The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

The Center for Nanotechnology in Society at Arizona State University

NSF #0937591 September 15, 2010 – September 14, 2011

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Annual Report for the Period
September 15, 2010 to September 14, 2011

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 (that are 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) completing the "end-to-end" assessment for TRC 2 by linking multiple RTTA capacities to create novel insights in a study of nanotechnology and the brain; 2) deepening the integration of NSE researchers into CNS-ASU; and 3) building collaborations for informal science education (ISE) on the societal aspects of NSE. Programmatic achievements include: establishing an internationally adopted definition of nanotechnology to assemble and mine bibliographic and patent databases; conducting two national public opinion polls and a poll of leading nano-scientists; demonstrating that intensive public engagement in anticipation of an emerging technology can have significant impact on participants; demonstrating that interactions between NSE researchers and social scientists can generate more reflexive decisions; sustaining an international research program on NSE and equity; exploring views and capacities of human nanotechnologies; and laying the foundations for a new research program in urban design, materials and the built environment.

The Center's principal **intellectual merit** derives from the large-scale, interdisciplinary ensemble that underpins it. The ability to 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. Both in terms of publications and citations, the Center's work has a substantial impact on scholarship. 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.

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**
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**
Heather Canary	Associate Professor	Humanities & Arts
Marilyn P. Carlson	Professor	Mathematics & Statistics
Matthew Chew	**Faculty Associate**	**Sustainability**
Nalini Chhetri	Lecturer	Letters & Sciences
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**
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**	**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**
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	**Associate Director**	**Consort. for Science, Policy & Outcomes**
Kirby Hoyt	**Faculty Associate**	**Design**
Kiril Hristovski	**Assistant Professor**	**Engineering of Matter, Transport & Energy**
Ben Hurlbut	**Assistant Professor**	**Life Sciences**
Mary Ingram-Water	Lecturer	Barrett Honors College
Marco Janssen	**Associate Professor**	**Ctr. for Study of Institutional Diversity**
Paul Johnson	Executive 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
Joe Kullman	**Sr. Media Relations Officer**	**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. RelationsLiaison	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
Robert Pahle	Assistant Research Professor	Decision Theatre for a Desert City
Mookesh Patel	Associate Professor	Visual Communication Design
Darren Petrucci	**Director**	**Architecture & Landscape Architecture**
Patrick Phelan	**Professor**	**Engineering**
Rhonda Phillips	**Professor**	**Community Resources/Development**
S. Thomas Picraux	Professor	Materials Research
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**
Wellington Reiter	Dean	Design
Barry Ritchie	Professor	Physics
Bruce Rittman	Regents Professor	Chemical Engineering
Jason S. Robert	Associate Professor	Life Sciences
Aaron Rothman	**Specialist**	**Phoenix Urban Research Laboratory**
Mark Ryan	**Adjunct Professor**	**Design**
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 Research Professor**	**Consort. for Science, Policy, & Outcomes**
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**
Rene Von Schomberg	**Directorate General Research**	**European Commission**
Qiangbin Wang	Professor	Biodesign Institute
Paul Westerhoff	**Professor**	**Sustainable Engrg. & Built Environment**
Jameson M. Wetmore	**Assistant Professor**	**Human Evolution & Social Change**
Roxanne Wheelock	**Staff**	**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

Roger Angel	Univ. of AZ, Regents' Prof.	Astronomy
Peter Asaro	Rutgers, Assistant Professor	Philosophy
Ardeth Barnhart	Univ. of AZ, Co-Director	AZ Research Institute for Solar Energy
Deborah Bassett	Univ. of WA, Dir Social Stud.	Workforce Development
Ottavia Bassetti	**Board Member**	**The Bassetti Foundation**
Larry Bell	**Sr. V.P. Strategic Initiatives**	**Museum of Science**
Robby Berloznik	**Director**	**Flemish Institute Society & Technology**
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Marianne Boenink	Univ. of Twente, Lecturer	Philosophy
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Robert Bowman	**Queens Univ. Belfast, Dir.**	**Center for Nanostructured Media**
Barry Bozeman	**Georgia, Professor**	**Public Administration & Policy**
Donald Braman	George Washington, Prof.	Law
Dominique Brossard	Wisconsin, Asst. Professor	Journalism & Mass Communication
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Christopher Coenen	Offc. Technology Assessment	German Parliament
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Susan Cozzens	**Georgia Tech, Professor**	**Public Policy**
Wendy C. Crone	Wisconsin, Professor	Engineering Physics
Edward Cupoli	**Professor**	**University of New York, Albany**
Dorothy Dankel	**Bergen, Researcher**	**Center for Study of Sciences & Humanities**
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Bruna De Marchi	Mass Emergencies Programme	Inst. of International Sociology of Gorizia
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Terry Devitt	Wisconsin, Science Writer	Science & Technology
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Fanie Duvenghuge	Manager	Microchip
Sharon Dunwoody	Wisconsin, Professor	Journalism & Mass Communication
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Shirin Elahi	Scenario Architect	Complex Global Risks
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Elizabeth Farrell	New Hampshire, Coord.	Culture & Sustainability, Food & Society
James Faubion	Rice, Professor	Anthropology
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Michael Gorman	**Virginia, Professor**	**Science, Technology and Society**
Stuart Graham	Georgia Tech, Professor	Management
Gisela Grant	**Internshjip Coordinator**	**Politics & Global Studies**
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Patrick Hamlett	NCSU, Associate Professor	Science, Technology & Society

