Brossard**. Forthcoming, May, 2012. "The Digital Producation Gap: The Role of News Media Use, Information Processing, and Opinion Expression." Paper Presentation. Annual Conference of the International Communication Association, Phoenix, AZ.

52. **Cobb, Michael**. March, 2009. "Public Engagement: National Citizens Technology Forum." Presentation. Nanotechnology and Public: Data for Decision Makers briefing to the U.S. Congressional Nanotechnology Caucus, Washington, DC.

53. **Cobb, Michael**. January, 2009. "U.S. Public Opinion about Nanotechnologies used for Human Enhancements: Consensus Conferences, Deliberation and Framing Effects on Risk Perceptions." Communicating Emerging Technologies II: Risks and Uncertainties, University of Nevada, Las Vegas, NV.

54. **Cobb, Michael** and **Patrick Hamlett**. June 27, 2008. "The First National Citizens Technology Forum on Converging Technologies and Human Enhancement: Adapting the Danish Consensus Conference in the USA." Paper presentation. Tenth International Conference on Public Communication of Science and Technology (PCST-10), Malmo, Sweden.

55. Conley, Shannon. April, 2009. "Nanotechnology Policy in Cambridge, Massachusetts: Local Reflexive Governance." Presentation. Midwest Political Science Association Conference, Chicago, IL.

56. Conley, Shannon. November, 2008. "Regulating Life: The Regulation of Assisted Reproduction in Canada and the UK." Center for the Study of Institutional Diversity Weekly Seminar Series, Arizona State University, Tempe, AZ.

57. **Conz, David**. October 12, 2007. "Reflexivity Assessment of STS Engagement of Nanotechnology." Presentation. Annual Meeting of the Society for Social Studies of Science, Montreal, Canada.

58. **Corley, Elizabeth A.** April, 2011. "Soft Law Mechanisms for Nanotechnology Governance." Paper Presentation. Workshop on Soft Law Oversight Mechanisms for Nanotechnology, Scottsdale, AZ.

59. **Corley, Elizabeth A.** March, 2011. "Public Attitudes about Nanotechnology Regulation." Paper Presentation. Biggest Issues for the Smallest Stuff: Regulation and Risk Management of Nanotechnology, Phoenix, AZ.

60. **Corley, Elizabeth A.** March, 2010. "Public Attitudes about Nanotechnology." Paper Presentation. NNI Capstone Workshop: Risk Management Methods & Societal, Ethical, and Legal Implications of Nanotechnology, Washington, DC.

61. **Corley, Elizabeth A.** 2010. "Expert and Public Perceptions about Nanotechnology Risks, Benefits and Regulations." Paper Presentation. David Lincoln Lecture Series, Paradise Valley, AZ.

62. **Corley, Elizabeth A.** 2009. "Public and Nano-Scientist Perceptions about Nanotechnology. Workshop on Emerging Technologies, Military Operations and National Security." Presentation. Case Western University, Cleveland, OH.

63. **Corley, Elizabeth A.** 2009. "Eliciting Public Understanding of and Values toward Emerging Technologies through Opinion Polls." Presentation. Society for the Study of Nanoscience and Emerging Technologies, Seattle, WA.

64. **Corley, Elizabeth A.** July, 2008. "Societal Dimensions of Nanotechnology: An Exploration of Public and Scientist Perceptions." Invited presentation. Young Scientists Nanotechnology Workshop, French Embassy, Washington, DC.

65. **Corley, Elizabeth A.** April, 2008. "Scientists and the Public: Comparing Views on Nanotechnology Risks and Regulations." Talk. CSPO Enlightening Lunch, Arizona State University, Tempe, AZ.

66. **Corley, Elizabeth A.** 2008. "Scientist and the Public Risk Perceptions about Nanotechnology." Societal Implications of Nanotechnology 2008 Principal Investigators Meeting at National Science Foundation, Arlington, VA.

67. **Corley, Elizabeth A.** and **Dietram A. Scheufele**. February, 2008. "A Comparative Look at Markets, Media, and Emerging Attitudes about Nanotechnology." Presentation. American Association for the Advancement of Science (AAAS) Annual Meeting, Boston, MA.

68. **Corley, Elizabeth A.** and **Dietram A. Scheufele**. November, 2006. "Factors Impacting Public Support of Federal Funding for Nanotechnology." Presentation. 28th Annual Association for Public Policy Analysis and Management Research Conference, Madison, WI.

69. **Corley, Elizabeth A.**, **Dietram A. Scheufele** and Qian Hu. November, 2008. "Exploring Public and Scientist Attitudes About the Risks and Regulation of Nanotechnology Research: What Does the Future Hold for Policy-Making." Presentation. Annual convention of the Association for Policy Analysis and Management, Los Angeles, CA.

70. **Corley, Elizabeth A.**, **Dietram A. Scheufele**, **Sharon Dunwoody**, **Elliott D. Hillback**, **Tsung-Jen Shih** and **David H. Guston**. October, 2007. "Nanotechnology Attitudes among Scientists and the Public." Presentation. Annual Meeting, Society for Social Studies of Science, Montreal, Canada.

71. **Corley, Elizabeth A.** and **Jan Youtie**. 2009. "Learning to Manage Multi-institutional Multidisciplinary Research Centers: A Case Study the LIFE Center." Paper Presentation. 10th Public Management Research Association Conference.

72. Cortes Lobos, Rodrigo. March, 2012. "Can Nanotechnology research contribute to Sustainable Development of the US Agri-food sector?" Presentation. S&T Global PhD Conference, Washington, DC.

73. Cortes Lobos, Rodrigo. November, 2011. "The Chilean Nanotechnology Sector: Catching up or Falling Behind?" Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

74. Cortes Lobos, Rodrigo. September, 2011. "Nanotechnology and the Millennium Development Goals: Energy, Water, and Agri-food." Presentation. Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

75. Cortes Lobos, Rodrigo. May, 2011. "Can Agri-food Nanotechnology contribute to achieve the Millennium Development Goals in Developing Countries?" Presentation. 7th International Globelics Academy, Tampere, Finland.

76. **Cozzens, Susan**. April, 2012. "Environmental Health and Safety in Nanotechnology: A Critical Interface with the Public." Presentation. NanoAfrica 2012, University of Freestate, South Africa.

77. **Cozzens, Susan**. November, 2011. "Equity, Equality, and Development: A Framework for Analyzing Nanotechnology Potentials." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

78. **Cozzens, Susan**. July, 2011. "Equity, Equality, and Nanotechnology." Presentation. Tshwane University of Technology, Pretoria, South Africa.

79. **Cozzens, Susan.** January, 2011. "TRC 1 - Equity and Responsibility Program Assessment." Presentation. Center for Nanotechnology in Society at ASU, Tempe, AZ.

80. **Cozzens, Susan**. December 03, 2010. "Knowledge to Policy: Contributing to the Measurement of Social, Health, and Environmental Benefits." Presentation. Science Measurement Workshop presented by the Office of Science and Technology Policy, Washington, DC.

81. **Cozzens, Susan**. July, 2010. "Nanotechnology and Society." Presentation. REU students at GA Tech NNIN Node, Atlanta, GA.

82. **Cozzens, Susan**, Rodrigo Cortes Lobos, Diran Soumonni and Thomas Woodson. November, 2011. "Nanotechnology and the Millennium Development Goals: Energy, Water, and Agri-food." Presentation. Globelics, Argentina.

83. **Dalrymple, Kajsa E**., Amy B. Becker, **Dominique E. Brossard**, **Dietram A. Scheufele** and Al C. Gunther. August, 2009. "Getting Citizens Involved: How Controversial Science Policy Debates Stimulates Issue Participation during a Political Campaign." Presentation. Annual Convention of the Association for Education in Journalism and Mass Communication, Boston, MA.

84. **Dalrymple, Kajsa E.**, **Dietram A. Scheufele** and **Elizabeth A. Corley**. May, 2009. "Proximity to Experts? Rethinking Operationalizations of Cognitive Outcomes Based on Dual-source Measures." Paper presentation. International Communication Association (Mass Communication Division) Conference, Chicago, IL.

85. Davies, Sarah R. November, 2011. "Knowing and Loving: Pleasure in Public Engagement." Presentation. 4S Annual Meeting, Cleveland, OH.

86. Davies, Sarah R. September, 2011. Invited Discussant. Inaugural Conference of the Belgian Science, Technology and Society (BSTS) Network, Brussels.

87. Davies, Sarah R. September, 2011. "Deliberating Futures: Pathways, Locales, and Imagery in the Imagination of Technoscientific Change." Paper Presentation. Governing Futures Conference, Vienna.

88. Davies, Sarah R. May 16, 2011. "NanoEthics: Responsibility, Risk, and Responsible Innovation." Presentation to Private Sector audience. Training Session, SESHA (ESH for High Technology) Annual Symposium, Scottsdale, AZ.

89. Davies, Sarah R. December, 2010. "Deliberation beyond Discourse: Experimenting with Science-Society Engagement." Presentation. CSPO Enlightening Lunch, Arizona State University, Tempe, AZ.

90. Davies, Sarah R. November, 2010. "Public Engagement: Genealogies and Reflections." Presentation. Practices of Anticipatory Governance Workshop, Arizona State University, Tempe, AZ.

91. Davies, Sarah R. September, 2010. ""Unethical for them": The Ethical as a Category in Public Talk." Presentation. Annual Meeting of the Society for the Study of Nanoscience and Emerging Technologies, Darmstadt, Germany.

92. Davies, Sarah R. April, 2010. "How We Talk When We Talk about Nano: Public Discussion of Future Technologies." Presentation. Center for Nanotechnology in Society, University of California Santa Barbara, Santa Barbara, CA.

93. Davies, Sarah R., **Cynthia Selin**, Gretchen Gano and Angela Pereira. May, 2011. "Finding Futures." Presentation. Science in a Digital Society, EC-JRC Workshop, Lisbon.

94. Davies, Sarah R. and Denisa Kera. February, 2012. "DIY Micro-Governance: Hackerspaces as Science Policy." Presentation. Inaugural Asia Pacific Science Policy Studies Research Conference, Wellington, New Zealand.

95. Davies, Sarah R. and **Noela Invernizzi**. November, 2011. "Nanotechnology and the Private Sector: Innovation, Governance, and Regulation." Panel Organizer. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

96. Dudo, Anthony D. May, 2010. "Project Overview: Nanotechnology in the News." Paper Presentation. National Science Foundation Site Visit for the Center for Nanotechnology in Society at ASU, Tempe, AZ.

97. Dudo, Anthony D., **Dominique E. Brossard**, **James Shanahan**, **Dietram A. Scheufele**, Michael Morgan and **Nancy Signorelli.** August, 2009. "Science on Television in the 21st Century: Recent Trends in Portrayals and their Contributions to Public Attitudes toward Science." Presentation. Annual Conference of the Association for Education in Journalism and Mass Communication, Boston, MA.

98. Dudo, Anthony D., Doo-Hun Choi and **Dietram A. Scheufele**. January, 2011. "Food Nanotechnology in the News: Coverage Patterns and Thematic Emphases during the Last Decade." Paper Presentation. All Hands Meeting for the Center for Nanotechnology in Society at ASU, Tempe, AZ.

99. Dudo, Anthony D**.**, **Sharon Dunwoody** and **Dietram A. Scheufele**. August, 2009. "The Emergence of Nano News: Tracking Thematic Trends and Changes in Media Coverage of Nanotechnology." Presentation. Annual Convention of the Association for Education in Journalism & Mass Communication, Boston, MA.

100. **Fernandez-Ribas, Andrea**. October 03, 2009. "Firms' Global Patent Strategies in an Emerging Technology." Paper presentation. Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

101. **Fernandez-Ribas, Andrea** and **Philip Shapira**. October, 2009. "The Globalization of Innovation in Nanotechnology: Some Empirical Evidence for US, Japanese, and European Firms." Presentation. 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

102. **Fernandez-Ribas, Andrea** and **Philip Shapira**. May, 2008. "Technological Diversity, Scientific Excellence and the Location of Inventive Activities Abroad: The Case of Nanotechnology." Presentation. National Bureau of Economic Research (NBER) Nanobank Conference, Boston, MA.

103. **Fichtner, Aaron**. 2007. "Preliminary Results: The Workforce Needs of Companies Using Nanotechnology in Arizona." Presentation. Nanotechnology 2007 Conference, San Jose, CA.

104. **Fisher, Erik**. March 22, 2012. "The Code of Conduct for Responsible Nanosciences and Nanotechnologies Research as a Platform for Deliberation." Presentation. Soft Law Oversight Mechanisms for Nanotechnology. Skysong, Arizona State University.

105. **Fisher, Erik**. November, 2011. "Stirring the Governance Capacities of Experts-in-the-Making." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

106. **Fisher, Erik**. November, 2011. "Lost in the NanoWorld: 10 years of Emergence." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

107. **Fisher, Erik**. June 17, 2011. "Future Regimes of Science, Politics and Convergence Work." Presentation. The Future of Science and Society: A Symposium in Honor of Arie Rip, University of Twente.

108. **Fisher, Erik**. May, 2011. "Responsible Innovation R&D: the US Experience." Presentation. . Franco-British Workshop on Responsible Innovation: From Concepts to Practice. Residence of the French Ambassador, London.

109. **Fisher, Erik**. May, 2011. "STIR Spin-offs: Beyond the Laboratory Engagement Study." Presentation. Institute for Innovation and Governance Studies. University of Twente.

110. **Fisher, Erik.** February 16, 2011. "Workshop Public Agenda: International Network for Responsible Innovation." Workshop organizer and principal investigator. STIR Project Workshop 4, Washington, DC.

111. **Fisher, Erik**. February, 2011. "STIR Project Overview." Presentation. International Network for Responsible Innovation. STIR Project Workshop. Woodrow Wilson International Center for Scholars, Washington, DC.

112. **Fisher, Erik**. December 03, 2010. "Public Value Integration in Science and Innovation Policy Professes." Presentation. Science Measurement Workshop presented by the Office of Science and Technology Policy, Washington, DC.

113. **Fisher, Erik**. October 28, 2010. "Science, Democracy and the Reinvention of the Liberal Arts." Presentation. Lowdenslager Annual Lecture. Western State College, Gunnison, CO.

114. **Fisher, Erik**. October, 2010. "Midstream Modulation and Socio-Technical Integration Research." Presentation. Ethics on the Work Floor: Interdisciplinary Research and Responsible Innovation workshop. Technical University of Delft, Delft, Netherlands.

115. **Fisher, Erik**. October, 2010. "Socio-Technical Integration Research." Presentation. NSF Science of Science and Innovation Policy Workshop: Building a Community of Practice II. American Association for the Advancement of Science, Washington, DC.

116. **Fisher, Erik**. August, 2010. "Integration Outcomes." Presentation. Integration Study Comparisons. STIR Project Workshop. University of Tokyo, Tokyo, Japan.

117. **Fisher, Erik**. June 09, 2010. "Lab-level Socio-technical Integration." Presentation. Genome British Columbia, GSEAC Retreat, Vancouver, Canada.

118. **Fisher, Erik**. June 02, 2010. "Midstream Modulation of Emerging Technology: Probing the Capacity of Research Decisions." Presentation. Research Council of Norway, Oslo, Norway.

119. **Fisher, Erik**. April, 2010. "The Political Ethnography of Lab-Level Bureaucrats: Probing the Capacity of Research Decisions." Presentation. Midwest Political Science Association 68th Annual National Conference, Chicago, IL.

120. **Fisher, Erik**. February 27, 2010. "What is Midstream Modulation." Presentation. Reflexive Systems Biology Kick-Off Meeting. University of Bergen, Bergen, Norway

121. **Fisher, Erik.** February 26, 2010. "TA-Trends in the U.S.." Keynote Lecture. TA Workshop: Keeping Pace with T.A. Instituut Samenleving and Technologie. Flemish Parliament, Brussels, Belgium.

122. **Fisher, Erik**. September 08, 2009. "Integration and Reflexivity: Integrating Social Science and Humanisitic Work with Laboratory Research in Emerging Science and Technology." Presentation. S.NET Pre-Conference Workshop: Real-time Technology Assessment and Anticipatory Governance. University of Washington.

123. **Fisher, Erik**. July, 2009. "Inquiry as Intervention." *STIR Workshop 2: Inquiry as Intervention*. Vatnahalsen, Norway. 4-7 July.

124. **Fisher, Erik**. June, 2009. "Laboratory Engagement. STIR: Initial Project Results." TA NanoNed Annual Meeting. Utrecht, the Netherlands.

125. **Fisher, Erik.** June, 2009. "The 'Two Cultures' in Science Policy." Center for Science and Technology Policy Research. University of Colorado at Boulder. Boulder, Colorado.

126. **Fisher, Erik**. June, 2009. "Science and Society in the Laboratory? Reflections of an Embedded Humanist." Colorado Fuel Cell Center. Colorado School of Mines. Golden, Colorado.

127. **Fisher, Erik.** June, 2009. "Integrating Science and Society in Nanotechnology Laboratories." *The Nano Renewable Energy Summit*. Denver, Colorado.

128. **Fisher, Erik**. June, 2009. "Integrating Ethics and Engineering in the Laboratory: Reflections of an Embedded Humanist." Graduate Interdisciplinary Liberal Engineering Ethics Workshop on *Integrating Ethics and Societal Issues into a Graduate Curriculum*. Virginia Tech. Blacksburg, Virginia.

129. **Fisher, Erik.** May, 2009. "Inquiry and Nanotechnology." *Human Practices Workshop*. University of California at Berkeley. Berkeley, California.

130. **Fisher, Erik.** May, 2009. "The 'Two Cultures' in Science Policy Today." University of Colorado-Denver, School of Public Affairs. Denver, Colorado.