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Barbara Harthorn	California, Santa Barbara	Director, CNS-UCSB
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
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Maja Horst	**Copenhagen Business School**	**Policy & Philosophy**
Leigha Horton	Performer	Science Museum of Minnesota
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Helen Ingram	California-Irvine, Professor	Planning, Policy, and Design
Noela Invernizzi	**Federal University of Parana**	**Development Studies**
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Deborah Johnson	Virginia, Professor	Science, Technology & Society
Marilyn Johnson	**Oregon Mus. Sci. & Industry**	**Science Director**
Dan M. Kahan	Yale, Professor	Law
Thomas Kelly	New Hampshire, Professor	Office of Sustainability
Kamilla Kjolberg	Bergen, Research Fellow	Study of the Sciences and Humanity
Daniel Kleinman	Wisconsin, Professor	Rural Sociology
Mark Knell	Norwegian Institute	Chemistry
Margaret Kosal	GA Tech, Asst. Professor	International Strategy, Technology & Policy
Lotte Krabbenborg	Groningen, Faculty	Science and Society
Kristen Kulinowki	**Rice University, Facul. Fellow**	**Chemistry**
Elizabeth K. Kullman	**Sen. Res. & Eval. Associate**	**Museum of Science**
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
Sam Lipson	**Director of Envir. Health**	**Cambridge Public Health Department**
Stephanie Long	**Mgr., Public Prog. & Science**	**Science Museum of Minnesota**
Michael Lynch	Cornell, Professor	Science & Technology
Roop Mahajan	**Virginia Tech, Director**	**Critical Technology & Applied Science**
Farzad Mahootian	**New York Univ., Professor**	**Global Liberal Studies**
Jim Malone	Physician	Private Practice
Paul Martin	**Sr. V.P. Science Learning**	**Science Museum of Minnesota**
Catherine McCarthy	Project Leader	Science Museum of Minn.
David McConville	**Director, Noospheric Res.**	**The Elumenati, LLC.**
Sheila McNamee	New Hampshire, Professor	Communication
Pierre Meulien	**President and CEO**	**Genome British Columbia**
Evan Michelson	Senior Research Associate	Rockefeller Foundation
Colin Milburn	**Cal.-Davis., Assoc. Professor**	**English and Science & Technology Studies**
Laurence Miller	Physician	Mayo Clinic – Scottsdale
Robert J. Milligan	Physician	Physician Services Group
Carl Mitcham	CO School of Mines, Prof.	Liberal Arts & International Studies
Alison Mohr	**Senior Research Fellow**	**University of Nottingham**
Julia A. Moore	Deputy Director	Woodrow Wilson Center

Steven Moore	**Texas at Austin, Professor**	**Architecture & Planning**
Maj Munch-Andersen	**Technical Univ. of Denmark**	**Senior Scientist, Dept. of Management**
Webb Myers	STIP Associate	Intelligent Info. Services Group
Alan Nelson	Director	Biodesign Institute
Richard Nelson	Columbia University, Professor	Economics
Nils Newman	STIP Associate	Intelligent Info. Services Group
Dean Nieusma	Rensselaer Poly. Inst., Prof.	Science & Technology Studies
Rune Nydal	**Norwegian Univ., Associate**	**Science & Technology**
Rosemary Ommer	**Adjunct Professor**	**University of Victoria**
Rae Ostman	**National Collab., Director**	**Sciencenter**
Krsto Pandza	Leeds Univ., Senior Lecturer	Business
Shobita Parthasarathy	Michigan, Assistant Professor	Public Policy
Eleonore Pauwels	**Research Scholar**	**Woodrow Wilson Center**
Alice Pawley	Assistant Professor	Purdue University
Angela G. Pereira	**Eur. Comm., Scientific Offc.**	**Joint Research Centre**
Sarah Pfatteicher	Assistant Dean	Wisconsin, Madison
Simon Pfersdorf	**Researcher**	**Instit. Tech. Assessment & Sys. Analysis**
Mark Philbrick	California-Berkeley	Public Policy
Roger Pielke, Jr.	Colorado, Professor	Environmental Studies
Kenneth Pimple	Indiana, Professor	Religious Studies
Alan Porter	**Georgia Tech, Professor**	**ISYE & Public Policy**
R. Queralto Moreno	Univ. of Seville, Professor	Ethics & Political Philosophy
Paul Rabinow	California, Berkeley, Prof.	Social Cultural Anthropology
Khan Rahi	Loka Institute, Staff	Community Research Network
Jerome Ravetz	Said Bus. Sch., Assoc. Fellow	Science, Innovation & Society
Christine Reich	Assistant Director	Museum of Science
David Rejeski	**Director**	**Woodrow Wilson Center**
Arie Rip	Univ. of Twente, Professor	Science & Technology Studies
H. Rodriguez Zabaleta	**Univ. del Pais Vasco**	**Automatic Control & Systems Engineering**
Juan Rogers	**Georgia Tech, Assoc. Prof.**	**Public Policy**
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Dale Rothman	Denver, Assoc. Prof.	International Futures
Alan Rubel	Greenwall Fellow	Georgetown Univ. Law Ctr.
Dietram Scheufele	**Wisconsin, Professor**	**Life Sciences Communication**
Jennifer Schneider	CO Schl. of Mines, Asst. Prof.	Liberal Arts & International Studies
Daan Schuurbiers	**Radboud Univ., Project Mgr.**	**Center for Society & Genomics**
John Selsky	Univ. South Fl., Assoc. Prof.	Management
Meena Selvakumar	**Director**	**Pacific Science Center**
Philip Shapira	**Georgia Tech, Professor**	**Public Policy**
Mark Shapiro	Ctr for Investigative Journalism	
Bret Shaw	**UW-Madison, Asst. Prof.**	**Life Sciences Communication**
David Sittenfeld	**Program Manager, Forum**	**Museum of Science**
Mitchell Small	Carnegie Mellon, Professor	Public Policy
Laurel Smith-Doerr	Program Director	National Science Foundation
Joe Spencer	Production Manager	ALD NanoSolutions
Nicholas Steneck	Professor	University of Michigan
Karl Stephan	Associate Professor	Texas State University
Roger Strand	Bergen, Professor	Science Theory
Deborah Strumsky	**Assistant Professor**	**UNC Charlotte**
Michael Sullivan	Director	Hispanic Research Center
Tsjalling Swiersta	Twente, Professor	Philosophy

Albert Teich	AAAS, Director	Science & Policy Programs
Frank Theys	**Visual Artist and Filmmaker**	**Savage Film**
Julia Trosman	Director	Center for Business Models
Jeff Ubois	**Archivist**	**The Bassetti Foundation**
Rinie van Est	Coordinator	Rathenau Institute
Carl Van Horn	Rutgers, Professor	Planning & Public Policy
Jue Wang	Florida Intl., Asst. Prof.	Religious Studies
Peter Weingart	**University of Bielefeld, Prof.**	**Institute for Science & Technology Studies**
Fern Wickson	Bergen, Associate Professor	Study of Science & Humanity
Matthias Wienroth	Durham, Research Assoc.	Geography
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
Edward Woodhouse	Rensselaer Poly. Inst., Prof.	Science & Technology Studies
John Wooding	Massachusetts, Lowell, Prof.	Economic & Social Development
Charyl Yarbrough	Rutgers, Project Director	Workforce Development
Go Yashizawa	**Tokyo University**	**Project Lecturer**
Peter Yeadon	**RISD/Decker Yeadon LLC**	**Associate Professor/Architect**
Jan Youtie	**Georgia Tech, Sr. Research.**	**Enterprise Innovation Institute**
G. Zenner Petersen	**Wisconsin-Madison, Dir. Ed.**	**Materials Research Science & Engineering**

ASU
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**
Punarvasu Joshi	**Post-doctoral Fellow**	**Elect. Comptr. & Energy Engineering**
Anastasios Panaretos	Post-doctoral Fellow	Electrical Engineering
Cathy Slade	Post-doctoral Fellow	Public Policy
Berea Williams	Post-doctoral Fellow	Chemistry & Biochemistry

ASU
Graduate Researchers

Parul Agrawal	Materials Science & Engineering
Rebecca Allen	**Biodesign Institute**
Judd Anderman	Science & Technology Policy
Caroline Appleton	**Biology & Society**
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**