131. **Fisher, Erik**. March, 2009. "Socio-Technical Integration Research." Presentation. Research Funding and the Good Life, University of Twente, the Netherlands.

132. **Fisher, Erik**. January, 2009. "STIR Project Overview." *STIR Workshop 1: Constructing Foundations*. Arizona State University. Tempe, Arizona.

133. **Fisher, Erik**. November, 2008. "Deliberation on the Implementation of a Code of Conduct and fostering International Dialogue and Collaboration." Expert participant. European Commission, Brussels, Belgium.

134. **Fisher, Erik**. November, 2008. "Nanotechnology: Environment, Health and Safety." Presentation. Environmental Professionals of Arizona / Academy of Certified Hazardous Materials Managers, Tempe, AZ.

135. **Fisher, Erik**. October, 2008. "Laboratory Engagements: Risky Discourse and Research Decisions." Presentation. Networks, Risk and Knowledge Sharing, University of Massachusetts, Amherst, MA.

136. **Fisher, Erik**. July, 2008. "Collaborations for Financial Success: Universities Collaborating with Government and the Private Sector." Panelist. The Nano Renewable Energy Summit, Denver, CO.

137. **Fisher, Erik**. July, 2008. "Midstream Modulation: Embedding the Humanities in Engineering Practice and Education." Presentation. Kluyver Colloquium, Delft Technical University, Delft, The Netherlands.

138. **Fisher, Erik**. April, 2008. "Embedded Humanists." Presentation. Engineering in Context, Colorado School of Mines, Golden, CO.

139. **Fisher, Erik**. March, 2008. "Midstream Modulation and the Politics of Engagement." Presentation. STS in Action, Claremont, CA.

140. **Fisher, Erik**. December, 2007. "Inventing the Socially Conscious Laboratory." Presentation. Consortium for Science, Policy & Outcomes, Arizona State University, Tempe, AZ.

141. **Fisher, Erik**. September, 2007. "Integrating Social Considerations into Nanotechnology Research." Presentation. 1st Rocky Mountain Nanotechnology Showcase, Denver, CO.

142. **Fisher, Erik**. August, 2007. "Broader Impacts and the Embedded Humanist." Presentation. Making Sense of the Broader Impacts of Science and Technology, Golden, CO.

143. **Fisher, Erik**. July, 2007. "Integrating Societal Considerations and Nanotechnology in the Four Corners Region." Presentation. Colorado Nanotechnology Alliance, Denver, CO.

144. **Fisher, Erik**. June 27, 2007. "Integrating Science and Society in the Laboratory." Presentation. Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM.

145. **Fisher, Erik**. June, 2007. "Drilling Down on U.S. Ethics Policy for Nanotechnology." Presentation. Center for Interdisciplinary Research (ZiF), Bielefeld University, Bielefeld, Germany.

146. **Fisher, Erik**. June, 2007. "Socio-technical Integration and the Nanotechnology Laboratory." Presentation. Visions about Nanoscience and Technology Workshop, Leuven, Belgium.

147. **Fisher, Erik**. June, 2007. "Investigating the Implementation of U.S. Ethics Policy for Nanotechnology." Presentation. Institute for Technology Assessment and Systems Analysis, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft, Karlsruhe, Germany.

148. **Fisher, Erik**. June, 2007. "Engaging the Reflexive Capacity of Nanotechnology Researchers." Presentation. Nanotechnology, Ethics & Sustainability; NANOMAT Conference, Bergen, Norway.

149. **Fisher, Erik**. June, 2007. "Socio-technical Integration at Macro and Micro Levels." Presentation. Rathenau Institute, Den Haag, The Netherlands.

150. **Fisher, Erik**. January, 2007. "Social and Policy Issues in Nanotechnology." Presentation. 5th CINT Users Workshop, Center for Integrated Nanotechnologies, Albuquerque, NM.

151. **Fisher, Erik**. November 20, 2006. "Current Societal Considerations in Nanotechnology." Presentation. Center for Integrated Nanotechnologies, Los Alamos National Laboratory, Los Alamos, NM.

152. **Fisher, Erik**. November, 2006. "Reflecting on the Shape of Nanotechnology Research from Within." Presentation. 4S Conference (Society for Social Studies of Science), Vancouver, Canada.

153. **Fisher, Erik**. September, 2006. "Socratic Engagement of Nanotechnology: A Case Study in Ethics Policy." Presentation. University of North Texas, Department of Philosophy and Religion Studies, Denton, TX.

154. Fisher, Erik. August, 2006. "From Upstream Engagement to Midstream Modulation: Shaping Technology from Within." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

155. Fisher, Erik. July, 2006. "Midstream Modulation: U.S. Federal Nanotechnology Policy Implementation." Presentation. TA NanoNed Day, Utrecht University, The Netherlands.

156. Fisher, Erik. May, 2006. "Midstream Modulation of Technological Trajectories." Trading Zones and Interactional Expertise Workshop, Arizona State University, Tempe, AZ.

157. **Fisher, Erik**. and Antonio Calleja López. October, 2009. "Reflexive modulation of laboratory practices for the governance of science and technology." *Society for the Social Studies of Science, Annual Meeting.* Washington DC.

158. **Fisher, Erik**, **Daan Schuurbiers** and Harro Van Lente. June, 2011. "A Whole New Set of Lab Responsibilities? Responsible Innovation and its Consequences for Research Practices." Presentation. Risky Entanglements? Contemporary Research Cultures Imagined and Practiced, Vienna, Austria.

159. **Fisher, Erik** and **David H. Guston**. July, 2011. "Integration of Social Science and Humanities Scholars with Natural Scientists." Presentation. Anticipatory Governance of Emerging Technologies: Foresight, Engagement and Integration. Euroscience Open Forum, Turino, Italy.

160. **Fisher, Erik** and **David H. Guston**. June, 2010. "Changing Practices: An Engagement of Expert Epistemologies in the Making." Presentation. Ninth Annual Meeting of the Science and Democracy Network. Kavli Royal Society International Centre, Chicheley Hall, United Kingdom.

161. **Fisher. Erik** and Derrick Anderson. December, 2009. "From Lab to Legislature: Public Value Mapping of Nanotechnology Science and Innovation Policy Making." *The Dupont Summit on Science and Technology Policy, "The New Administrations Challenges on Science & Technology: Staying the Course in Times of Crisis."* Policy Studies Organization, Carnegie Institution for Science, Washington DC.

162. **Fisher, Erik**, Derrick Anderson and David Renolds. August, 2008. "Mapping and Modulating the Public Value of Academic Research." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

163. **Fisher, Erik** and Francois Thoreau. September, 2010. "On Reflection and Reflexiveness: Positioning the Self, Enframing the Other." Presentation. Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Darmstadt, Germany.

164. **Fisher, Erik** and Hannot Rodriguez. August, 2010. "Socio-technical Integration in European Framework Programmes." Poster Presentation. Gordon Research Conference on Science and Technology Policy, Waterville Valley, NH.

165. **Fisher, Erik** and Hannot Rodriguez. April, 2010. "Tracking the Pervasiveness of Socio-Technical Integration in the European Research and Development Framework Programmes." Presentation. Science and Governance: Global and Comparative Perspectives. Arizona State University, Tempe, AZ.

166. Fisher, Erik and **Roop L. Mahajan**. November, 2006. "Midstream Modulation." Presentation. International Mechanical Engineering Conference, Chicago, IL.

167. **Fisher, Erik** and Shannon Conley. November, 2011. "Socio-Technical Integration: Collaborating with Geneticists in Patient Engagement." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

168. **Fisher, Erik** and Topi Heikkero. May, 2011. "Public Deliberation in the Education of Science: Contemporary Practices and Classical Ideals." Presentation. Annual Meeting of the Society for Philosophy and Technology. University of North Texas.

169. Foley, Rider W. and **Arnim Wiek**. November, 2011. "Reconciling Urban Sustainability Syndromes and Urban Nanoscape." Poster Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

170. Foley, Rider W., B. Kay, Richard Rushforth and **Arnim Wiek**. Forthcoming, May, 2012. "Can Nanotechnology Decontaminate Water in a Morally Contested Contex." Presentation. International Symposium on Sustainable Systems and Technology, Boston, MA.

171. Foley, Rider W., C. Kuzdas, B. Warner, Lauren Withycombe Keeler, D, Iwaniec and **Arnim Wiek**. February, 2012. "Designing Sustainable Governance: Cross-Domain Comparison and Evaluation." Poster Presentation. 3rd Annual International Conference on Sustainability Science, Tempe, AZ.

172. Gallo, Jason. October 19, 2007. "The National Science Foundation and the Creation of a Standing Army for Science." Paper presentation. Annual Meeting of the Society for the History of Technology, Washington, DC.

173. Gallo, Jason. April, 2007. "The National Science Foundation and the Control of Information." Department of Life Sciences Communication colloquium series, University of Wisconsin, Madison, WI.

174. Gano, Gretchen. 2011. "Local Deliberation and Imagined Transition Epistemologies." Presentation. Annual Meeting of the Society for the Social Studies of Science, Cleveland, OH.

175. Gano, Gretchen. 2011. "Finding Futures." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

176. Gano, Gretchen. 2011. "Empowerment and Social Learning: Long Term Benefits of Citizen Deliberation about Nanotechnologies for Human Enhancement." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

177. Gano, Gretchen. 2011. " What we've learned about Nano and Society a Working Session on Data Sharing for NSF NSECs." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

178. Gano, Gretchen. 2011. "Emergent Technology Assessment: the Transition Initiative and Energy Futures." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

179. Gano, Gretchen. 2011. "Exploring the Uncertain Technological Future: Lessons in Anticipatory Governance." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

180. Gao, L., **Alan L. Porter**, Tingting Ma, Wenping Wang, Stephen Carley and X. Zhang. 2011. "Measuring the Interdisciplinarity of Nano-Biosensor Research based on Citation Analysis." Presentation. Atlanta Conference on Science and Innovation Policy 2011, Atlanta, GA.

181. Garay, Manuel and **Erik Fisher**. August, 2008. "NSECs and the Integration of Societal Concerns into R&D." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

182. **Garcia, Antonio** and **Joan McGregor**. October 17, 2008. "Will Genetic Discrimination Replace Racial Discrimination?" Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

183. **Goodnick, Stephen** and **Tim Lant**. November 20, 2009. "Good to the Last Drop? The Water-Energy Connection." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

184. **Gordon, Claire** and Ira Bennett. February 16, 2007. "Why Things (Still) Don't Fit: Human Variation and Ergonomics in the 21st Century." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

185. Guo, Ying, **Alan L. Porter** and Lu Huang. May, 2011. "Empirically Informing a Technology Delivery System Model for an Emerging Technology: Illustrated for Dye-Sensitized Solar Cells." Presentation. 4th International Seville Conference on "Future-Oriented Technology Analysis".

186. Guo, Ying, **Alan L. Porter** and Lu Huang. October, 2009. "Comparing and Probing National Research Strategies for Nanotechnology Thin-film Solar Cells." Presentation. 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

187. Guo, Ying, **Alan L. Porter** and Lu Huang. April 09, 2009. "Nano-enhanced Thin-film Solar Cells: Global Activity and Forecast." Paper presentation. IAMOT 2009, 18th International Conference on Management of Technology, Management of Green Technology, International Association for Management of Technology, Orlando, FL.

188. Guo, Ying, Lu Huang and **Alan L. Porter**. October, 2009. "Profiling Research Patterns for a New and Emerging Science and Technology: Dye-sensitized Solar Cells." Presentation. 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

189. Guo, Ying, Lu Huang, L. Zhang, D. Zhu and **Alan L. Porter**. 2011. "Up-to-down Science & Technology Planning: a New Approach Based on Patent Data and Technology Roadmapping." Presentation. Global TechMining Conference, Atlanta, GA.

190. **Guston, David H.** March 06, 2012. "The Pumpkin or the Tiger? Polanyi, Soddy and the Anticipation of Emerging Technologies." Presentation. Workshop on Pacing Governance with Technology, Scottsdale, AZ.

191. **Guston, David H.** March 01, 2012. "EMERGE: From Technology to Democracy." Presentation. Emerge: Artists + Scientists Redesign the Future, Tempe, AZ.

192. **Guston, David H.** February 14, 2012. "Nanotechnology and Anticipation." Talk. UW Bothell Innovation Forum, with other panelists speaking on Innovation Squared: Why innovations in technology require innovations in ethics, Bothell, WA.

193. **Guston, David H.** February 13, 2012. "Anticipatory Governance of Emerging Technologies." Talk. Biological Futures in a Globalized World colloquium series at University of Washington, Seattle, WA.

194. **Guston, David H.** December, 2011. "Innovation and Advances in Governance of Nanotechnology: New Research in Anticipatory Governance of Nanotechnology." Presentation. National Science Foundation 2011 NSF NSE Grantees Meeting, Arlington, VA.

195. **Guston, David H.** November 03, 2011. "The Pumpkin or the Tiger? Or, Michael Polanyi, Frederick Soddy and the Anticipatory Governance of Emerging Technoscience." Presentation. Society for the Study of Science (4S) Annual Conference, Cleveland, OH.

196. **Guston, David H.** June, 2011. "Shaping Science and Nanotechnology Future." Presentation. 2011 "Environmental Nanotechnology" Gordon Research Conference, Waterville Valley, NH.

197. **Guston, David H.** May 22, 2011. "The Role of Nanotechnologies in our Future." Presentation. Humanist Society of Greater Phoenix.

198. **Guston, David H.** April 04, 2011. "Nano and the City: Anticipatory Governance and Urban Sustainability." Presentation at 8th Annual U.S. - Korea Forum on N. California Technical Institute, Pasadena, CA.

199. **Guston, David H.** March 14, 2011. "Anticipatory Governance: A Strategic Vision for Building Reflexivity into Emerging Technologies." Presentation. Resilience 2011, Arizona State University, Tempe, AZ.

200. **Guston, David H.** March 11, 2011. "CNS-ASU and its Strategic Vision of Anticipatory Governance." Talk. Service Academy Alumni of Arizona.

201. **Guston, David H.** March 02, 2011. "Anticipatory Governance of Emerging Technologies." Presentation. Technology and Ethics Working Group, Yale University, New Haven, CT.

202. **Guston, David H.** December 06, 2010. "Anticipatory Governance of Emerging Technologies." Presentation. "New Tools for Science Policy: Better S&T for the Real World" series, CSPO, Washington, DC.

203. **Guston, David H.** November 17, 2010. "Anticipatory Governance of Emerging Technologies." Presentation. ESRC Genomics Forum, University of Edinburgh, Edinburgh, United Kingdom.

204. **Guston, David H.** November 15, 2010. "The Pumpkin of the Tiger? Or, When to Consider the Risks of Research?" Presentation. Institute of Hazard, Risk, and Resilience, Durham University, Durham, United Kingdom.

205. **Guston, David H.** November 10, 2010. "Anticipatory Governance of Emerging Technologies." Presentation. Institute of Systems and Synthetic Biology, Imperial College, London, United Kingdom.

206. **Guston, David H.** November 04, 2010. "Anticipatory Governance of Emerging Technologies: The Center for Nanotechnology in Society at ASU." Presentation. Triple Helix at ASU, Tempe, AZ.

207. **Guston, David H.** July, 2010. "Anticipatory Governance of Emerging Technologies: Foresight, Engagement and Integration." Presentation. Euroscience Open Forum 2010, Torino, Italy.

208. **Guston, David H.** May 10, 2010. "Reflections on Anticipatory Governance of Nanotechnology: Meanings for the Regulatory Environment." Talk. Toward Regulation of Nanomaterials: Conversation between academia, industry, law, and government, University of Notre Dame, IN.

209. **Guston, David H.** March, 2010. "Broader Societal Implications." Plenary remarks. Nano2: International Study of the Long-term Impacts and Future Opportunities for Nanoscale Science and Engineering, Evanston, IL.

210. **Guston, David H.** March, 2010. "The Anticipatory Governance of Emerging Technologies." Plenary remarks. INEW 2010: The Second International Nanomaterials Ethics Workshop. Korea Institute of Science and Technology, Seoul, Korea.

211. **Guston, David H.** March, 2010. "The Center for Nanotechnology at Arizona State University." Lecture. Program in the History and Philosophy of Science, Seoul National University, Seoul, Korea.

212. **Guston, David H.** February, 2010. "Bridging Nanoscience and Society: The Center for Nanotechnology in Society at ASU." Presentation. Annual Meeting of the American Association for the Advancement of Science, San Diego, CA.

213. **Guston, David H.** December, 2009. "Anticipatory Governance at the Center for Nanotechnology in Society." Lecture. ESRC Critical Public Engagement Seminar. Durham University, Durham, UK.

214. **Guston, David H.** December, 2009. "Public Engagement at CNS-ASU: The National Citizens Technology Forum and Other Modes." Lecture. Institute for Hazard Risk Research. Durham University, Durham, UK.

215. **Guston, David H.** October, 2009. "Genealogies of Anticipatory Governance." Presentation. Annual Meeting of the Society for Social Studies of Science, Washington, DC.

216. **Guston, David H.** October, 2009. "STS and Policy in the Academy." Chairs Plenary Panel. Annual Meeting of the Society for Social Studies of Science, Washington, DC.

217. **Guston, David H.** October, 2009. "Emerging Technologies and Sustainability: Parts I and II." Webinar briefing. Consultative Group on Biodiversity with the Center for Genetics and Society, San Francisco, CA.

218. **Guston, David H.** September 09, 2009. "The Roots, Branches and First Fruits of Anticipatory Governance." Presentation. Nanoethics Graduate Education Symposium, University of Washington, Seattle, WA.

219. **Guston, David H.** June, 2009. "Anticipatory Governance of Emerging Technologies." Presentation. NINE Summer Students Program. Sandia National Laboratory, Sandia, NM.