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
Manuel Garay Valenzuela		Education Leadership & Policy Studies
Aixa Garcia-Mont		Education
Meredith Gartin		**Global Health**
Sandeep Kaur Gill		Nanoscience
Cesar Gonzalez Esquer		SOLS Graduate Programs
Kelly Hale		Anthropology
Dongran Han		Chemistry
Keivon Hobeheidar		Biological Sciences
Qian Hu		Public Affairs
Douglas Huron		**Global Technology Development**
Nate Hisamura		Mathematics
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
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**
Beate-Josefine Luber	University of Bielefeld	Graduate Student
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
Rebecca Murans		**Design**
Israel Murguia		**Public Administration**
Tanya Musgrave		**Public Policy**
Tracy Niday		Chemistry
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**
Alicia Rodgers		Science & Technology Policy
Laura Rodriguez		**Technology & Innovation**
Jennifer Rogers	California, Santa Barbara	Graduate Student
Kehinde Salau		Mathmatics & Statistics
Cyndy Schwartz		**Human & Social Dimensions of S & T**
Jaswinder Scharma		Biomedicine
Nisha Sherma		Chemistry
Quinn Spadola		Physics
Trista Taylor		**Public Administration**
Justin Tosi		Political Science
Brenda Trinidad		**Human & Social Dimensions of S & T**
Yusuf Tufail		SOLS Graduate Programs
Walter Valdivia		**Public Administration**
Oriol Vidal Aparicio		Political Science
Jennifer Watkins		**Chemistry & Biochemistry**
Jinglei Zhang		Chemistry & Biochemistry

Affiliated
Post-Doctoral Scholars

Jason Delborne	Wisconsin	Rural Sociology
Sonia Gatchair	Georgia Tech	Public Policy
Padraig Murphy	Dublin City University	Communication
Debasmita Patra	Cornell	Communication
Ramya Rajagopalan	Wisconsin	Sociology
Elena Simakova	Cornell	Science & Technology Studies
Jue Wang	**Georgia Tech**	**Public Policy**

Affiliated Graduate Researchers

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**
Javiera Barandiaran	California, Berkeley	Environmental Sciences
Amy Barr	New Hampshire	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**
Michael Cacciatore	**Wisconsin-Madison**	**Life Sciences Communication**
Antonio Calleja-Lopez	**University of Seville**	**Political Science**
Stephen Carley	Georgia Tech	Public Policy
Doo-Hun Choi	**Wisconsin-Madison**	**Life Sciences Communication**
Rodrigo Cortes	**Georgia Tech**	**Public Policy**
Kajsa Dalrymple	**Wisconsin**	**Life Sciences Communication**
Ana Delgado	**University of Bergen**	**Sciences and the Humanities**
Julie Dillemuth	California, Santa Barbara	Geography

Anthony Dudo	**Wisconsin**	**Journalism & Mass Communication**
Paul Ellwood	**Leeds Univ. Business School**	**Business**
Jason Gallo	Northwestern	Media, Technology & Society
Reynold Galope	Georgia Tech	Public Policy
Harmeet Ghandi	Georgia Tech	Quantitative & Computational Finance
John Garner	Georgia Tech	Computing
Ying Guo	Beijing Institute of Tech.	Political Science
Courtney Hanna	**Univ. of British Columbia**	**Integrated Sciences**
Leela Hebbar	Rutgers	Public Policy
Elliott Hillback	Wisconsin	Journalism & Mass Communication
Shirley Ho	Wisconsin	Journalism & Mass Communication
Can Huang	Georgia Tech	Industrial Management
Lu Huang	Beijing Institute of Tech.	Political Science
Jennifer Jensch	Wisconsin	Public Policy
Ronak Kamdar	Georgia Tech	Quantitative Finance & ISYE
Luciano Kay	**Georgia Tech**	**Public Policy**
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
Pete Ladwig	**Wisconsin**	**Life Sciences Communication**
Erin Lamos	Georgia Tech	Public Policy
Brice Laurent	Ecole des Mines	Public Policy
Ricky Leung	Wisconsin	Sociology
Chien-Chun Liu	Georgia Tech	Management
Federica Lucivero	**University of Twente**	**Philosophy**
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
Tanner Osman	Georgia Tech	Public Policy
Krishna Parthasaathi	Georgia Tech	Industrial & Systems Engineering
Jayesh Patil	Georgia Tech	Computing
Ruimin Pei	**Beijing Institute of Tech.**	**Political Science**
Robin Phelps	**Colorado, Denver**	**Public Affairs**
Sofia Randhawa	Georgia Tech	Quantitative Finance & ISYE
Vanessa Schweizer	Carnegie Mellon	Engineering & Public Policy
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
Vrishali Subramanian	Georgia Tech	Public Policy
Li Tang	**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**
Charles Walsh	Georgia Tech	Public Policy
Rosalyna Wijaya	Wisconsin	Journalism & Mass Communication
John Willingham	North Carolina State	International Studies
Thomas Woodson	**Georgia Tech**	**Public Policy**
Xuanting Ye	**Beijing Institute of Tech.**	**Political Science**
Heming Zhang	Nankai Univ./Georgia Tech	Public Policy
Shuliang Zhang	Beijing Institute of Tech.	Political Science
Qin Zhu	**Dalian University of Tech.**	**Philosophy**