220. **Guston, David H.** June, 2009. "From the Lab to the Legislature: Locating Technology Assessment." Lecture on Science and Values. The Politicisation of Science. University of Bielefeld, Bielefeld, Germany.

221. **Guston, David H.** April, 2009. "Anticipatory Governance of Emerging Nanotechnologies at CNS-ASU." Video Plenary Lecture. Nanotechnology: Here and Now Meeting. Ministry of Research, Science and Technology, Wellington, New Zealand.

222. **Guston, David H.**, et al. March 09, 2009. "Nanotechnology and the Public: Data for Decision Makers." Briefing. U.S. Congressional Nanotechnology Caucus, Washington, DC.

223. **Guston, David H.** March, 2009. "Nano, Human Enhancement, and Public Engagement." Presentation. Faculty seminar on transhumanism, Center for the Study of Religion and Conflict, Arizona State University, Tempe, AZ.

224. **Guston, David H.** March, 2009. "Anticipatory Governance at the Center for Nanotechnology in Society at ASU." Presentation. Center for the Study of Institutional Diversity brown bag, Arizona State University, Tempe, AZ.

225. **Guston, David H.** March, 2009. "Public Engagement: National Citizens' Technology Forum." Presentation. Nanotechnology and the Public: Data for Decision Makers briefing before the U.S. Congressional Nanotechnology Caucus, Washington, DC.

226. **Guston, David H.** March, 2009. "Anticipatory Governance at the Center for Nanotechnology in Society at ASU." Presentation. Department of Political Science brown bag, Arizona State University, Tempe, AZ.

227. **Guston, David H.** March, 2009. "Anticipatory Governance at the Center for Nanotechnology in Society at ASU." Video lecture. Graduate class in Science and Technology Policy, Ford School of Public Policy, University of Michigan, Ann Arbor, MI.

228. **Guston, David H.** September 10, 2008. "CNS-ASU and Nano-in-Society in the USA." Presentation by video. Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

229. **Guston, David H.** July, 2008. "Reflections on CNS-ASU and Nano in Society in the U.." Keynote talk. Dutch NanoNed Flagship TA and Societal Aspects of Nanotechnology meeting, Utrecht, The Netherlands.

230. **Guston, David H.** June, 2008. "The Center for Nanotechnology in Society at ASU and the Anticipatory Governance of Emerging Technologies." Presentation. Institute for Science and Technology Studies, Bielefeld University, Bielefeld, Germany.

231. **Guston, David H**. June, 2008. "Anticipatory governance of Nanotechnologies: The Center for Nanotechnology in Society at ASU." Special talk. Visiting Japanese technology assessment delegation, Arizona State University, Tempe, AZ.

232. **Guston, David H.** April 04, 2008. "Governing Emerging Technologies." Presentation. Arizona Institute of Nanoelectronics opening ceremonies, Tempe, AZ.

233. **Guston, David H.** February, 2008. "Anticipatory Governance at the Center for Nanotechnology in Society at ASU." Video lecture. Graduate class in Science and Technology Policy, Ford School of Public Policy, University of Michigan, Ann Arbor, MI.

234. **Guston, David H.** November, 2007. "Toward Anticipatory Governance of Emerging Technologies." Presentation. Special Series on Science and Public Policy, Brown University, Providence, RI.

235. **Guston, David H.** November, 2007. "Governing Emerging Technologies." Presentation. Spirit of the Senses Salon, Phoenix, AZ.

236. **Guston, David H.** June 14, 2007. "Anticipatory governance and reflexivity: A means for realtime technology assessment." Talk. The Future of Nanotechnology: A Celebration of the 30th Anniversary of the Cornell NanoScale Science & Technology Facility, Cornell University, Ithaca, NY.

237. **Guston, David H.** December, 2006. "Anticipatory Governance of Emerging Technologies." Presentation. Monthly meeting of the Arizona Nanotechnology Cluster, Tempe, AZ.

238. **Guston, David H.** October, 2006. "Anticipatory Governance of Emerging Technologies: The Center for Nanotechnology in Society at ASU." Presentation. Stanford University Seminar in Science, Technology and Society, Stanford, CA.

239. **Guston, David H.** August, 2006. "Anticipatory Governance of Emerging Technologies." Presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

240. **Guston, David H.** May, 2006. "CNS-ASU: Interdisciplinary Programs in a Self-Styled Boundary Organization." Presentation. Conference of Trading Zones, Interactional Expertise, and Interdisciplinary Collaboration, Arizona State University, Tempe, AZ.

241. **Guston, David H.** May, 2006. "What Do We Want to Learn from Public Participation in Nanotechnology?" Presentation. NNI Public Participation in Nanotechnology Workshop, Arlington, VA.

242. **Guston, David H.** April, 2006. "Social Science Engages Nanotechnology." Invited talk. Virginia Tech, Blacksburg, VA.

243. **Guston, David H.** February 17, 2006. "The Center for Nanotechnology in Society at ASU." Nanotechnology Seminar: Social Science Engages Nanotechnology, AAAS Annual Meeting 2006, St. Louis, MO.

244. **Guston, David H.** February, 2006. "Anticipatory Governance at the Center for Nanotechnology in Society at ASU." Video lecture. Graduate class in Science and Technology Policy, Ford School of Public Policy, University of Michigan, Ann Arbor, MI.

245. **Guston, David H.** February, 2006. "Societal Implications of Nanotechnology." Lecture. Discovery Lecture Series 2006, Transforming Society Through Emerging Technologies: The National Nanotechnology Initiative at Five Years, Purdue University, West Lafayette, IN.

246. **Guston, David H.** and **Arnim Wiek**. November 16, 2010. "Nano and the City: Anticipatory Governance and Urban Sustainability." Presentation. Department of Geography, Durham University, Durham, United Kingdom.

247. **Guston, David H.** and **Arnim Wiek**. September, 2010. "Urban Design, Materials, and Built Environment: Nano in the City Research at ASU-CNS." Presentation. S.NET Conference, Darmstadt Technical University, Darmstadt, Germany.

248. **Halden, Rolf** and **Ben Hurlbut**. May 20, 2011. "Germ-Free and other Myths: Examining Antimicrobial Products." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

249. **Hamlett, Patrick.** March, 2008. "Public Deliberations About Science and Technology: Should the Public Have a Say on the Future of Nanotechnology." Presentation. NSF Science and Technology Center Program, Center for Environmentally Responsible Solvents and Processes Innovation Seminar Series, North Carolina State University, Raleigh, NC.

250. **Hamlett, Patrick** and **Michael Cobb**. August, 2008. "Reporting the Results of the first National Citizens Technology Forum." Presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

251. **Hamlett, Patrick** and **Michael Cobb**. July, 2008. "The First National Citizens Technology Forum on Human Enhancement: Results and Prospects." Paper presentation. VIPSI-2008 (Information Processing Society, International) Conference: Knowledge Engineering, Tutorials, & Brainstorming, Pisa, Italy.

252. **Hamlett, Patrick** and **Michael Cobb**. May, 2008. "The First National Citizens Technology Forum on Nanotechnology - First Results." Presentation. University & Industry Consortium, Spring 2008 Meeting, Lansing, MI.

253. Harsh, Matthew. November, 2011. "Issues Facing STS Research on the Governance of Emerging Technologies in sub-Saharan Africa." Presentation. Annual Meeting of the Society for the History of Technology, Cleveland, OH.

254. Harsh, Matthew. March 29, 2011. "Pro-poor Nanotechnology Applications for Water: Characterizing Private Sector Research Using Publication Data." Paper presentation. Winter School on Emerging Nanotechnologies, organized by Grenoble Ecole de Management, Autrans, France.

255. Harsh, Matthew and Thomas Woodson. November, 2011. "Pro-Poor Nanotechnology Applications for Water: Characterizing Private Sector Research." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

256. Harsh, Matthew and Thomas Woodson. April, 2011. "Mapping Nano-Innovation Systems for Water Applications." Presentation. Winter School on Emerging Nanotechnologies, Grenoble cole de Management, Pinsot, France.

257. Hays, Sean. July, 2009. "Nietzsche and the Philosophical Underpinnings of Human Enhancement." Presentation. SPT 2009: Converging Technologies, Changing Societies. Society for Philosophy and Technology, University of Twente, the Netherlands.

258. Hays, Sean. March, 2009. "Transhumanism, Anti-humanism, and Nietzsche's Overman." Presentation. Human Enhancement & Nanotechnology, Western Michigan University, Kalamazoo, MI.

259. **He, Jiping** and **Jason S. Robert**. June 04, 2006. "Wiring Brains to Machines: Science Fiction or Science Fact." Talk. CNS-ASU Science Cafe, Mills End Coffee Shop, Tempe, AZ.

260. **Hendrickson, Kirstin** and **Scott Lefler**. November 19, 2010. "You Are What You Eat: America's Relationship with Food." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

261. **Herkert, Joseph**, Heather Canary, **Karin Ellison** and **Jameson Wetmore**. November, 2011. "Integrating Microethics and Macroethics in Graduate Science and Engineering Education." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

262. **Hibner Koblitz, Ann**, **Priscilla Greenwood** and **Jennifer McNeill Bekki**. March 21, 2008. "Women in Science: Various Issues and Viewpoints." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

263. **Hillback, Elliott D.**, Anthony D. Dudo, Jiun-Yi Tsai, **Sharon Dunwoody**, **Dominique E. Brossard** and **Dietram A. Scheufele**. December, 2009. "Tracking Online Behavior after Exposure to News of a Local Nanotechnology Risk: A Risk Information Seeking and Processing (RISP) Model Approach." Presentation. Annual Convention of the Society for Risk Analysis (Emerging Nanoscale Materials Specialty Group Student Merit Award), Baltimore, MD.

264. **Ho, Shirley S.**, **Dietram A. Scheufele** and **Elizabeth A. Corley**. June, 2010. "Integrating Models of Mass-Interpersonal Communication: Testing Moderation and Mediation Effects of Elaborative Processing and Interpersonal Discussion on Scientific Knowledge and Public Attitudes Tow." Presentation. Annual Convention of the International Communication Association, Singapore.

265. **Ho, Shirley S.**, **Dietram A. Scheufele** and **Elizabeth A. Corley**. August, 2009. "Value Predispositions, Mass Media, and Attitudes toward Nanotechnology: The Interplay of Public and Experts." Presentation. Annual Convention of the Association for Education in Journalism and Mass Communication, Boston, MA.

266. **Ho, Shirley S.**, **Dietram A. Scheufele** and **Elizabeth A. Corley**. May, 2009. "Making Sense of Policy Choices: A Closer Look at the Mediating Roles of Elaborative Processing and Interpersonal Discussion on Public Perceptions of Nanotechnology." Paper presentation. Annual convention of the International Communication Association, Chicago, IL.

267. Ho, Shirley S., **Dietram A. Scheufele** and **Elizabeth A. Corley**. August, 2008. "Influences of Mass Media, Interpersonal Communication, and Cognitive Processing on Risks Versus Benefits Perception of Nanotechnology." Paper presentation. Annual convention of the Association for Education in Journalism and Mass Communication, Chicago, IL.

268. **Hogle, Linda F.** March, 2007. "Stem Cells as a Study in Transience: A Future History." Paper presentation. Max Planck Institute for the History of Science, Berlin, Germany.

269. **Holbert, Keith** and **Clark A. Miller**. January 18, 2008. "Why Not Nuclear Power? The Science and Politics behind Nuclear Energy." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

270. Huang, Lu, **Alan L. Porter** and Ying Guo. April 06, 2009. "Identifying the Role of Emerging Nanoparticles in Biosensors." Paper presentation. IAMOT 2009, 18th International Conference on Management of Technology, Management of Green Technology, International Association of Management of Technology, Orlando, FL.

271. Huang, Lu, Ying Guo and **Alan L. Porter**. October, 2009. "A Systematic Technology Forecasting Approach for New and Emerging Science and Technology: Case Study of Nano-enhanced

Biosensors." Presentation. 2009 Atlanta Conference on Science and Innovation Policy. The Paper won the Best Graduate Student Paper Award at the 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

272. Huang, Lu, Ying Guo, D. Zhu, **Alan L. Porter**, **Jan Youtie** and **Douglas K.R. Robinson**. 2011. "Organizing a Multidisciplinary Workshop for Forecasting Innovation Pathways: The Case of Nano-Enabled Biosensors." Presentation. Atlanta Conference on Science and Innovation Policy 2011, Atlanta, GA.

273. Huang, Lu, Ying Guo, Tingting Ma and **Alan L. Porter**. May, 2011. "Text Mining of Information Resources to Inform Forecasting of Innovation Pathways." Presentation. 4th International Seville Conference on "Future-Oriented Technology Analysis".

274. **Huang, Wan-Ling**, **Eric Welch** and **Elizabeth A. Corley**. 2009. "Public Sector Voluntary Initiatives: The Adoption of the Environmental Management System for Biosolids by Public Waste Water Treatment Facilities in the United States." Paper Presentation. Midwest Political Science Association Conference.

275. **Jacobs, Bert** and **Jameson Wetmore**. March 23, 2007. "Transferring Western Technology to Developing Countries: Good Intentions, Unexpected Outcomes." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

276. **Jimenez, Benedict**, **Eric Welch** and **Elizabeth A. Corley**. 2009. "Explaining Differences in the Quality and Effectiveness of Environmental Management Systems in Public Organizations: The Experience of Public Sewage and Wastewater Treatment Facility Operators in the." Paper Presentation. Midwest Political Science Association Conference.

277. Johnson, Darlene, Santiago Manriquez, **Terry Ryan**, Lynda Zeise and **Cynthia Selin**. November 21, 2008. "Democratizing Science: Should the Public Have a Voice in Science Research and Development." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

278. **Johnston, Stephen** and **Joan McGregor**. September, 2006. "Predicting Your Medical Future (Doc-in-a-Box)." CNS-ASU Science Cafe, Changing Hands Bookstore, Tempe, AZ.

279. **Jung, Ranu** and **Jason S. Robert**. January, 2007. "Adaptive Technologies for the Central Nervous System: Are We Changing What It Means to be Human." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

280. **Kambhampati, Subbarao** and David Calverley. November, 2007. "Do Robots Need a Bill of Rights? Implications of Artificial Intelligence." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

281. **Kavazanjian, Edward** and **Tim Lant**. April 15, 2011. "Disasters in Arizona: Are We Prepared." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

282. Kay, Luciano. November 05, 2011. "Aggregate Patterns of Linkage of Nanotechnology Centers with Industry: Program Outcomes." Session. Evaluation of a Nano Science and Technology Centers Program: Mixed Methods Approach to Assessing its Realization of Policy Objectives, American Evaluation Association.

283. Kay, Luciano. October, 2009. "The Emergence of Nanotechnology Enterprise in Brazil." Presentation. 2nd Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

284. Kay, Luciano. October, 2009. "Nanotecnologia en America Latina. Brasil y la Emergencia de Nano-empresas." Presentation. VI Seminario Internacional Nanotecnologia, Sociedade e Meio Ambiente - VI Seminanosoma, Manaus, Brazil.

285. Kay, Luciano. May, 2009. "Developing Nanotechnology in Latin America." Poster presentation. NSF Site Visit for CNS Renewal, Tempe, AZ.

286. Kay, Luciano. May, 2009. "Nanotechnology R and D Collaboration with Brazil. Managing Challenges and Opportunities in an Emerging Networked Technology." Presentation. Workshop of International R and D Cooperation with Latin America, Madrid, Spain.

287. Kay, Luciano. January, 2009. "Nanotechnology Research Networks in Brazil." Poster presentation. CNS All Hands Meeting, Tempe, AZ.

288. Kay, Luciano. January, 2008. "Nanotechnology in Latin America." Paper presentation. DRUID-DIME Academy Winter 2008 Ph.D. Conference on Economics and Management of Innovation and Organizational Change, Rebild, Denmark.

289. Kay, Luciano, **Noela Invernizzi** and **Philip Shapira**. October, 2009. "The Role of Brazilian Firms in Nanotechnology Development." Presentation. 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

290. **Kim, Matt** and **Prasad Boradkar**. September, 2007. "Designing Things: Balancing Beauty, Utility and Sustainability in Products." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

291. Kim, Youngjae, **Elizabeth A. Corley** and **Dietram A. Scheufele**. November, 2011. "How Should We Regulate Nanotechnology? Perceptions of Leading U.S. Nano-scientists." Paper Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

292. Kim, Youngjae, **Elizabeth A. Corley** and **Dietram A. Scheufele**. January, 2011. "Should we Regulate Nanotech at the Local, National, or International Level." Paper Presentation. All Hands Meeting for the Center for Nanotechnology in Society at ASU, Tempe, AZ.

293. Kullman, Joe and **Joel Garreau**. March 19, 2010. "Facts or Hype: What is the Media Telling Us About Nano and Other New Technologies." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

294. Ladwig, Peter, Doo-Hun Choi, Ashley A. Anderson, Michael A. Cacciatore, Xuan Liang, **Dominique E. Brossard**, et al. May, 2011. "Coverage of Emerging Technologies: A Comparison Between Print and Online Media." Paper Presentation. Annual Convention of the International Communication Association, Boston, MA.

295. Ladwig, Peter, Kajsa E. Dalrymple, **Dietram A. Scheufele**, **Dominique E. Brossard** and **Elizabeth A. Corley**. August, 2010. "Perceived or Factual Knowledge? Comparing Operationalizations of Science Knowledge." Paper Presentation. Annual Convention of the Association for Education in Journalism & Mass Communication, Denver, CO.

296. Laurent, Brice and **Erik Fisher**. August, 2007. "The Integration of Public Input into the American Nanotechnology Federal Program: Meanings and Contradictions." Presentation. Third Living Knowledge conference, Ecoles des Mines, Paris, France.

297. **Libaers, Dirk**. September, 2006. "The Role and Contribution of Foreign-born Scientists and Engineers to the U.S. Nano Science and Technology Research Enterprise." Presentation. 2006 Technology Transfer Society Conference, Atlanta, GA.

298. Lidberg, Shannon. November, 2008. "Who Benefits? India's National Design Policy and the Setting of Designers' Priorities." Presentation. CNS-ASU Workshop on Nanotechnology, Equity and Equality, Tempe, AZ.

299. Lidberg, Shannon. August, 2008. "Design Policy Around the Globe: How Developed and Emerging Markets are Using Design for Economic Competitiveness." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

300. Lidberg, Shannon. March, 2008. "Examining Potential Futures: A Designer's Toolbox for Identifying Potential Social and Cultural Implications." Presentation. ST Global Conference, Washington, DC.

301. **Lindsay, Stuart**. March 23, 2006. "Humankind's Future On the Head of a Pin: Nanotechnology - What it is, What it can do." Talk. CNS-ASU Science Cafe, Mills End Coffee Shop, Tempe, AZ.

302. **Lobo, Jose**. November 09, 2011. "How Green is Nano?" Presentation. Society for the study of Nanoscience and Emerging Technologies 2011 Conference, Tempe, AZ.

303. **Lobo, Jose** and **Deborah Strumsky**. March, 2010. "What Can Be Learned From Successful Nanotechnology Patent Applications." Presentation. Transatlantic Workshop on Nanotechnology Innovation and Policy, Atlanta, GA.

304. **Lynch, John** and **Matthew Cooper**. February 17, 2012. "Science and Religion: How Can We Peace It All Together." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

305. **Lynch, John** and **Norbert Samuelson**. February 20, 2009. "Evolution and Faith Revisited: Can the Two be Reconciled." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

306. Ma, Tingting, **Alan L. Porter**, J. Ready, Chen Xu, L. Gao, Wenping Wang, et al. May, 2011. "A Technology Opportunities Analysis Model: Applied to Dye-Sensitized Solar Cells for China." Presentation. 4th International Seville Conference on "Future-Oriented Technology".

307. **Maracas, George**, **Patrick Phelan** and **Braden Allenby**. September 19, 2008. "Is Nanotechnology Good for Sustainability or Not." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

308. **Marchant, Gary E.** July, 2006. "Nanotechnology Regulation: The United States Approach." Presentation. Conference on New Global Regulatory Frontiers: Evaluating what will work for Nanotechnology, Monash University, Melbourne, Australia.

309. Maricle, Genevieve. January, 2008. "The State of Policy and Socio-Economic Research." Presentation. American Meteorological Society Annual Meeting, New Orleans, LA.

310. Maricle, Genevieve. December, 2007. "Shaping Science: Turning Science Studies into Science Action." Presentation. Center for Science and Technology Policy Research Noontime Seminar Series, Boulder, CO.

311. Maricle, Genevieve. October, 2007. "Wrestling with Engagement: Tools for Iterating Intervention in STS." Presentation. Society for the Social Studies of Science Annual Meeting, Montreal, Canada.

312. **McGregor, Joan** and **Jameson Wetmore**. August, 2008. "Researching and Teaching the Ethics and Social Implications of Emerging Technologies." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

313. McKeon, Patrick. September 23, 2008. "State-Level Nanotechnology Policy Initiatives and Implications for Georgia." Presentation. Nano@Tech, Georgia Institute of Technology, Atlanta, GA.

314. McKeon, Patrick. 2008. "State-Level Nanotechnology Policy Initiatives and Implications for Georgia." Presentation. Fresh Perspectives on Economic Development, Atlanta, GA.

315. **Meldrum, Deirdre** and **Jameson Wetmore**. October 19, 2007. "Less is More Technology: Is Smaller and Cheaper Always Better." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

316. Meng, Yu. April, 2009. "Female Involvement in Nanotechnology Patenting: Does it Make a Difference." Presentation. Workshop on Original Policy Research, School of Public Policy, Georgia Institute of Technology, Atlanta, GA.

317. Merkerk, Rutger van, **David H. Guston** and Ruud Smits. November, 2006. "An International Comparison of Recent Technology Assessment Approaches: Bypassing Collingridge." Presentation. 4S Conference (Society for Social Studies of Science), Vancouver, British Columbia, Canada.

318. **Michelaki, Kostalena** and **Sandwip Dey**. February 18, 2011. "Invention Then and Now: Ancient and Modern Materials." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

319. **Miller, Clark A.** September, 2010. "Readying Citizens for Anticipatory Governance: A Challenge for Science Museums." Presentation. NISE Network Meeting, San Francisco, CA.

320. **Miller, Clark A**. March, 2010. "Innovation: Thoughts on Science, Technology, Transformation, and Valuation." Talk. Manifolds-A Social Innovation Symposium, Fergus, Canada.

321. **Miller, Clark A.** March, 2010. "Systems Integration: The Human and Social Dimensions of Energy System Transformation." Talk. Advisory Meeting, Directorate of Mathematical and Physical Sciences, National Science Foundation, Washington, DC.

322. **Miller, Clark A.** 2009. "Themes in Nanotechnology in Society Research." Talk. Nanoscale Informal Science Education Annual Meeting, San Francisco, CA.

323. **Miller, Clark A.** 2009. "Nanotechnology: Environment, Health, and Safety." Talk. Semiconductor Environment, Safety, and Health Association, Scottsdale, AZ.

324. **Miller, Clark A.** April, 2007. "Commentary: The Law and the Future Brain." Presentation. U.S. District Court and Sandra Day OConnor College of Law, Arizona State University, Tempe, AZ.

325. **Miller, Clark A.** December 09, 2006. "Boundary Organizations: Strategies for Linking Knowledge to Action." Presentation. Workshop on Boundary Organizations, Tempe, AZ.

326. **Miller, Clark A.** November 16, 2006. "Informing Anticipatory Governance of New and Emerging Technologies through Nanotechnology in Society Research." Presentation. Nanoscale Informal Science Education Network (NISE Net).

327. **Miller, Clark A.** October, 2006. "Reflexive, Anticipatory Governance of Science and Technology." Roundtable presentation. Public Administration and Challenges of Emerging Technologies Roundtable, 2006 NASPAA Annual Conference: The Future of the Public Sector, National Association of Schools of Public Administration and A, Minneapolis, MN.

328. **Miller, Clark A.** June, 2006. "Think Differently! Strategies for Success in Nano." Presentation. Food Research Institute, University of Wisconsin-Madison, Madison, WI.

329. **Miller, Clark A.** April 19, 2006. "Nanotechnology in Society Education: Teaching the Mental Habits of Social Engineers and Critical Citizens." Presentation. Education in Nanoscience and Engineering Symposium, 2006 Spring Meeting, Materials Research Society, San Francisco, CA.

330. **Miller, Clark A.** March, 2006. "Nanotechnology in Society." Presentation. Ohio State University, Columbus, OH.

331. **Miller, Clark A.** and **Ira Bennett.** March, 2009. "Imagining the Future: Can Science Fiction Help Us Govern Technology." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

332. **Miller, Clark A.** and Ira Bennett. April, 2007. "Science Fiction as Technology Assessment: Some Preliminary Thoughts on Anticipatory Governance for the Rest of Us." Presentation. Cornell University, Ithaca, NY.

333. **Moore, Ana**. September 27, 2006. "Renewable Energy Through Photosynthesis." Talk. CNS-ASU Science Cafe, Friendly House, Phoenix, AZ

334. **Newman, Nils**. November, 2006. "Nanotechnology Research Mapping and Assessment." Presentation. STI Indicators Conference, Leuven, Belgium.

335. Newman, Nils. June 07, 2006. "Where is Nano Going?" Presentation. Advancing Measures of Innovation: Knowledge Flows, Business Metrics, and Measurement Strategies Workshop, National Science Foundation, Arlington, VA.

336. **Newman, Nils**, **Ismael Rafols**, **Jan Youtie**, **Alan L. Porter** and Luciano Kay. November, 2011. "Patent Overlay Mapping: Visualizing Technological Distance." Panel Presentation. Nanotechnology, Innovation, and Commercialization: Learning about a Technology Cycle through Patent Data, Patent Statistics for Decision Makers 2011.

337. **Pandza, Kristo**, Paul Ellwood and **Erik Fisher**. October, 2009. "From Social Aspirations to Organizational Capability: Identifying Micro-Foundations and the Role of Strategizing." *Interactive Strategy Process Work-in-Progress Workshop/ SMS Pre-Conference: Advancing Strategy Process Research.* Washington D.C. October 11.

338. Pei, R., **Alan L. Porter** and P. Gao. December, 2010. "Profiling a Decade of Chinese Nano-Biomedical Science Research." Presentation. IEEE International Engineering and Engineering Management (IEEM), China.

339. Philbrick, Mark. September, 2009. "Operationalizing Anticipatory Governance: Steering Emerging Technologies Towards Sustainability" Presentation. Inaugural Meeting of the Society for the Study of Nanoscale and Emerging Technologies. September 8-11, 2009, Seattle, WA.

340. Philbrick, Mark. 2009. "The National Citizens' Technology Forum: Lessons for the Future" Presentation. Annual Meeting of the Society for the Social Studies of Science. October 28-November 1, 2009, Washington, DC.

341. **Porter, Alan L.** December, 2010. "Profiling and Knowledge Tracking." Presentation. Chinese Academy of Sciences Library, Beijing.

342. **Porter, Alan L.** November, 2009. "Assessing Nanotechnology: Research Metrics and Maps." Presentation. American Evaluation Association Annual Conference, Orlando, FL.

343. **Porter, Alan L.** August, 2009. "Locating Nanotechnology among the Disciplines, Nano @ Tech."

344. **Porter, Alan L.** November 30, 2007. "Trends in Data Treatment in the United States." Keynote presentation. International Conference on Competitive Intelligence, Carlos III University of Madrid, Madrid, Spain.

345. **Porter, Alan L.** October, 2007. "Public Lecture." Institute for S&T Information, Beijing, China.

346. **Porter, Alan L.** November 15, 2006. "Mining Patents and Research Publications to Improve Technology Management: Nano Illustrations." Presentation. 2nd PATINEX Conference, Seoul, South Korea.

347. **Porter, Alan L.**, David J. Schoeneck, **Ajay S. Bhaskarabhatla**, **Jan Youtie** and **Dirk Libaers**. May, 2006. "Explorations in Research and Innovation Systems Assessment: Where Is Nano Going." Presentation. The Atlanta Conference on Science and Technology Policy 2006 US-EU Policies for Research and Innovation, Atlanta, GA.

348. **Porter, Alan L.**, David J. Schoeneck, **Nils Newman**, **Philip Shapira**, **Jan Youtie** and Rich Kolar. September, 2006. "Nano R&D Profiles: A Deeper Look." Presentation. International Conference on Science & Technology Indicators, Leuven, Belgium.

349. **Porter, Alan L.**, David J. Schoeneck, **Philip Shapira**, **Jan Youtie** and Rich Kolar. September, 2006. "Defining the Nanotechnology Domain in Realtime Technology Assessment." Presentation. Presented at 2006 Technology Transfer Society Conference, Atlanta, GA.

350. **Porter, Alan L.** and **Ismael Rafols**. 2009. "Measuring and Mapping Interdisciplinary in Six Research Fields Over Time (1975-2005)." Presentation. ISSI Conference, Rio de Janeiro.

351. **Porter, Alan L.** and **Ismael Rafols**. September, 2008. "Science Overlay Maps: Easy-to-use Tools to Help Visualize and Track Bodies of Research, A Deeper Look at the Visualization of Scientific Discovery in the Federal Context." Presentation. Workshop at the National Science Foundation, Arlington, VA.

352. **Porter, Alan L.**, **Jan Youtie**, **Philip Shapira**, David J. Schoeneck, Li Tang and Pratik Mehta. April, 2007. "Profiling Nano R&D." Presentation. Presented at Nano-Giga Challenges, Phoenix, AZ.

353. **Porter, Alan L.** and **Jayesh Patil**. March, 2007. "Where Is Nano Going?" Presentation. Nano-Giga Challenges, Phoenix, AZ.

354. **Porter, Alan L.** and Lu Huang. December, 2010. "Tech Mining and Forecasting of Innovation Pathways, as Applied to Nano-enhanced Biosensors." Presentation. International Conference on Technological Innovation and Competitive Technical Intelligence, Beijing.

355. **Porter, Alan L.**, **Martin Meyer** and **Ismael Rafols**. May, 2008. "The Cognitive Geography of Nanotechnologies: Location and Knowledge Flows of Nano-Research in the Map of Science." Presentation. Presentation at the NBER Conference on Emerging Industries: Nanotechnology and NanoIndicators, Cambridge, MA.

356. **Porter, Alan L.**, **Nils Newman** and **Jan Youtie**. October, 2009. "Tech Mining, VantagePoint, and Science Overlay Mapping." Presentation. Pre-conference Workshop of 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

357. **Porter, Alan L.**, **Philip Shapira** and **Jan Youtie**. October, 2008. "Nano Social Science: An Emerging Specialization." Presentation. Nanotechnology and Society: Emerging Opportunities & Challenges Networks, Risk and Knowledge Sharing, University of Massachusetts, Amherst, MA.

358. **Porter, Alan L.**, **Philip Shapira** and **Jan Youtie**. September, 2006. "Defining the Nanotechnology Domain in a Real Time Technology Assessment." Presentation. Technology Transfer Society Annual Conference, Atlanta, GA.

359. **Porter, Alan L.** and Stephen Carley. November, 2010. "Three Generation Research Knowledge Tracking: Publication and Citation Analyses." Demonstration Workshop. American Evaluation Association Conference, San Antonio, TX.

360. **Porter, Alan L.**, Tingting Ma and Ying Gao. November, 2011. "Tracking Emergence of Nanotechnology Dye-Sensitized Solar Cells (DSSCs)." Panel Presentation. Nanotechnology, Innovation, and Commercialization: Learning about a Technology Cycle through Patent Data, Patent Statistics for Decision Makers 2011.

361. **Porter, Alan L.**, Tingting Ma and Ying Guo. November, 2011. "Patents+ in Newly Emerging Science and Technology: Tracking Emergence of Dye-Sensitized Solar Cells." Presentation. Patent Statistics for Decision Makers, Alexandria, VA.

362. **Porter, Alan L.**, Tingting Ma and Ying Guo. June, 2011. "Multiple Perspective Research Profiling: Illustrated for Dye-Sensitized Solar Cells." Proceedings. International Council for Scientific and Technical Information 2011 Summer Conference.

363. **Porter, Alan L.,** Ying Guo and Lu Huang. October 12, 2010. "Integrating Patent Analysis with R and D and Business Analyses to Forecast Innovation Prospects: Nano-Enhanced Solar Cells." Presentation. Patent Information Users Group PIUG 2010 Northeast Conference, New Brunswick, NJ.

364. **Porter, Alan L.**, Ying Guo, Lu Huang and Douglas K. R. Robinson. November, 2011. "Forecasting Innovation Pathways: The Case of Nano-enhanced Solar Cells." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

365. **Porter, Alan L.**, Ying Guo, Lu Huang and Douglas K. R. Robinson. December, 2010. "Forecasting Innovation Pathways: The Case of Nano-enhanced Solar Cells." Paper Presentation. International Conference on Technological Innovation and Competitive Technical Intelligence, Beijing.

366. **Posner, Jonathan** and **Jameson Wetmore**. April, 2009. "Technologies of Distraction: Mobile Phones, iPods, and E-mail." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

367. **Rafols, Ismael** and **Alan L. Porter**. October, 2009. "Interdisciplinary in Nanoscience: What is the Nano Field and how does it Share its Knowledge." Presentation. 2nd Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

368. **Rafols, Ismael**, **Alan L. Porter**, **Jan Youtie** and Li Tang. September, 2008. "Nanotechnology as a Multi-polar Science." Presentation. Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

369. **Rafols, Ismael**, **Alan L. Porter** and **Loet Leydesdorff**. October, 2009. "Science Overlay Maps: A New Tool for Research Evaluation." Presentation. 2009 Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

370. **Rafols, Ismael**, **Alan L. Porter** and **Loet Leydesdorff**. 2009. "The Use of Global Maps of Science in Management and Policy Contexts." Presentation. Accepted. ENID Indicators Conference 2010.

371. **Rafols, Ismael**, **Alan L. Porter** and **Martin Meyer**. September, 2009. "A Model of Interdisciplinarity in Nanotechnology: How Local Knowledge Integration Links a Globally Fragmented Field." Presentation. SNET Conference.

372. **Rafols, Ismael**, **Martin Meyer**, Jung-Hwan Park and **Alan L. Porter**. August, 2008. "The Cognitive Geography of Nanotechnologies: Location and Knowledge Flows of Nano-Research in the Map of Science." Presentation. Presented at Society for Social Studies of Science (4S), Rotterdam, The Netherlands.

373. **Randles, Sally** and **Jan Youtie**. November, 2011. "Responsible Innovation and Responsible Governance." Roundtable Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

374. **Rittmann, Bruce** and **Dawn Schwenke**. September 18, 2009. "Ending Age-Related Disease: How Will Our Lives Change if we're Healthier Longer." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

375. **Robert, Jason S.** January, 2009. "Technology and Human Enhancement: Whats the Connection." Presentation. Midwestern University, Glendale, AZ.

376. **Robert, Jason S.** June, 2007. "Braving the Brain." Presentation. Canadian Bioethics Society, Toronto, Canada.

377. **Robert, Jason S.** May, 2007. "Cyborgs, Ratbots, and Bionic Humans: Wiring Brains to Machines." Presentation. Discovery Center, Halifax, Nova Scotia, Canada.