ASU

Undergrad Interns & Researchers

Kalil Abdullah	Molecular Biotechnology
Eric Beeler	**Susstainability**
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
Charles Walsh	Wisconsin	School of Business

CNS-ASU Staff

Melissa Cornish	Biodesign Institute Liaison
Corrine Dillon	Program Manager
Gretchen Gano	**Education & Outreach Coordinator**
Michelle Iafrat	**Administrative Associate**
Regina Sanborn	**Program Manager**
Joy Trottier	Administrative Associate

Participants affiliated, not receiving CNS-ASU support:

ASU

Azadeh Adibi	**Graduate Student**	**Industrial Design**
Ismaeel Almarazeeq	**Student**	**Industrial Engineering**
G. Alvarez Sieber	**Graduate Student**	**Engineering**
Ariel Anbar	Professor	Earth & Space Exploration
Catherine Arnold	**Communications Coordinator**	**CSPO**
Heman Au	**Student**	**Industrial Design**
John Ball	**Graduate Student**	**Design, Environment & Arts**
Michelle Barry	**Graduate Research Associate**	**Sustain. Engr. & Built Envir.**
Vineet Bhosle	**Graduate Student**	**Architecture**
Rachel Bowditch	Assistant Professor	Theatre & Film
Nicholas Broderick	Student	Theatre & Film
M. Chavez-Echeagaray	**Graduate Student**	**Computer Science**
Daniel Cifuentes	**Graduate Student**	**Arch. & Urban Design**
David Corral	**Student**	**Civil Engineering**
Michael Crow	President	Arizona State University
S. Doddaballapur	**Graduate Student**	**Urban Design & Built. Envir.**
Travis Doom	**Management Intern**	**CSPO**
Lauren Dykes	Graduate Teaching Assistant	Theatre & Film
Mark Edwards	Professor	Business
Mohamed Elkhesky	**Graduate Student**	**Mechanical Engineering**
Ron Elliott	**Graduate Student**	**Architecture**

John Ernzen	**Student**	**Biomedical Engineering**
Vicki Ewald	**Staff**	**Buckeye Express**
Joseph Fletcher	**Student**	**Computer Science**
Alfinio Flores	Professor	Curriculum & Instruction
Antonio Garcia	Associate Director	Hispanic Research Center
Justin Gauger	**Student**	**History**
J. Gonzalez-Sanchez	**Graduate Student**	**Computer Science**
Joel Greene	Professor	Public Policy
Andrey Gunawan	**Graduate Teaching Assistant**	**Elect. Conptr. & Energy Emg.**
Jason Griffiths	**Assistant Professor**	**Arch. & Landscape Arch.**
Stuart Hadley	Vice President	Public Affairs & Foreign Rel.
Joshua Hammer	**Student**	**Biomedical Engineering**
Afzal Hossain	**Graduate Teaching Assistant**	**Arch. & Landscape Arch.**
Oscar Huerta	**Graduate Student**	**Design**
Zahra Hussaini	**Student**	**Materials Science & Engrg.**
Aziza Ismael	**Student**	**Design Studies**
Korhan Kaftanoglu	**Graduate Research Associate**	**Elect. Comptr. & Energy Eng.**
Josh Katzker	Graduate Teaching Assistant	Theatre & Film
Amruta Khanolkar	**Graduate Teaching Assistant**	**Arch. & Landscape Arch.**
Daniel Kharisma	**Graduate Student**	**Civil, Envir. & Sustain. Engin.**
Dhara Kothavala	**Graduate Student**	**Sustainability**
Rachel Levinson	Government Relations Liaison	Research & Economic Affairs
Tyler Libey	**Graduate Student**	**Biomedical Engineering**
Min Lin	**Student**	**Computer Systems Engin.**
Jingzian Mao	**Graduate Student**	**Computer Science**
Deirdre Meldrum	Dean	Fulton School of Engineering
George Moakley	Student	Theatre & Film
Gabriel Montemayor	**Assistant Professor**	**Arch. & Landscape Arch.**
Rafiu Mustapha	**Graduate Student**	**Engineering**
Anumeha Narain	**Graduate Student**	**Industrial Design**
Lindsey O'Connell	**Student**	**Bio and Society**
Daniel Oliden	**Graduate Student**	**Sustain. & the Built Envir.**
Victor Orioke	**Student**	**Biomedical Engineering**
Varun Patel	**Student**	**Biomedical Engineering**
Chi-Han Peng	**Graduate Student**	**Computer Science**
Vincent Pizziconi	Bioengineering	Professor
Carlan Pontious	**Student**	**Industrial Design**
Randal Pope	**Graduate Student**	**GRES**
Adriana Ramos	**Student**	**Urban Design**
Mindy Robbins	**Student**	**Architectural Studies**
Shaily Rungta	**Graduate Student**	**Built Environment**
Michael Russo	**Graduate Student**	**Architecture**
Jamie Sandomire	Student	Theatre & Film
Deepika Sangoi	**Graduate Teaching Assistant**	**Arch. & Landscape Arch.**
Sara Schwabe	Graduate Teaching Assistant	Theatre & Film
Samantha Sears	**Graduate Teaching Assistant**	**Arch. & Landscape Arch.**
Ankur R. Sharma	**Graduate Student**	**Electrical Engineering**
Nicholas Shekerjian	**Student**	**Architectural Studies**
Vipul Singh	**Graduate Research Assistant**	**Built Environment**
Michael E. Smith	Professor	Evolution & Social Change
Milton Sommerfield	Professor	Life Sciences