378. **Robert, Jason S.** May, 2007. "Neural Interface Systems: Ethical and Conceptual Issues at the Frontier of Brain Repair." Presentation. Neuroethics Program, Stanford Center for Biomedical Ethics, Palo Alto, CA.

379. **Robert, Jason S.** April, 2007. "Problematizing Enhancement." Presentation. Dartmouth College, N, Hanover, NH.

380. **Robert, Jason S.** February, 2007. "Braving the World of Neurotechnology." Presentation. Health Law Institute Seminar Series, Dalhousie University, Nova Scotia, Canada.

381. **Robert, Jason S.** October, 2006. "Brain Repair and Neural Enhancement." 4S Conference (Society for Social Studies of Science), Vancouver, Canada.

382. **Robert, Jason S.** October, 2006. "Nanotechnology, Neurotechnology, and Society." Presentation. Institute of Nanotechnology Symposium, Northwestern University, Evanston, IL.

383. **Robert, Jason S.** October, 2006. "Forbidden Science Boundaries on New Emerging Science and Technology." Presentation. Jewish Women's Symposium, Tempe, AZ.

384. **Robert, Jason S.** August, 2006. "Controversial Science, Controversial Scientist." Presentation. NABIS Conference, Chicago, IL.

385. **Rogers, Juan D.** November 05, 2011. "Program Level Assessment of Outcomes and Impacts of Research Performance of Centers." Session. Evaluation of a Nano Science and Technology Centers Program: Mixed Methods Approach to Assessing Its Realization of Policy Objectives, American Evaluation Association.

386. **Rogers, Juan D.** December, 2010. "Publication Patterns and Collaborative Work at NSECs." Presentation. 2010 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA.

387. **Rogers, Juan D.** October, 2009. "Nanotechnology Research Centers: What Value do they add? What Values do they Operate on." Presentation. 2nd Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

388. **Rogers, Juan D.**, **Jan Youtie** and Luciano Kay. November, 2011. "Commercialization Patterns of Nanoscale Science and Engineering Centers: The Cafe of Polymer v. Clean-Room based Technology." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

389. **Rogers, Robert P. Jr.** June, 2008. "Research Centers as Policy Tools in Emerging Technologies: Scientific and Technical Human Capital in Nanotechnology Centers in the U.S." Presentation. Chinese Academy of Sciences, Beijing, China.

390. **Rogers, Robert P. Jr.** April, 2007. "The Role of Research Centers in the US Nanotechnology Initiative." Presentation. Workshop on Social Dimensions of Nanotechnology, Paris, France.

391. **Roland, Kenneth** and **Antonio Garcia**. September 16, 2011. "Vaccines: Can They Give us a Disease-Free World." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

392. **Samuelson, Hava** and **Braden Allenby**. April 16, 2010. "Upgrading Ourselves: Can Technology Make Us Better." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

393. **Sarewitz, Daniel**. October, 2008. "Paths to Outcomes Based Innovation Policy." Presentation. National Institutes of Health Science of Science Management Meeting, Bethesda, MD.

394. **Sarewitz, Daniel**. September, 2008. "Science Policy and Innovation." Presentation. Presidential Council of Advisors on Science and Technology, Washington, DC.

395. **Sarewitz, Daniel**. November 26, 2007. "New Tools for Science Policy Making." Presentation. Harvard University, Science, Technology, and Society Circle, Cambridge, MA.

396. **Sarewitz, Daniel**. October, 2007. "Anticipatory Governance of Emerging Technologies: Competing Values, Irreducible Uncertainties, and Transformation Innovation." Presentation. University of Oviedo, Oviedo, Spain.

397. **Sarewitz, Daniel**. October, 2007. "Technology and Effectiveness in Contested Political Settings, Center for Research on Energy, Environment, and Transportation." Presentation. CIEMAT, Madrid, Spain.

398. **Sarewitz, Daniel**. April, 2007. "Political Effectiveness in Science and Technology." Presentation. Workshop on Science and Social Values, Center for Interdisciplinary Research, Bielefeld University, Bielefeld, Germany.

399. **Sarewitz, Daniel**. March, 2007. "Connecting Research to Social Outcomes." Presentation. Presentation to the University of Nebraska Board of Regents, Lincoln, NE.

400. **Sarewitz, Daniel**. January, 2007. "Ways of Knowing Novel Materials, Symposium on Environmental Effects of Novel Materials and Processes." Presentation. Royal Commission on Environmental Pollution, London, England.

401. **Sarewitz, Daniel**. August, 2006. "Policy Perspectives." Panel. Meta-Analysis: Emerging Themes in Science Policy. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

402. **Sarewitz, Daniel**. February, 2006. "Tools for Goldilocks: Rethinking the Relationships Among Research, Funding, and Progress." Presentation. AAAS Annual Meeting, Symposium on The Goldilocks Dilemma Facing Science Funding: Can it be Just Right, St. Louis, MO.

403. **Sarewitz, Daniel** and **Roy Curtis**. May 18, 2007. "Forbidding Science: Are There Things We Just Shouldn't Know." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

404. **Scheufele, Dietram A.** March, 2009. "Public Understanding of and Attitudes toward Nanotechnology: An Overview." Presentation. Presented at the Nanotechnology and Public: Data for Decision Makers briefing to the Congressional Nanotechnology Caucus, Washington, DC.

405. **Scheufele, Dietram A.** February, 2008. "A Comparative Look at Markets, Media, and Emerging Attitudes About Nanotechnology." Panel. The Annual Convention of the American Association for the Advancement of Science, Boston, MA.

406. **Scheufele, Dietram A.** February, 2008. "Engaging Religious Audiences on Nanotechnology." Presentation. Annual Convention of the American Association for the Advancement of Science, Boston, MA.

407. **Scheufele, Dietram A.** May, 2007. "Public Perceptions and Understanding of Nanotechnology." Presentation. Center for Nanoscale Science and Technology (CNST) Nanotechnology Workshop, University of Illinois, Urbana-Champaign, IL.

408. **Scheufele, Dietram A.** March 16, 2007. "Public Perceptions and Understandings of Nanotechnology." Presentation. Nano and Giga Challenges in Electronics and Photonics conference, Tempe, AZ.

409. **Scheufele, Dietram A.** March 08, 2007. "Risky Business? Risk Perception & Nano Business." Panel. Symposium, Illinois Institute of Technology, Center on Nanotechnology and Society, Chicago, IL.

410. **Scheufele, Dietram A.** January 30, 2007. "How Media and Audiences Make Sense of Scientific Issues: The Case of Nanotechnology." Presentation. CMCIS Research Lecture Series, University of South Carolina, Columbia, SC.

411. **Scheufele, Dietram A.** 2007. "Understanding the Opinion and Communication Dynamics Surrounding Nanotechnology." Presentation. Symposium on the Social Studies of Nanotechnology, University of Pennsylvania, Wharton School of Business & Chemical Heritage Foundation,, Philadelphia, PA.

412. **Scheufele, Dietram A.** 2006. "Influences on Public Opinion About Nanotechnology." Presentation. Public Participation in Nanotechnology & Nanoscale Science workshop, National Nanotechnology Coordination Office, Washington, DC.

413. **Scheufele, Dietram A.** 2006. "It's Not All About Information: Exploring People's Attitudes Toward New Technologies." Lecture. Science, Democracy, and Public Policy colloquium, La Follette School of Public Affairs, University of Wisconsin, Madison, WI.

414. **Scheufele, Dietram A.** 2006. "Public Communication and Policy Making About Nanotechnology." Talk. Nano Workshop for Policy Makers, Materials Research Science and Engineering Center and Engineering Center on Nanostructured Interfaces, University of Wisconsin, Madrid, WI.

415. **Scheufele, Dietram A.** 2006. "Successful Public Communication about Nanotechnology." Talk. The Baldwin Nano Workshop for Journalists, Materials Research Science and Engineering Center and Engineering Center on Nanostructured Interfaces, University of Wisconsin, Madison, WI.

416. **Scheufele, Dietram A.** 2006. "Successful Public Communication about Nanotechnology." Talk. Integration of Societal Implications into Science workshop, U.S. Department of Energy, Washington, DC.

417. **Scheufele, Dietram A.**, **Dominique E. Brossard** and **Kajsa E. Dalrymple**. November 16, 2007. "Whose Voice Matters Most? Public Opinion about the Role of Scientists, Religious Groups, Officials, and Citizens in Public Discourse about Science." Presentation. Annual Convention of the Midwest Association for Public Opinion Research, Chicago, IL.

418. **Scheufele, Dietram A.**, **Elizabeth A. Corley**, Tsung-Jen Shih, **Kajsa E. Dalrymple** and **Shirley S. Ho**. November, 2008. "Public Opinion Dynamics Surrounding Emerging Technologies in Europe and the U.S." Presentation. Annual convention of the Midwest Association for Public Opinion Research.

419. **Scheufele, Dietram A.**, **Elizabeth A. Corley**, **Elliott D. Hillback**, Tsung-Jen Shih, **Sharon Dunwoody** and **David H. Guston**. October 13, 2007. "Nano Attitudes Among Scientists and the Public." Presentation. Annual Convention of the Society for Social Studies of Science, Montreal, Canada.

420. Schuurbiers, Daan. May 04, 2009. In and Out of the Lab." Lab Meeting. Center for Bioenergy and Photosynthesis, Arizona State University, Tempe, AZ.

421. Schuurbiers, Daan. January 19, 2009. "Bugs in the Petri Dish and Beyond - Results from a Midstream Modulation Study in a Microbiology Lab in Delft." Presentation. STIR Workshop 1: Constructing Foundations, Tempe, AZ.

422. Schuurbiers, Daan. January 17, 2009. "Can Shadows Shed Light?" Presentation. STIR Workshop 1: Constructing Foundations, Tempe, AZ.

423. Schuurbiers, Daan. January 15, 2009. "Midstream Modulation as Part of a PhD on Social Responsibility in Science." Presentation. CNS All Hands Meeting, Tempe, AZ.

424. Schuurbiers, Daan. September 19, 2008. "Of Social Responsibility and Scientific Practice - Midstream Modulation in Two Microbiology Laboratories." Presentation. CSG Workshop "Doing Society and Genomics", Nijmegen, The Netherlands.

425. **Seager, Thomas**, **Diane Gruber** and David Uhlman. November 18, 2011. "Will Our Products Last? Or is it Just a Thing of the Past." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

426. **Selin, Cynthia**. February, 2012. "Materializing Futures: How Artifacts, Prototypes and Objects Support Public Deliberation of Alternative Futures." Presentation. ASU School of Public Affairs Colloquium series, Tempe, AZ.

427. **Selin, Cynthia**. December, 2011. "Climate of Uncertainty: Civic Scenarios for Decision Making." Presentation. New Tools for Science Policy, CSPO, Washington, DC.

428. **Selin, Cynthia**. December, 2011. "Museums as Mediums for Engaging Citizens in Climate Change Adaptation Scenario Planning." Presentation. Dupont Summit 2011: Pressing Issues, Little Time, Washington, DC.

429. **Selin, Cynthia**. July, 2011. "Urban Foresight: Rethinking Technology in Complex Systems." Invited Talk. Joint Research Centre, European Commission, Ispra, Italy.

430. **Selin, Cynthia**. May, 2011. "Diagnosing Futures: How Scenarios Support Reflexive Governance of Socio-Technical Systems." Presentation. School of Sustainability. Future Scenarios of Nanotechnology. Society for the Study of Nanotechnology and Emerging Technologies, Tempe, AZ.

431. **Selin, Cynthia**. May, 2011. "Futuring and Foresight in Nanotechnology." Presentation. CNS Private Sector Engagement Workshop, Tempe, AZ.

432. **Selin, Cynthia**. March 14, 2011. "Rethinking Urban Governance: Knitting together Foresight and Sustainability." Presentation. Resilience, Innovation and Sustainability: Navigating the Complexities of Global Change, Tempe, AZ.

433. **Selin, Cynthia**. March, 2011. "Scenaric Thinking and Earth Systems Engineering and Management: A Generative Dialogue." Presentation. CESEM Distinguished Lecture Series, Arizona State University, Tempe, AZ.

434. **Selin, Cynthia**. March, 2011. "Diagnosing Futures: How Scenarios Support Reflexive Governance of Socio-Technical Systems." Presentation. School of Sustainability Brown Bag, Arizona State University, Tempe, AZ.

435. **Selin, Cynthia**. December, 2010. "Plausibility Reasoning and Nanotechnology Futures." Presentation. Society for Risk Analysis Annual Conference, Salt Lake City, UT.

436. **Selin, Cynthia**. November, 2010. "Foresight and Innovation." Presentation. Practices of Anticipatory Governance Workshop, Arizona State University, Tempe, AZ.

437. **Selin, Cynthia**. October, 2010. "Foresight and Scenarios." Presentation. Nanoscale Informal Science Education Network Annual Meeting, San Francisco, CA.

438. **Selin, Cynthia**. September, 2010. "Plausibilistic Reasoning in Nanotechnology Futures." Presentation. Society for the Study of Nanotechnology and Emerging Technologies, Darmstadt, Germany.

439. **Selin, Cynthia**. August, 2010. "Nanotechnology & Plausibility." Presentation. Society for the Social Studies of Science, Tokyo, Japan.

440. **Selin, Cynthia**. July, 2010. "The Future of Sustainable Phoenix." Presentation. Institute for the Future, Palo Alto, CA.

441. **Selin, Cynthia**. May, 2010. "The Future of Organizing." Presentation. Organization Design Forum Annual Meeting, Denver, CO.

442. **Selin, Cynthia**. April, 2010. "The Future of Nanotechnology" Nanotechnology Law and Policy Course. Arizona State University. Tempe, AZ.

443. **Selin, Cynthia**. March, 2010. "Anticipation and Foresight." International Study of the Long-term Impacts and Future Opportunities for Nanoscale Science and Engineering Workshop. Chicago.

444. **Selin, Cynthia**. March, 2010. "Envisioning Solar to Fuels." Workshop on Energy Futures, Policy and Society. Arizona State University. Tempe, AZ.

445. **Selin, Cynthia**. November, 2009. "Plausibility." ASU Plausibility Workshop. Tempe, AZ.

446. **Selin, Cynthia.** October, 2009. "Diagnosing Futures." Society for the Social Studies of Science. Washington, DC.

447. **Selin, Cynthia**. September, 2009. "Deliberation and Anticipation." Society for the Study of Nanoscience and Emerging Technologies. Seattle, WA.

448. **Selin, Cynthia.** June, 2009. "Anticipation and Deliberation on the Nano City." Risoe National Laboratory, Denmark.

449. **Selin, Cynthia**. April, 2009. "Using Scenarios and Foresight to Manage Turbulence." Presentation. Organizational Design Forum, Tacoma, WA.

450. **Selin, Cynthia**. May, 2008. "Managing the Uncertainty of Nanotechnologies." Panel. Challenges to Law, Ethics, and Policy Making Conference at University of Padua, Padua, Italy.

451. **Selin, Cynthia**. February, 2008. "Evidencing the Future and other Dilemmas Working in the Future Tense." Presentation. Anthropology Department, Rice University, Houston, TX.

452. **Selin, Cynthia**. October 12, 2007. "Between Hope and Prudence: Experiments with Scenaric Learning." Presentation. Society for the Social Studies of Science, Annual Meeting, Montreal, Canada.

453. **Selin, Cynthia**. October, 2007. "The Future Tense: The Ways and Means of Anticipation." Presentation. CSPO Enlightening Lunch, Tempe, AZ.

454. **Selin, Cynthia**. September, 2007. "The Future of Nano & Bio Technologies." Panel. CRN conference on Challenges & Opportunities, Tucson, AZ.

455. Selin, Cynthia. July, 2007. "Real Time Technology Assessment: Anticipation, Integration, & Engagement." Presentation. Program on Technology Scenarios, Risoe, National Laboratory, Roskilde, Denmark.

456. Selin, Cynthia. April, 2007. "Hope and Prudence: Experiments in Scenaric Learning." Presentation. Futures of Life: Acquiring and Creating Anticipatory Knowledge, Cornell University, Ithaca, NY.

457. Selin, Cynthia. March 23, 2007. "Anticipatory Governance through Scenarios." Presentation. Workshop on Global Environmental Futures: Interrogating the Practice and Politics of Scenarios, Watson Institute for International Studies, Brown University, Providence, RI.

458. Selin, Cynthia. September, 2006. "The Center for Nanotechnology in Society." Presentation. NanoTX Conference, Dallas, TX.

459. Selin, Cynthia and Ira Bennett. November 19, 2006. "Visions of Nanotechnology." Talk. CNS-ASU Science Cafe, Changing Hands Bookstore, Tempe, AZ.

460. **Selin, Cynthia**, Sarah R. Davies, Gretchen Gano and **Angela Pereira**. December, 2010. "Material Deliberation: Tapping the Dilemmas of Water, Technology, and the City." Presentation. Spaces and Flows Conference, University of California, Los Angeles, CA.

461. **Selover, Nancy** and **Ray Quay**. October 21, 2011. "Will Arizona's Climate Change Leave us Thirsty." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

462. Shanley, Lea A. September, 2006. "Control and Access: GIS Legal Issues for Indian Nations in the United States." Presentation. URISA 2006 Annual Conference, Chicago, IL.

463. Shanley, Lea A. June, 2006. "Privacy and Security: Internet Publication of Digital Spatial Data and Land Records in Wisconsin." Presentation. Presentation at WLIA Regional Meeting on Privacy, Copyright, Data Distribution and GIS Law, Elkhart Lake, WI.

464. Shanley, Lea A. and Steve J. Ventura. August, 2007. "Land Records and Map Services: Internet Privacy Policies in Wisconsin." for URISA 2007Annual Conference, Chicago, IL.