Anne Stone	**Professor**	**Hum. Evol. & Social Change**
Chen Tang	**Graduate Student**	**Industrial Design**
Michael Thompson	Student	Theatre & Film
Ben Tieni	**Student**	**Graphic Design**
Paulette Tohonnie	**Student**	**Interior Design**
Jose Torres	**Student**	**Landscape Architecture**
Diane Van Hoy	**Student**	**Aerospace 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.
Lea Wilson	**Graduate Teaching Assistant**	**Sustainability**
Russell Wisniewski	**Student**	**Architectural Studies**
Kuan-Chuen Wu	**Graduate Student**	**Electrical Engineering**

Affiliated

Ida Andersen	Director	Danish Board of Technology
Timothy Apenzeller	Editor	National Geographic
David Attis	Senior Director	Policy Studies
David Beck	Staff	NISEnet
Roberta M. Berry	Professor	Georgia Institute of Technology
Rosalyn Berne	Professor	University of Virginia
Gary Bild	Member	Nanotech. Industry Liaison
Christopher Bosso	Professor	Northeastern University
Garrett Brown	Editor	National Geographic
Sebastien Brunet	Professor	University of Liege
Rick Canady	Staff	Food & Drug Administration
Amy Carroll	Staff	House Committee
Lorenzo Cena	Graduate Student	University of Iowa
Jan Cerveny	Staff	Department of Energy
Joshua Chamot	Staff	Legislative & Public Affairs
William Clark	Professor	Harvard University
James Collins	Head of Biological Sciences	National Science Foundation
William Cyrs	Graduate Student	University of Iowa
Michael Dennis	Staff	Society & Technology
Heather Douglas	Professor	University of Tennessee
Kate Duckworth	Staff	NISEnet
Chris Ewald	**Staff**	**Buckeye Express**
Ellen Feigal	Staff	TGen
Elizabeth Farrell	Staff	University of New Hampshire
Jonathan Fink	**V.P. Res. & Strategic Part.**	**Porland State University**
Monica Gaughan	Professor	University of Georgia
Stephen Godwin	Director	National Research Council
David Goldston	Professor	Harvard University
Douglas Goodman	Member	Nanotech. Industry Liaison
Herb Goronkin	Member	Nanotech. Industry Liaison
Richard Gullickson	Staff	Lawrence Livermore Lab
Diana Hicks	Public Policy	Georgia Institute of Tech.
Stephen Hilgartner	Science & Technology Studies	Cornell University
Michael Holland	Staff	House Science Committee

John Hughes	Member	Nanotech. Industry Liaison
Kent Hughes	Director	Teach America
Anil Jain	Computer Science & Engin.	Michigan State University
Sheila Jasanoff	Science & Technologies Studies	Harvard University
Carol Johnson	**Planning Department**	**City of Phoenix**
Eli Kawam	**President and CTO**	**EKLATEK Engineering**
Donna Kent	Global Studies	Televerde
Matt Kim	Member	Nanotech. Industry Liaison
Fred Kronz	Philosophy	University of Texas
Ray Kurzweil	Member	Board of Visitors
Dirk Libaers	Public Policy	Georgia Institute of Tech.
Troy Livingston	Staff	NISEnet
Uttam Malani	Public Policy	Georgia Institute of Technology
Benjamin M. Mann	Program Manager	Defense Science Office
Robin Marks	Staff	NISEnet
John McGarity	Member	Nanotech. Industry Liaison
Maxwell J. Mehlman	Professor	Case Western Reserve Univ.
Celia Merzbacher	Staff	Office of Naval Research
Daniel Metlay	Staff	Nuclear Waste Review Board
Michael Moffitt	Associate Professor	University of Michigan
Jeff Morris	Staff	Environ. Protection Agency
Daniel Morrison	Professor	Vanderbilt University
Sean Murdock	Member	Nanotech. Industry Liaison
Richard Nelson	Member	Board of Visitors
Susan Norton	Editor	National Geographic
James Paul	Staff	House Committee
Priscilla Regan	Professor	Social, Behavioral & Econ.
Michael Roco	Senior Advisor	National Science Foundation
Marc Rothenberg	Staff	Legislative & Public Affairs
Tind Shepper Ryen	Staff	House Committee on Science
Laura Schiavo	Curator	National Building Museum
Karen Shakman	**Project Architect**	**Iconic Architecture**
Mark Shapiro	Member	Board of Visitors
Gregory Simonson	Professor	Science, Tech. & Military
Mitchell Small	Professor	Carnegie Mellon University
Alexa Stephens	Public Policy	Georgia Tech
Joanne Tornow	Program Manager	National Science Foundation
Anna Waldron	Professor	Cornell University
Fred Weber	Member	Nanotech. Industry Liaison
James Wilsdon	Director	The Royal Society
Carly Wobig	Graduate Student	University of Illinois