465. **Shapira, Philip**. October 14, 2011. "The Emergence of Distributed Technology Assessment in the USA, Research Workshop: Foresight and Science, Technology and Innovation Policies: Best Practices." Panel. Policy Instruments for Science, Technology and Innovation (Evaluation of Science and Technology Policies). National Research University - Higher School of Economics, Moscow.

466. **Shapira, Philip**. March 29, 2011. "Trajectories of Nanotechnology Research and Innovation." Presentation. Grenoble Ecole de Management's Winter School on Emerging Nanotechnologies, Autrans, France.

467. **Shapira, Philip.** December, 2010. "Trajectories of Nanotechnology Research and Innovation." Presentation. 2010 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA.

468. **Shapira, Philip.** October 01, 2010. "Innovation System Dynamics and the Globalization of Nanotechnology Innovation." Presentation. S.NET Conference 2010, Darmstadt, Germany.

469. **Shapira, Philip**. March, 2010. "Nanotechnology Innovation and Commercialization." Panel on Innovative and Responsible Governance to Address Grand Challenges of Human Development, Workshop on the Long-term Impacts and Future Opportunities for Nanoscale Science and Engineering (NANO2), Chicago (Evanston), IL.

470. **Shapira, Philip**. June, 2009. "Anticipating Nanotechnology: Applying Real-Time Technology Assessment to Develop Strategic Insights for Nanotechnology Research and Innovation." Seminar. Centre for Self Organising Molecular Systems (SOMS), University of Leeds, UK.

471. **Shapira, Philip**. May, 2009. "From Lab to Market: Pathways of Research Commercialization in Nanotechnology Firms in China." Presentation. Colloquium on Nanotechnology Innovation and Commercialization in China, Manchester, UK.

472. **Shapira, Philip**. April, 2009. "State Models for Supporting Emerging Nanotechnology." Presentation. Workshop on Regional, State and Local Initiatives in Nanotechnology, National Nanotechnology Initiative, Oklahoma City, OK.

473. **Shapira, Philip**. March, 2009. "Anticipating Nanotechnology: Real-Time Technology Assessment of Research and Innovation Systems." Presentation. School of Management and Economics, Knowledge Management and Data Analysis Laboratory, Beijing Institute of Technology, Beijing, China.

474. **Shapira, Philip**. March, 2009. "Anticipating Nanotechnology: Real-Time Technology Assessment and the Center for Nanotechnology in Society." Presentation. Institute for Future Technology (IFTECH), Tokyo, Japan.

475. **Shapira, Philip**. March, 2009. "Emergence of Distributed Technology Assessment in the USA: From OTA to the Center for Nanotechnology in Society." Presentation. International Workshop on Innovation and Institutionalization of TA in Japan, I2TA, University of Tokyo, Tokyo, Japan.

476. **Shapira, Philip**. June 20, 2007. "Nanotechnology in Society: Research and Innovation Systems Program Assessment." Presentation. Beijing Institute of Economic Management, Chinese Academy of Science, June 19, 2007; and at Institute of Policy and Management, Chinese Academy of Sciences, Beijing, China.

477. **Shapira, Philip**. February, 2007. "Societal Assessment of Nanotechnology U.S. Experience." Presentation. Symposium on Nanotechnology by the Ministry of Research, Science and Technology at the Advanced Materials and Nanotechnology (AMN-3) 2007 Conference, Wellington, New Zealand.

478. **Shapira, Philip** and **Alan L. Porter**. March 23, 2009. "Nanotechnology: Will it Drive a New Innovation Economy for the US." Presentation. Project on Emerging Nanotechnologies, Woodrow Wilson International Center for Scholars, Washington, DC.

479. **Shapira, Philip** and **Alan L. Porter**. September, 2005. "Mapping the Nanotechnology Enterprise." Presentation. American Political Science Association Annual Meeting, Washington, DC.

480. **Shapira, Philip**, **Alan L. Porter** and **Jan Youtie**. August, 2006. "Refining Search Terms for Nanotechnology." Presentation. Presented at the National Science Foundation, Arlington, VA.

481. **Shapira, Philip**, **Alan L. Porter**, **Jan Youtie** and Li Tang. September, 2008. "Nanotechnology Questions, Methods, Metrics and Results: CNS." Presentation. Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

482. **Shapira, Philip** and **David H. Guston**. March, 2007. "Societal Assessment of Nanotechnology US Experience." Presentation. Ministry of Research, Science and Technology, Wellington, New Zealand.

483. **Shapira, Philip** and **Jan Youtie**. January, 2011. "RTTA 1 - Research Program Assessment." Presentation. Center for Nanotechnology in Society at ASU, Tempe, AZ.

484. **Shapira, Philip** and **Jan Youtie.** March, 2010. "Transatlantic Workshop on Nanotechnology Innovation and Policy." Presentation. Transatlantic Workshop on Nanotechnology Innovation and Policy, Atlanta, GA.

485. **Shapira, Philip** and **Jan Youtie**. May, 2008. "What's New about Emerging Metropolitan Nanodistricts in the United States and Europe? Characteristics of Research and Commercialization." Presentation. The NBER Conference on Emerging Industries: Nanotechnology and NanoIndicators, Cambridge, MA.

486. **Shapira, Philip**, **Jan Youtie** and **Alan L. Porter**. November 11, 2011. "Trajectories of Global Nanotechnology Commercialization." Presentation. IGERT Seminar, Georgia Institute of Technology, Atlanta, GA.

487. **Shapira, Philip**, **Jan Youtie** and Luciano Kay. October, 2009. "Global Developments in Nanotechnology Commercialization." Presentation. 2nd Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

488. **Shapira, Philip**, **Jan Youtie** and Sanjay Arora. November, 2011. "Probing Early Patterns of Commercialization in Graphene." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

489. **Shapira, Philip** and Jue Wang. April, 2008. "From Lab to Market: Strategies and Issues in the Commercialization of Nanotechnology in China." Presentation. Panel on Cultures Meet Technology: New Approaches to Innovation and Economic Development in Asia and the West, Association for Asian Studies, 2008 Annual Meeting, Atlanta, GA.

490. Shih, Tsung-Jen, **Dietram A. Scheufele** and **Elizabeth A. Corley**. June, 2010. "Exploring Item Non-Response in Public Opinion Surveys about Nanotechnology: Evidence from 21 Countries." Presentation. Annual Convention of the International Communication Association, Singapore.

491. Shih, Tsung-Jen, **Dietram A. Scheufele** and **Elizabeth A. Corley**. June, 2010. "A Multilevel Model of Risk and Benefit Perception." Presentation. Annual Convention of the International Communication Association, Singapore.

492. **Slade, Catherine.** December, 2009. "Public Values in Nanomedicine." Presentation. The Dupont Summit on Science and Technology Policy. "The New Administration Challenges on Science and Technology: Staying the Course in Times of Crisis." Policy Studies Organization, Carnegi, Washington, DC.

493. **Slade, Cathy**, Derrick Anderson, **Erik Fisher** and **Barry Bozeman**. August, 2009. "Public Value Mapping of Nanotechnology: A Developing Approach for Tracking Public and Social Values in Science and Innovation Policies." Presentation. Annual Meeting of the American Sociological Association. August 7-11, 200, San Francisco, CA.

494. **Sommerfield, Milton R.**, **Mark Edwards** and **David Conz.** January 15, 2010. "Bugs for Fuels: Microbes in our Energy Future." CNS-ASU Science Café, Arizona Science Center, Phoenix, AZ.

495. Soumonni, Diran. February, 2012. "Assessing South Africas Nanotechnology Strategy: What Role for the Private Sector in Pro-Poor Innovation?" Presentation. Workshop on Original Policy Research (WOPR) seminar in the School of Public Policy, Atlanta, GA.

496. **Stone, Anne** and **William H. Kimbel**. September 17, 2010. "Who Are You Calling Neandertal? Tracing Our Ancient Ancestors." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

497. **Strumsky, Deborah**. November 16, 2011. "How Green is Nano." Presentation. The Institute for Operations Research and the Management Sciences (INFORMS) Annual Conference, Charlotte, NC.

498. **Suchman, Mark C.** 2007. "The Implications of Nanotechnology for Social Science and Social Policy." Presentation. Cornell CNF Public Interest Talk Series, Ithaca, NY.

499. **Suchman, Mark C.** 2007. "Sharing is (S)caring on the Digital Frontier: The Challenges of Information Technology Governance in Health Care Organizations." Presentation. Cornell Center for the Study of Economy and Society, 2006-2007 Seminar Series on Institutions, Market Processes, and the Firm and to Brown University Department of Sociology Colloquium, Ithaca, NY.

500. **Suchman, Mark C.** 2007. "HIT or Miss? The Governance Challenges of Health Information Technology." Presentation. Cornell Law School Faculty Workshop; and to Duke Law School Faculty Workshop, Ithaca, NY.

501. **Suchman, Mark C.** 2006. "Taming the Market for Medical Information: Sharing is (S)caring on the Digital Frontier." Presentation. University of California-Irvine Critical Legalities Symposium, Irvine, CA.

502. Tang, Li. April, 2008. "Networks of Research Collaboration in China: Evidence from Nanotechnology Publication Activities, 1990-2006." Presentation. Invited Presentation at the University of Maastricht, The Netherlands, Maastricht, The Netherlands.

503. Tang, Li. February, 2008. "Nanotechnology Knowledge Networks in China." Presentation. PRIME Nanotechnology Winter School, Grenoble, France.

504. Tang, Li. October, 2007. "Networks of Research Collaboration in China: Evidence from nanotechnology publication activities, 1990-2006." Presentation. Atlanta Science and Technology Policy Conference, Atlanta, GA.

505. Tang, Li. October, 2007. "New Argonauts & Scientific Networks: Evidence from Chinas Nanotech Publication." Presentation. Atlanta Science and Technology Policy Conference, Atlanta, GA.

506. Thoreau, Francois. September 08, 2009. "Integrated Research and Protected Spaces: A New Role for ST." Poster presentation. Society for the Study of Nanoscience and Emerging Technologies, Seattle, WA.

507. **Thorpe, Michael** and **Manfred Laubichler**. April, 2007. "Reductionism and Emergence in Science: New versus Old Views of Nature and the Universe." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

508. **Thorpe, Michael** and **Eric Ramsey**. April 20, 2007. "Could a Computer Become Sentient? Reductionism and Emergence in Science." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

509. Valdivia, Walter. August, 2008. "Technology, Growth, and Inequality." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

510. Valdivia, Walter. June, 2008. "Inequality and Nanotechnology." Presentation. Workshop on Inequality and Emerging Technologies, Valleta, Malta.

511. Valdivia, Walter. January, 2008. "Science Policy and Inequality." Presentation. First Indo-American Institute of Nano-scale Science and Engineering, Chennai, India.

512. Valdivia, Walter. January, 2008. "Science Policy and Inequality: A Research Program." Presentation. NISTADS, New Delhi, India.

513. Valdivia, Walter. October, 2007. "Non-Cooperative Games in Science Policy." Presentation. Atlanta Conference on Science and Innovation Policy, Atlanta, GA.

514. Valdivia, Walter. March, 2007. "Anticipatory Governance of Emerging Technologies." Presentation. Science-Society Interface at Universite de Lausanne, Lausanne, Switzerland.

515. **Vermaas, Willem**, **Michael White** and **Barry Ritchie**. February 15, 2008. "Evolution and Faith: Room for Both." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

516. Wang, Jue, **Elizabeth A. Corley** and Eric Welch. 2009. "Barriers and Motivators for the Adoption of Public Sector Environmental Management Systems." Paper Presentation. Western Social Science Association.

517. Wang, Jue. February, 2008. "From Lab to Market: Strategies and Issues in the Commercialization of Nanotechnology in China." Presentation. Presentation at the National Academy of Sciences, Student Forum on Science and Technology Policy, Washington, DC.

518. Wang, Jue. September, 2007. "From Lab to Market: Strategies and Issues in the Commercialization of Nanotechnology in China." Presentation. National Academy of Science, Conference on the Dragon and the Elephant: Understand the Development of Innovation Capacity in China and India, Washington, DC.

519. Wang, Jue. September, 2006. "Resource Spillover from Academia to High Tech Industry: Evidence from Nanotech Start-up Enterprises." Presentation. 2006 Technology Transfer Society Conference, Atlanta, GA.

520. Wang, Wenping. November 05, 2011. "Analyzing the Effect of Interdisciplinary Research on Patent Evaluation: Case Studies in NBS and DSSCs." Session. Measuring Research Interdisciplinarity and Knowledge Diffusion, American Evaluation Association.

521. **Westerhoff, Paul** and Meredith Gartin. January 21, 2011. "A Drop to Drink: What could Wind Up in Our Water." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

522. **Wetmore, Jameson**. March 09, 2012. "A Users Guide to Everyday Technology." Keynote Speech. Issue Day, Maumee Valley Country Day School, Toledo, OH.

523. **Wetmore, Jameson**. March 09, 2012. "Amish Technology." Workshop. Issue Day, Maumee Valley Country Day School, Toledo, OH.

524. **Wetmore, Jameson**. March 09, 2012. "Nano Equity Game: Whose Nano is it?" Workshop. Issue Day, Maumee Valley Country Day School, Toledo, OH.

525. **Wetmore, Jameson**. March, 2012. "Nano Equity Game: Whose Nano is it?" Presentation. Nano and Society training program, Arizona Science Center, Phoenix, AZ.

526. **Wetmore, Jameson**. January, 2012. "Nano Equity Game: Whose Nano is it?" Presentation. NISENet Program committee meeting, Oregon Museum of Science & Industry.

527. **Wetmore, Jameson**. December, 2011. "Nano Equity Game: Whose Nano is it?" Presentation. Adult Night, Arizona Science Center, Phoenix, AZ.

528. **Wetmore, Jameson**. November, 2011. "Equity, Equality, and Responsibility." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

529. **Wetmore, Jameson**. November, 2011. "Congress on Teaching the Social and Ethical Implications of Research." Conference Organizer. Joint Meeting of the NNIN SEI Coordinators, NSEC SEI Coordinators, ASUs three EESE grants, and NISENets social implications group, Tempe, AZ.

530. **Wetmore, Jameson**. November, 2011. "The Challenges of Equity, Equality, and Development." Panel Organizer. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

531. **Wetmore, Jameson**. November, 2011. "Teaching Social and Ethical Implications of Research to Scientists and Engineers." Panel Organizer. Society for Social Studies of Science, Cleveland, OH.

532. **Wetmore, Jameson**. November, 2011. "Nano Equity Game: Whose Nano is it?" Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

533. **Wetmore, Jameson**. October, 2011. "The Challenge of Path Dependency and the Need for Anticipatory Governance." Presentation. CSPO in DC: New Tools for Science Policy, Washington, DC.

534. **Wetmore, Jameson**. September 20, 2011. "New Technologies New Risks? What are the Implications of a Technologically Complex World on the Way we think about the Risks of Novel Technologies and Practices?" Panel Presentation. Symposium on Risk Uncertainty and Sustainable Innovation, University of Michigan, Ann Arbor, MI.

535. **Wetmore, Jameson**. July 18, 2011. "Swimming Upstream: When Scientists and Engineers are More Concerned about Science & Technology than the Public." Presentation. Upstream Engagement with Science and Technology: Opportunities and Challenges, a mini-symposium, ESRC Genomics Network, University of Edinburgh, Scotland.

536. **Wetmore, Jameson**. March 14, 2011. "The Challenges of Path Dependence and the Need for Anticipatory Governance." Presentation. CNS-ASU Resilience 2011 Workshop at ASU, Tempe, AZ.

537. **Wetmore, Jameson**. April 03, 2010. "Nanodays-Student Presentations of Basic Science and Nanotechnology Applications." Arizona Science Center, Phoenix, AZ.

538. **Wetmore, Jameson**. March 25, 2010. "Opportunities for Engaging with the Public." Asilomar International Conference on Climate Intervention Technologies, Pacific Grove, CA.

539. **Wetmore, Jameson**. March, 2010. "Nanodays-Student Presentations of Basic Science and Nanotechnology Applications." Tempe Festival of the Arts. March 26-28, 2010, Tempe, AZ.

540. **Wetmore, Jameson**. February 22, 2010. "Lessons of Engagement: Learning from Policymakers and the Public." Presentation. Annual Meeting of the American Association for the Advancement of Science.

541. **Wetmore, Jameson**. December 09, 2009. ""Overview of CNS-ASU" with David H. Guston." Presentation. 2009 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA.

542. **Wetmore, Jameson**. December 09, 2009. "Best Practices of NSEC's and MRSEC's for Advancing NSE Education-Diversity Aspects." Presentation. 2009 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA.

543. **Wetmore, Jameson**. November 08, 2009. "Technology and the City." Presentation. On the Cutting Edge...Today's Jewish Women Symposium, Scottsdale, AZ.

544. **Wetmore, Jameson**. October 30, 2009. "Begging for Regulation: The Quest to Tame Nanotechnology." Presentation. Annual Meeting of the Society for Social Studies of Science, Washington, DC.

545. **Wetmore, Jameson**. July 22, 2009. "Anticipatory Governance of Emerging Technologies." Presentation. National Institute for Nano-Engineering Summer Student Program, Sandia National Labs. Invited.

546. **Wetmore, Jameson**. July 08, 2009. "Nanotechnology and Society." Presentation with Troy Benn. Arizona Science Center's Junior Science Correspondents Program, Phoenix, AZ.

547. **Wetmore, Jameson** June 16, 2009. "What Should Everyone Know about Technology?" Panel discussion. American Society for Engineering Education Annual Conference, Austin, TX.

548. **Wetmore, Jameson**. June, 2009. "Integrating Microethics and Macroethics in Graduate Science and Engineering Education: Developing Instructional Models." Presentation with Joe Herkert. American Society for Engineering Education Annual Conference, Austin, TX.

549. **Wetmore, Jameson**. March, 2009. "Innovation and Graduate Education." Presentation. Presented at Centers, Universities, and the Science, Arlington, VA.

550. **Wetmore, Jameson**. December, 2008. "Amish Sociologists: Building Society with Technology." Presentation. National Nanotechnology Infrastructure Network, Indian Institute of Technology, Kanpur Winter School on Organic Electronics, Kanpur, India.

551. **Wetmore, Jameson**. November, 2008. "Nanotechnology the Promise, Politics, and Personal Impacts." Presentation. Presentation to the Women's Symposium, co-sponsored by the Jewish Studies Department at Arizona State University and the Bureau of Jewish Education of Greater Phoenix, Phoenix, AZ.

552. **Wetmore, Jameson**. August, 2008. "A Dialogue on Nanotechnology and Religion: Using Religious Expertise to Build Nanotechnology." Poster Presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

553. **Wetmore, Jameson**. June, 2008. "The Challenge of Path Dependence." Presentation. IEEE Symposium on Technology & Society, Fredericton, New Brunswick, Canada.

554. **Wetmore, Jameson**. April, 2008. "What Do You Think About a Technology You Can't Even Se." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

555. **Wetmore, Jameson**. December, 2007. "Amish Technology." Presentation. Spirit of the Senses Salon, Phoenix, AZ.

556. **Wetmore, Jameson**. November, 2007. "ASB 591: Seminar on Professionalism, on the Academic job search." Presentation. Seminar on Professionalism.

557. **Wetmore, Jameson**. October, 2007. "Building a Better Air Bag: the Continuing Search for a Technical Fix." Presentation. Mobility History, Heritage and Design Fifth Annual Conference on History of Transport, Traffic and Mobility (T2M), Helmond, The Netherlands.

558. **Wetmore, Jameson**. September, 2007. "Bureaucrats, Lobbyists, and Regulators, Oh My! Introducing Graduate Students to Science outside the Lab." Presentation. CSPOs Enlightening Lunch, with Ira Bennett, Arizona State University, Tempe, AZ.

559. **Wetmore, Jameson**. August, 2007. "Cats Cradle, by Kurt Vonnegut." Presentation. Spirit of the Senses Salon, Scottsdale, AZ.

560. **Wetmore, Jameson**. June, 2007. "Teaching the Ethics and Social Implications of Emerging Technologies to Graduate Level Students." Presentation. American Society for Engineering Education Annual Conference, Honolulu, HI.

561. **Wetmore, Jameson**. March, 2007. "Transferring Western Technology to Developing Countries: Good Intentions, Unexpected Outcomes." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

562. **Wetmore, Jameson**. March, 2007. "STS in the Trenches: Engaging Scientists and Engineers." Presentation. STS Engaged Workshop, University of Virginia Department of Science, Technology and Society, Charlottesville, VA.

563. **Wetmore, Jameson**. February, 2007. "Nanotech and Religion: Ambitions, Influence, and Policy." Presentation. CNS-UCSB, Santa Barbara, CA.

564. Wetmore, Jameson. August, 2006. "Religious Forays into Nanotechnology Policy." Presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

565. **Wetmore, Jameson** and Andrea Lewis. January 20, 2012. "What's in our Skincare?" Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

566. **Wetmore, Jameson** and **Ira Bennett**. January, 2012. "SEI Professional Development Plans." Presentation. Societal and Ethical Implications Meeting, Nanoscale Informal Science Education Network, Oregon Museum of Science and Industry, Portland, OR.

567. **White, Dave** and Troy Benn. May 15, 2009. "To Drink or Not to Drink: What Should We Do to Have Good-Tasting, Safe and Sustainable Water into the Future." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

568. **Wiek, Arnim**. November, 2011. "STIR and the City: Integration Research and Sustainability Science." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

569. **Wiek, Arnim**. March 14, 2011. "Resilience, Sustainability, and Anticipatory Governance - Pieces of the Puzzle." Presentation. Resilience 2011, Arizona State University, Tempe, AZ.

570. **Wiek, Arnim** and Rider W. Foley. March 16, 2012. "Will Science and Technology put the Able into Sustainable?" Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

571. **Wiek, Arnim** and Rider W. Foley. December 19, 2011. "The Dragon Beneath Phoenix: Meaningful Community Involvement, Effective Remediation, and Sustainable Urban Development at the M52 Superfund Site in Phoenix." Presentation. Jiangsu Senior Executive Public Administration Training Program. Arizona State University, Phoenix, AZ.

572. **Wiek, Arnim** and Rider W. Foley. November, 2011. "Nanotechnology for Sustainability? Analyzing the Demand for and Supply of Nanotechnology in City Environments." Presentation. Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies, Tempe, AZ.

573. **Wolbring, Gregor**. August, 2006. "Governance of Nano-bio-info-cogno-synbio." Presentation. NABIS Conference, Chicago, IL.

574. **Wolbring, Gregor**. December, 2005. "The Triangle of Enhancement Medicine, Disabled People, and the Concept of Health: A New Challenge for HTA, Health Research, and Health Policy. Health Technology Assessment (HTA) Initiative #23." Presentation. Alberta Heritage Foundation for Medical Research,, Edmonton, Alberta, Canada.

575. **Woodbury, Neal**. April, 2006. "Evolution on a Chip: Making Molecules Work for U." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

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Invention Disclosure

1. Scio: A Nano-enhanced, Convenient, Portable Cancer Biomarker Testing Device. (2008, April).

2. Flux: A Cast with Adjustable Rigidity that Allows for Faster Recovery. (2008, April).

3. Explore: A Mobile Haptic Text to Braille Translator. (2008, April).

4. Nome: An Energy-producing Shelter for Natural Disaster Victims. (2009, April).

5. Everwell: A Device for Rural Users that Converts Air Humidity into Potable Water. (2009, April).

6. Tangent: A Solar-powered Individualized Urban Transportation. (2009, April).

16. Biosketches

There were no new investigators working for the Center for Nanotechnology in Society at Arizona State University (CNS-ASU) this past reporting year.

17. Honors and Awards

Arora, Sanjay A. Won poster competition at Georgia Institute of Technology's Research and Innovation Conference for his poster on "*Commercialization of New and Emerging Technologies: A Cross Country Comparison of Graphene Firms."* February 2012.

Bhadra, Monamie. Was awarded dissertation research fellowship from the American Institute for Indian Studies for her study of nuclear energy policy in India. October 2011.

Hays, Sean A. Accepted Post-Doctoral Fellowship at the University of Bergen's Centre for the Study of the Sciences. February 2012.

Ho, Shirley, Dietram A. Scheufele, and Elizabeth A. Corley. Awarded the Top Faculty Paper in the Mass Communication Division at the International Communication Association Conference. June 2011.

Iafrat, Michelle. Promoted to Program Coordinator, Administration and Events for the Center for Nanotechnology in Society at Arizona State University. October 2011.

Kalinowski, Tomasz. Awarded "Best Student Presentation" at the 22nd Annual International Conference on Soil, Water, Energy, and Air, annual meeting of the Environmental Health and Sciences Foundation for his presentation, "*In Situ* Microcosm Array: A Novel Tool for Conducting Treatability Studies *in Situ"*. March 2012.

Lim, Merlyna. Invited to give keynote lecture at the 41st Annual Frank Church Symposium on "*Democracy in a Changing World"* at Idaho State University. March 2012

Marchant, Gary. Named Regents' Professor at Arizona State University. Marchant is the Executive Director of the Center for Law, Science, and Innovation. November 2011.

McKnight, John Carter. Named graduate fellow for both the Starship Initiatives by the Lincoln Center for Applied Ethics, and for the Center for Games and Impact for his presentation, "*Space Makes You Bitter: Sandbox Culture in Second Life and EVE Online."* March 2012.

Philbrick, Mark. Named AAAS Fellow with the Department of Energy Efficiency and Renewable Energy, working on innovation deployment and research policy. June 2011.

Sanborn, Regina D. Promoted to Assistant Director for the Center for Nanotechnology in Society at Arizona State University. October 2011

Sylvester, Douglas. Named dean of the Sandra Day O'Connor College of Law. Is a professor of law and faculty fellow at the Center for Law, Science, and Innovation. March 2012.

Consortium for Science, Policy and Outcomes (CSPO), CNS-ASU's parent center, ranked fourth internationally among science and technology think tanks – and first among university-based think tanks in S&T – according to the Global Go-To Think Tanks Report by the Think Tanks and Civil Society Program at the Foreign Policy Research Institute at the University of Pennsylvania. February 2012.

18. Fiscal Sections

a. Statement of Unobligated Funds

In accordance with budget projections, CNS-ASU will have expended the Year 2 allocation of $1,301,400 in grant funds by September 14, 2012, the end of the CNS-ASU grant year for NSF Award #0937501, so there will be no unobligated funds.

b. Grant Budgets

There are several budget reports and associated budget justifications reported in this section as follows:

i. Actual budget expenses from September 15, 2011 through March 31, 2012.

ii. Projected budget expenses from April 1, 2012 through September 14, 2012.

iii. Projected budget expenses from September 15, 2012 to September 14, 2013.

19. Cost-Sharing

There are several budget reports and associated budget justifications included in this section as follows:

a. Cost-sharing budget of actual expenses incurred from September 15, 2011 through March 31, 2012.

b. Cost-sharing budget projections from April 1, 2012 through September 14, 2012.

c. Cost-sharing budget projections from September 15, 2012 through September 14, 2013.

d. Cumulative of cost-sharing account from September 15, 20120 to March 31, 2012.

Other financial commitments to CNS-ASU come from ASU Biodesign Institute, the College of Liberal Arts and Sciences, the Ira A. Fulton Schools of Engineering, the School of Human Evolution and Social Change, the School of Sustainability, the W.P. Carey School of Business, the College of Public Programs, the Herberger Institute of Design and the Arts, and the School of Social Transformation, which provide funds for faculty, graduate students, and undergraduate students to work with CNS-ASU on its research projects. These commitments are reflected in Table 2 and Table 5 of this report.

Also, included in this section is a statement from the ASU Office of Sponsored Projects and Research Administration (ORSPA) certifying the cost-sharing account amounts.

Regina Sanborn

From: Sarah Kern
Sent: Tuesday, April 03, 2012 4:02 PM
To: Regina Sanborn
Subject: FW: Cost Sharing Equal To or Greater Than $500,000/SES/1675/0937591/Guston/

FYI -Sarah

From: fastlane@nsf.gov [mailto:fastlane@nsf.gov]
Sent: Tuesday, April 03, 2012 4:00 PM
To: flmail@nsf.gov; Sarah Kern
Subject: Cost Sharing Equal To or Greater Than $500,000/SES/1675/0937591/Guston/

Original Addresse: flmail@nsf.gov;Sarah.Kern@asu.edu

This is SRO's copy

Cost Sharing Equal To or Greater Than $500,000 was submitted via FastLane on April 3, 2012 6:59:55 PM by:

Sponsored Projects Officer (SPO) First Name: Sarah
Sponsored Projects Officer (SPO) Last Name: Kern
SPO E-Mail address: Sarah.Kern@asu.edu

PI First Name: David
PI Last Name: Guston
PI E-Mail address: david.guston@asu.edu

Notification Details :
Notification Type: Cost Sharing Equal To or Greater Than $500,000
Start Date: 04/01/2011
End Date: 03/15/2012
Cost Sharing Amount for the reporting Period: 279370.17
Cumulative Cost Sharing Amount reported to date: 412360.75
Cost Sharing Notification Type: Annual Cost Sharing Notification
Explanation: null

This e-mail was sent from an address that cannot accept incoming e-mail therefore please DO NOT REPLY TO THIS MESSAGE.

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20. Leverage

The Center for Nanotechnology in Society at Arizona State University (CNS-ASU) has developed relationships/partnerships with two hundred twenty-nine (229) academic partnering institutions and one hundred eighty-six (186) non-academic partnering institutions, both domestic and international. The partners are named in Table 5.

Arizona State University (ASU) provides salary support for most of the faculty who work on CNS-ASU projects. Table 5 shows the amount of financial support CNS-ASU will receive from ASU and its subawards (Georgia Institute of Technology and University of Wisconsin, Madison) between September 15, 2011 and September 14, 2012.

Some successful partnerships include:

1. Consortium for Science, Policy and Outcomes (CSPO) – the Center for Nanotechnology in Society at Arizona State University (CNS-ASU) receives support from the Consortium for Science, Policy and Outcomes (CSPO), which includes office space, desktop computers for all CNS-ASU faculty, staff, post-doctoral associates, and students, as well as access to servers, printers, copiers, scanners, projectors, fax machine, and a conference room with videoconferencing capability.

2. Emerge Conference -- a special event held on March 1-3, 2012, uniting artists, engineers, bio-scientists, social scientists, story–tellers, and designers to build, draw, write, and rethink the future of the human species and the environments that we share. Together, participants created provocative and evocative stories, games, performances, and objects from which a vision of our future emerges.

   The developers of *Emerge* were Thanassis Rikakis (Director of the Herberger Institute School of Art, Media + Engineering and the Herberger Institute Digital Culture Initiative), Joel Garreau (Lincoln Professor of Law, Culture and Values at the Sandra Day O'Connor College of Law; Director, "The Prevail Project: Wise Governance for Challenging Futures"), Cynthia Selin (ASU School of Sustainability; the Center for Nanotechnology in Society at ASU) and – the inspiration for this event – the best-selling future-fiction author, "design fiction" evangelist, and provocateur, **Bruce Sterling**.

   Global leaders from industry and creative practice joined distinguished ASU faculty and talented students for hands-on workshops, as well as the Digital Culture Festival, which included exhibits, interactive shows, and live presentations. *Emerge* presented a line-up of world class speakers for the conference-closing keynote sessions, including noted writers, designers, and futurists such as **Stewart Brand** (*The Whole Earth Discipline*), **Bruce Sterling** (*The Difference Engine, Beyond the Beyond*), **Sherry Turkle** (*Alone Together: Why We Expect More from Technology and Less from Each Other*), **Bruce Mau** (*Incomplete Manifesto for Growth, Massive Change Network*), **Neal Stephenson** (*Snow Crash, The Diamond Age, Reamde*), and ASU President **Michael Crow**.

   CNS-ASU's modest $30,000 investment in this conference, which raised almost $250,000 in in-kind contributions and sponsorships, resulted in a connection to six hundred forty-five (645)

people, who now have a greater understanding of the social implications of science and technology.

3. Innovation Space -- an entrepreneurial joint venture among the Herberger Institute for Design and the Arts, the Ira A. Fulton Schools of Engineering, and the W.P. Carey School of Business at Arizona State University. The goal of this transdisciplinary education and research lab is to teach students how to develop products that create market value, while serving real societal needs and minimizing impacts on the environment. Students learn to create products that are progressive, possible, and profitable, which also have a meaningful impact on the daily lives of ordinary people.

   Innovation Space utilizes two fundamental strategies for creating sustainable innovation: a model of new product development known as Integrated Innovation and the emerging field of biomimicry. CNS-ASU contributes $30,000 annually to this endeavor.

4. Biodesign Institute -- plays a critical role in advancing the research mission of Arizona State University to conduct use-inspired research, fuse intellectual disciplines, and value entrepreneurship.

   Encompassing 350,000 square-feet of award-winning, state-of-the-art, LEED-certified buildings, the Biodesign Institute represents the State of Arizona's largest research infrastructure investment in bioscience-related research. ASU is the first university in the U.S. to create an interdisciplinary research Institute entirely devoted to bio-inspired innovation principles, representing a vast expansion of ASU's state-of-the-art research capacity, and also serving a core mission to engage the talents of its multidisciplinary scientists to find solutions to some of society's largest challenges.

   The three major areas in which The Biodesign Institute is working to make a difference are: biomedicine & health outcomes, sustainability and security. This framework allows the Institute to address these critical global challenges by creating "use-inspired," as well as "bio-inspired" solutions.

   CNS-ASU and the Biodesign Institute offer fellowships to two graduate students. The purpose of this program is to train students to work in cross-functional teams toward real-world outcomes. Since all research has implications beyond the laboratory, CNS-ASU invests in graduate students to study some of these outcomes by paying a percentage of their salary, employee related expenses, and tuition. CNS-BDI Fellows participate in CNS-ASU sponsored curricular and co-curricular activities, including special courses, seminars, lectures, science cafes, and other opportunities, in addition to adding a "societal implications" chapter to their dissertation, the "PhD plus" component, which discusses the societal context of their research.

5. Ira A. Fulton Schools of Engineering – plays a pivotal role in producing engineers and innovations to address the changing needs of society. FSE emphasizes problem-solving, innovation, entrepreneurship, multi-disciplinary interactions, societal context and connections.

   The Ira A. Fulton Schools of Engineering rank in the top 50 engineering schools in the United States, and offer 15 degree programs. It also is one of the largest engineering schools, with more than 200 faculty, more than 7,700 students, and more than $78 million in externally funded research.

CNS-ASU and the Ira A. Fulton Schools of Engineering offer fellowships to two graduate students. The purpose of this program is to train students to work in cross-functional teams toward real-world outcomes. Since all research has implications beyond the laboratory, CNS-ASU invest in graduate students to study some of these outcomes by paying a percentage of their salary, employee related expenses, and tuition. CNS-FSE Fellows participate in CNS-ASU sponsored curricular and co-curricular activities, including special courses, seminars, lectures, science cafes, and other opportunities, in addition to adding a "societal implications" chapter to their dissertation, the "PhD plus" component, which discusses the societal context of their research.