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

i. Executive Committee

Elizabeth Corley, Associate Professor, ASU Department of Public Affairs
David H. Guston, Professor, ASU School of Government, Politics, & Global Studies
Deirdre Meldrum, Dean, ASU Fulton School of Engineering
Clark A. Miller, Associate Professor, ASU School of Government, Politics, & Global Studies
Dietram Scheufele, Professor, Journalism and Mass Communication, and Life Sciences, University of Wisconsin-Madison
Jan Youtie, Manager, Policy Services, Georgia Institute of Technology

ii. Board of Visitors

Edward Cupoli, Professor, University of New York, Albany
William Hallman, Professor/Chair, Dept. Human Ecology, Rutgers, State Univ. of New Jersey
Kristen Kulinowski, Faculty Fellow, Department of Chemistry, Rice University
Jennifer Kuzma, Associate Professor, Department of Public Affairs, University of Minnesota
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

Gary Bild
Larry Bock, Chairman, Luxe Ventures
Ellen Feigal, Director of Medical Devices and Imaging, TGen
Douglas Goodman
Herb Goronkin
John Hughes
Anil Jain, Professor, Department of Computer Science & Engineering, Michigan State University
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

Larry Bell, Senior Vice President, Strategic Initiatives, Museum of Science
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
Barrett, The Honors College
Biodesign Institute
Center for Research on Education in Science, Mathematics, Engineering, & Technology (CRESMET)
Center for the Study of Religion & Conflict
Center for Law, Science and Technology
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
Global Institute of Sustainability
Graduate College
Health Services
Herberger Institute for Design & the Arts
Hispanic Research Center
Ira A. Fulton Schools of Engineering
LightWorks
Mary Lou Fulton College of Education
Office of Knowledge and Enterprise Development (OKED)
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 Sustainability
Science Policy Assessment & Research on Climate (SPARC)
Stardust Center
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

Antwerp University
Austrian Academy of Science
Beijing Institute of Technology, China

Carnegie Mellon University
Case Western Reserve University
Center for Nanotechnology in Society at University of California, Santa Barbara
Colorado School of Mines
Columbia University
Copenhagen Business School, Denmark
Cornell University
Dalian University of Technology, China
Delft Technical University, the Netherlands
Dublin City University
Durham University, United Kingdom
Ecole des Mines, France
ETH Zurich
European Commission
Ewha Women's University
Federal University of Parana, Brazil
Flemish Institute of Science & Technology
Florida International University
George Washington University
Georgetown University
Georgia Institute of Technology
Grenoble Institute of Technology
Harvard University
Illinois Institute of Technology
Indiana University
Institute of International Sociology of Gorizia
Institut d'Etudes Politiques de Grenoble, France
James Martin Institute for Science & Civilization, Oxford University, UK
Lancaster University, UK
Leeds University Business School, UK
Mesa Biotech Academy
Mesa High School
Michigan State University
MIT SENSEable City Lab
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
Portland State University
Purdue University
Queens University
Radboud University
Rensselaer Polytechnic Institute
Rice University
Rice University/ICON
Rutgers, The State University of New Jersey
Said Business School, Oxford
Technical University of Denmark
Texas State University, San Marcos

The Center for International Development, Harvard University
Tokyo University
UCLA/Harvard/NBER: Collaborative Research; Personnel Exchanges
Universidad de Zacatecas, Mexico
Universidad del Pais Vasco, Spain
University at Albany
University of Antwerp, Belgium
University of Arizona
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, Santa Barbara
University of Colorado, Boulder
University of Colorado, Denver
University of Denver
University of Edinburgh
University of Georgia
University of Gothenburg, Sweden
University of Groningen, Netherlands
University of Illinois, Chicago
University of Iowa
University of Leeds
University of Liege, Belgium
University of Manchester
University of Massachusetts, Amherst
University of Michigan
University of Minnesota
University of New Hampshire
University of North Carolina, Charlotte
University of Nottingham
University of Seville, Spain
University of South Carolina
University of South Florida
University of Tennessee, Knoxville
University of Texas
University of Twente, the Netherlands
University of Victoria
University of Virginia
University of Washington
University of Wisconsin, Madison
Vanderbilt University
Virginia Tech University
Yale University