6. Barrett Honors College - Barrett students have the unique advantage of experiencing a small, intellectually, and socially vibrant environment, while having access to the vast resources of the major research university at ASU. Barrett students simultaneously benefit from being with others of the same intellectual preparation and commitment, and enjoy the advantages of a university environment actively engaged in exploring all areas of human interest and concern.

   All students who enter ASU through Barrett, The Honors College, also enroll in a disciplinary college, and pursue one or more of the 275+ available disciplinary majors and concentrations. Their education is the result of the integration of all colleges at ASU, including Barrett, that cultivate the talents and interests of Barrett students and endeavor to meet their changing needs as they develop academically and socially. Barrett students, hired as CNS-ASU student interns, participate in the CNS-ASU poster session at the All Hands Meeting and the site visit from the National Science Foundation.

7. Responsible Innovation: A UK-US Dialogue – was held in Washington, DC on January 23-24, 2012 at the ASU DC office. The two-day event featured scholars, from the United Kingdom and the United States, funded in part by CNS-ASU and Nick Hooper of the Science and Innovation Network at the British Consulate in Los Angeles, California, who discussed recent and current activities around responsible innovation, refined what is meant by the term, "responsible innovation," and decided on how to move forward.

Table 6: Partnering Institutions (cumulative)									
Name of Institution	Receives Financial Support from Center	Contributes financial support to the center	Minority Servicing Institution Partner	Female Serving Institution Partner	National Lab/other govt. Partner	Industry Partner	Museum Partner	International Partner	Other
I.a. Academic Partnering Institutions (ASU)									
Applied Learning Technologies Institute	x								
Arizona Institute for Nano-Electronics (AINE)									x
Arizona Technology Enterprises (AzTE)									x
Axon Technologies									x
Barrett, The Honors College									x
Biodesign Institute	x	x							
Center for Biology & Society									x
CRESMET									x
Center for the Study of Religion and Conflict									x
Center for Law, Science and Innovation	x								
Center for Solid State Electronics Research	x								
Center for Study of Institutional Diversity	x								
College of Liberal Arts and Sciences		x							
College of Public Programs	x								
College of Technology & Innovation	x								
Complex Adaptive Systems Initiative (CASI)									x
Consortium for Science, Policy and Outcomes		x							
Decision Theater for a Desert City									x
Foundation, ASU									x
Global Institute of Sustainability									x
Graduate College	x								
Hayden Library									x
Health Services									x
Herberger Institute for Design and the Arts	x								
Hispanic Research Center			x						
Institute for Human Origin									x
Ira A. Fulton School of Engineering	x	x							
Learning Sciences Institute									x
LightWorks	x								
Mary Lou Fulton School of Education	x								
New Interdisciplinary Arts & Sciences									x
Office of China Intitatives and Strategy									x
Office of Knowledge and Enterprise Development (OKED)		x							
Office of Public Affairs									x
Office of the President		x							x
Office of Vice President and Provost									x
Office of University Initiatives									x
Occupational Health and Safety									x
Phoenix Urban Research Laboratory	x								
SOLS-Responsible Conduct of Research Program	x								x
Sandra Day O'Connor School of Law	x								
School of Earth & Space Exploration									x
School of Government, Politics, and Global Studies	x	x							
School of Human Evolution and Social Change	x	x							
School of International Letters and Cultures	x								
School of Letters and Sciences	x								
School of Life Sciences	x								
School of Mathematical and Statistical Sciences									x
School of Philosophical, Historical, and Religious Studies									x
School of Social Transformation									x
School of Sustainability	x								
Science Policy Assessment and Research on Climate (SPARC)									x
Stardust Center	x								
Technology Based Learning Research							x		x
University Art Museum									x
University Public Schools									x
W.P. Carey School of Business	x								
Walter Cronkite School of Journalism and Mass Communication									x
I.b. Academic Partnering Institutions									
Aarhus University, Denmark								x	
Ansal Institute of Denmark								x	
Antwerp University								x	
Austrian Academy of Science								x	
Beijing Institute of Technology, China	x							x	
Boise State University									x
Bowling Green State University									x
Brown University	x								
Cardiff University	x								
Carnegie Mellon University								x	
Case Western Reserve University									x
Center for Nanotechnolgy in Society, UCSB		x							

		Chandler Gilbert Community College									x
		Clark University									x
		Collins College									x
		Colorado School of Mines	x								
		Columbia University									x
		Copenhagen Business School, Denmark	x							x	
		Corinthian College									x
		Cornell University									x
		Dalian University of Technology, China	x							x	
		Delft Technical University, the Netherlands								x	
		DeVry University									x
		Dublin City University								x	
		Durham University, United Kingdom								x	
		Ecoles des Mines, France								x	
		ETH Zurich								x	
		Eugene Lang College the New School for Liberal Arts									x
		European Commission	x							x	
		Ewha Women's University				x				x	
		Federal University of Parana, Brazil	x							x	
		Federal University Santa Catarina, Brazil	x							x	
		Flemish Institute of Science & Technology								x	
		Florida International University									x
		George Mason University									x
		George Washington University									x
		Georgetown University									x
		Georgia Institute of Technology	x								
		Glendale Community College									x
		Grenoble Institute of Technology	x							x	
		Grove City College									x
		Harvard University									x
		Howard University									x
		Illinois Institute of Technology									x
		Indiana University	x								
		Institute of International Sociology of Gorizia	x							x	
		Institut d'Etudes Politiques de Grenoble, France	x							x	
		Iowa State University									x
		James Martin Institute for Science and Civilization, Oxford, UK								x	
		Karlsruhe Institute of Technology, Germany	x							x	
		Korea Institute of Science and Technology, Seoul, Korea								x	
		Lancaster University								x	
		Leeds University Business School, UK	x							x	
		Lehigh University									x
		Litchfield Elementary School District									x
		Long Island University									x
		Manchester Business School	x							x	
		Maricopa Community Colleges									x
		Mesa Biotech Academy									x
		Mesa Community College									x
		Mesa High School									x
		Michigan State University									x
		MIT SENSEable City Lab									x
		Nagoya University, Japan	x							x	
		National Academy of the Sciences									x
		National University of Singapore & Asia								x	
		New York University	x								
		North Carolina State University	x								
		Northeasten University									x
		Northwestern University									x
		Norwegian University of Science & Technology, Norway								x	
		NSEC/CNS-University of California, Santa Barbara (UCSB)									x
		Osaka University, Japan								x	
		Penn State University									x
		Portland State University									x
		Purdue University	x								
		Queens University								x	
		Radboud University								x	
		Rensselaer Polytechnic Institute	x								
		Rhode Island School of Design	x								x
		Rice University									x
		Rice University/ICON		x							
		Rutgers, The State University of New Jersey	x								
		Said Business School, Oxford								x	
		Scottsdale Community College									x
		Simon Fraser University, British Columbia								x	
		S.I.W.S. N.R. Swamy College, India	x							x	
		Stanford University	x								x
		Technical University of Delft								x	
		Technical University of Denmark								x	
		Technical University of Darmstadt								x	
		Tennessee State University									x
		Texas State University, San Marcos	x								
		The Center for International Development, Harvard University									x

		Tokyo University	x							x	
		Tsinghua University, China								x	x
		UCLA/Harvard/NBER: Collaborative Research; Personnel Exchanges									x
		Unicamp University, Brazil								x	
		University de Zacatecas, Mexico	x							x	
		Universidad del Pais Vasco, Spain								x	
		University of Antwerp, Belgium	x							x	
		University of Arizona								x	
		University of Basel								x	x
		University of Bergen, Norway	x							x	
		University of Bielefeld, Germany	x							x	
		University of British Columbia								x	
		University of Calgary, Canada	x							x	
		University of California, Berkeley	x								
		University of California, Davis									x
		University of California, Irvine									x
		University of California, Los Angeles									x
		University of California, San Diego	x								
		University of California, Santa Barbara									x
		University of Chicago									x
		University of Colorado, Boulder	x								
		University of Colorado, Denver	x								
		University of Copenhagen								x	x
		University of Denver									x
		University of Edinburgh	x							x	
		University of Exeter, United Kingdom								x	x
		University of Florida									x
		University of Georgia	x								
		University of Gothenburg, Sweden								x	
		University of Groningen, the Netherlands								x	
		University of Illinois, Chicago									x
		University of Illinois, Springfield									x
		University of Illinois, Urbana-Champaign									x
		University of Iowa									x
		University of Jiangsu, China								x	
		University of Lausanne, Switzerland								x	
		University of Leeds	x							x	
		University of Liege, Belgium	x							x	
		University of Manchester	x								
		University of Maryland									x
		University of Massachusetts, Amherst									x
		University of Melborne, Australia								x	
		University of Michigan									x
		University of Minnesota									x
		University of Montana									x
		University of Nebraska, Lincoln	x								
		University of Nevada, Las Vegas									x
		University of New Hampshire	x								
		University of North Carolina, Charlotte									x
		University of Notre Dame									x
		Univesity of Nottingham								x	
		University of Padua								x	
		University of Seville, Spain	x							x	
		University of South Carolina									x
		University of South Florida									x
		University of Southern California									x
		University of Southern Indiana									x
		University of Sussex, United Kingdom								x	
		University of Tennessee, Knoxville									x
		University of Texas, Austin									x
		University of Trieste, Italy								x	
		University of Twente, the Netherlands	x							x	
		University of Utah									x
		University of Victoria	x							x	
		University of Vienna								x	
		University of Virginia									x
		University of Washington									x
		University of Wisconsin, Madison	x								
		UT-Battelle									x
		Utrecht University								x	
		Vanderbilt University									x
		Virginia Tech University									x
		VU University of Amsterdam								x	
		Washington University, Saint Louis									x
		West Chester University of Pennsylvania									x
		Western Michigan University									x
		Yale University									x
	Total Number Academic Partners										
		229									
II. Non-academic Partnering Institutions											

		Agilent Technologies	x							
		Airplayn								x
		ALD Nano Solutions						x		
		Alsek Research								x
		American Association for the Advancement of Science (AAAS)		x						x
		American Bar Foundation								x
		Apriva ISS								x
		Arizona BioIndustry Organization						x		
		Arizona Commerce Authority						x		
		Arizona Corporation Commission						x		
		Arizona Department of Education						x		
		Arizona Department of Health Services						x		
		Arizona Nanotechnology Cluster						x		
		Arizona Public Service (APS)						x		x
		Arizona Research Institute for Solar Energy						x		x
		Arizona Science Center							x	
		Arizona Technology Council						x		
		Australian Government						x		x
		Bank of America								x
		Bassetti Foundation								x
		BioIndustry Organization of Southern Arizona						x		
		Boudreaux and Associates								x
		BrasEq						x		x
		Brilliant Concepts, LLC.								x
		British Embassy					x			x
		Buckeye Express								x
		Cambridge Public Health Department	x							
		Carnegie Mellon								x
		CB Richard Ellis								x
		CEA-Saclay								x
		Cell Publishing		x						x
		Center for Business Models in Health Care								x
		Center for Responsible Nanotechnology								x
		Changeist, LLC.								x
		Chemical Heritage Foundation							x	
		City of Apache Junction								x
		City of Phoenix								x
		City of Scottsdale								x
		Complex Global Risks								x
		Corgan Associates								x
		Danish Board of Technology								x
		David Crowley Gallery								x
		Decker Yeadon LLC								x
		Department of Energy (DOE)						x		
		Department of the Treasury						x		
		Department of Transporation						x		
		Digital Thinking Network								x
		Downtown Phoenix Journal								x
		Ecological Society of America								x
		EKLATEK Engineering								x
		Emerging Leaders in Science & Society (ELISS)								x
		Engineering & Physical Sciences Research Council (EPSRC)								x
		Environmental Protection Agency (EPA)						x		
		Equus Development Corporation						x		
		European Commission								x
		Exploratorium, San Francisco							x	
		Federal Aviation Administration Office of Environment & Energy						x		
		FBI Weapons of Mass Destruction					x			
		Food and Drug Administration (FDA)					x			
		Gallagher and Kennedy								x
		General Dynamics						x		
		Genøk Centre for Biosafety								x
		Genome British Columbia								x
		German Parliament								x
		Global Business Network						x		
		Gould Evans								x
		Gordon Research Conferences (GRC)		x						
		Greenwall Foundation		x						
		HDR Architecture								
		Heatsync Labs					x			
		Heliae								x
		Home Depot						x		
		Iconic Architecture								x
		Institute for Agriculture and Trade Policy								x
		Institute for Ecological Economy Research, Germany								x
		Institute for the Future	x							
		Institute of Technical Assessment & Systems Analysis								x
		Intel						x		
		Intelligent Information Services Corporation (IISC)						x		
		International Nanotechnology in Society Network (INSN)								x
		International Research Center								x
		Ira Domsky Environmental								x

		Italian National Research Council, Turin, Italy								x	
		ITel									x
		Ivy Consulting, Inc.									x
		Jennings, Strouss and Salmon PLC		x							
		Kristine Wilcox Consulting									x
		Las Vegas-Clark County Library District									x
		Lasertel, Inc.									x
		Lawrence Livermore Lab					x				
		Leathers Milligan & Associates									x
		Loka Institute									x
		London Science Museum							x	x	
		Luxe Ventures						x			
		Mabelson Law Group									x
		Max Chandler Robot Art									x
		Mayo Clinic-Scottsdale						x			
		Meridian Institute	x								
		Metacurrency Project									x
		Microchip						x			
		MJS Designs, Inc.									x
		Modern Insights									x
		Museum of Life & Science, North Carolina							x		
		Museum of Science, Boston							x		
		Nanoscale Informal Science Education Network (NISE Net)							x		
		National Academy of Engineeering	x								
		National Advisory Committee on Aeronautics (NASA)					x				
		National Business Museum							x		
		National Geographic Society									x
		National Institute of Standards and Technology (NIST)									x
		National Insitutes of Health (NIH)									x
		National Nanomanufacturing Network (NNN)									x
		National Nanotechnology Coordinating Office									x
		National Nanotechnology Infrastructure Network									x
		National Research Council									x
		National Science Foundation					x				
		Nature Publishing Group		x						x	
		New Haven Independent									x
		Norweigian Institute					x			x	
		Nothing but NET									x
		Nuclear Waste Review Board					x				
		Office of Naval Research					x				
		Oregon Museum of Science & Industry							x		x
		PACeHR									x
		Penman PR	x								
		Pennsylvania Bio Nano Systems	x								
		Phoenix Zoo									x
		Physician Services Group									x
		PING Inc.						x			
		Planetary ONE	x								x
		Practical Action									x
		Presidential Commission for the Study of Bioethical Issues					x				
		QuantTera									x
		Rathenau Institute								x	
		RCI Surveys, Inc.									x
		Research Council of Norway	x							x	x
		Research Councils U.K. (RCUK) in the U.S.									x
		Re/Max Fine Propoerties									x
		Richard + Bauer Architecture									x
		Rockefeller Foundation		x							
		Ryley Carlock & Applewhite	x								
		Salt River Project						x			
		Sandia National Laboratory					x				
		Savage Film									x
		Science & Technology Policy Institute	x								
		Sciencecener, New York						x			
		Science Foundation of Arizona									x
		Science Museum of Minnesota						x			x
		SciTech Strategies, Inc.									x
		Scottsdale League for the Arts									x
		Semi-Conductor Research Corporation	x								
		SETI Institute									x
		SmithGroup									x
		Snell and Wilmer Law									x
		Sokolov, Sokolov, Burgess Solutions (SSB)									x
		Spirit of the Senses Salon									x
		Springer Publishing		x							
		SRI Institute	x								
		Strategic Advantage, Inc.									x
		Sundt Construction, Inc.									x
		Synthetic Biology Engineering Research Center (SynBERC)					x				
		Targeted Genetics Corporation (TGen)									x
		Teach America									x
		Tempe Festival of the Arts									x

		Televerde									x
		Testani Design Trouple, Inc.									x
		The Eluminati, LLC									x
		The Embryo Project									x
		The Energy and Resources Institute (TERI)								x	
		The Foresight Institute									x
		The Galaxy Organization									x
		The Rockefeller Foundation	x								
		The Royal Society									x
		The Washington Post									x
		Translational Genomics Research Institute (TGEN)									x
		TraskBritt Intellectual									x
		Underwood Bros., Inc.									x
		Unicorn Media, Inc.									x
		U.S. Government Accountability Office (U.S. GAO)					x				
		U.S. Department of Agriculture									x
		U.S. Department of Homeland Security					x				
		U.S. DOE/Center for Integrated Nanotechnology (CINT)					x				
		Venezuelan Institute for Scientific Research									x
		Will Bruder & Partners Ltd.									x
		Winnipeg Art Gallery									x
		Woodrow Wilson International Center for Scholars									x
	Total Number Non-academic Partners:										
		186									

21. Current and Pending Support

Following are the Current and Pending Support documents for the PI and all thrust leaders as follows:

1. Elizabeth A. Corley – RTTA 2 co-team leader
2. Susan Cozzens – TRC 1 co-team leader
3. Erik Fisher – RTTA 4 team leader, International Activities team leader
4. David H. Guston – PI and Center Director
5. Merlyna Lim – RTTA 3 co-team leader
6. Jose Lobo – RTTA 2 co-team leader
7. Clark Miller – Center Associate Director
8. Dietram Scheufele – RTTA 2 co-team leader
9. Cynthia Selin – RTTA 3 co-team leader, Outreach team leader
10. Philip Shapira – RTTA 1 co-team leader
11. Sander E. van der Leeuw – TRC 2 co-team leader
12. Jameson M. Wetmore – TRC 1 co-team leader, Education team leader
13. Arnim Wiek – TRC 2 co-team leader
14. Jan Youtie – RTTA 1 co-team leader