4. (d) Non-Academic Participating Institutions

ALD Nano Solutions
American Association for the Advancement of Science (AAAS)
American Bar Foundation
Arizona Nanotechnology Cluster
Arizona Bioindustry Organization
Arizona Science Center
Arizona Technology Council
Arizona Research Institute for Solar Energy
Bassetti Foundation
Bioindustry Organization of Southern Arizona
Buckeye Express
Carnegie Mellon
Cell Publishing
Center for Business Models in Health Care
Center for Responsible Nanotechnology
City of Phoenix
Complex Global Risks
Danish Board of Technology
Decker Yeadon LLC
Department of Energy (DOE)
Ecological Society of America
EKLATEK Engineering
Exploratorium, San Francisco
Environmental Protection Agency (EPA)
European Commission
Food and Drug Administration (FDA)
Genome British Columbia
German Parliament
Global Business Network
Gordon Research Conferences
Greenwall Foundation
Iconic Architecture
Institute of Technical Assessment & Systems Analysis
Intelligent Information Group Services
International Nanotechnology in Society Network (INSN)
Jennings, Strouss, & Salmon PLC
Lawrence Livermore Lab
Loka Institute
Luxe Ventures
Mayo Clinic – Scottsdale
Meridian Institute
Microchip
Museum of Life & Science, North Carolina
Museum of Science, Boston
Nanoscale Informal Science Education Network (NISENet)
National Academy of Engineering
National Business Museum
National Geographic Society
National Nanotechnology Coordinating Office

National Nanotechnology Infrastructure Network
National Research Council
National Science Foundation
Nature Publishing Group
Norwegian Institute
Nuclear Waste Review Board
Office of Knowledge Enterprise Development
Office of Naval Research
Oregon Museum of Science & Industry
Practical Action
Physician Services Group
Planetary ONE
Rathenau Institute
Research Council of Norway
Rhode Island School of Design
Rockefeller Foundation
Sandia National Laboratory
Savage Film
Sciencenter, New York
Science Museum of Minnesota
Spirit of the Senses Salon
Springer Publishing
Sundt Construction, Inc.
Targeted Genetics Corporation (TGen)
Teach America
Tempe Festival of the Arts (Fall and Spring)
Televerde
The Elumenati, LLC
The Foresight Institute
The Rockefeller Foundation
The Royal Society
The Washington Post
U.S. DOE/Center for Integrated Nanotechnology (CINT)
Will Bruder & Partners Ltd.
Woodrow Wilson International Center for Scholars

5. Quantifiable Outputs

Table 1: Quantifiable Outputs - NSF Award #0531194						
	Reporting Year-1	Reporting Year-2	Reporting Year-3	Reporting Year-4	Reporting Year 5	Total
Outputs	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010	
Publications resulted from NSEC Support						
in Peer Reviewed Journal	10	7	4	8	27	56
in Peer Reviewed Conference Proceedings	0	0	0	0	0	0
in Peer Reviewed Book Chapters	1	7	7	2	4	21
Technical Reports	6	2	2	4	7	21
Working Papers	1	1	3	12	11	28
Books	0	0	2	0	0	2
Theses	1	6	11	9	8	35
in Trade Journals	0	2	2	2	3	9
Other Journal Publications	0	3	1	1	2	7
Internet	0	2	0	0	8	10
with Multiple Authors	10	9	11	16	46	92
co-authored with NSEC faculty	10	9	11	16	42	88
NSEC Technology Transfer						
Inventions Disclosed	0	3	3	3	0	9
Patents Filed	0	0	0	0	0	0
Patents Awarded	0	0	0	0	0	0
Software Licensed	0	0	0	0	0	0
Spin-off Companies Started	0	0	0	0	0	0
Degrees to NSEC Students						
Bachelors Degrees Granted	3	8	1	11	3	26
Masters Degrees Granted	2	4	1	4	6	17
Doctoral Degrees Granted	1	1	3	5	5	15
NSEC Graduates Hired by						
Industry	0	1	0	2	3	6
NSEC participating Firms	0	0	0	0	0	0
Other US Firms	0	1	0	0	0	1
Government	0	1	0	1	0	2
Academic Institutions	2	5	3	2	10	22
Other	0	1	0	3	1	5
Unknown	4	4	1	11	0	20
NSEC Influence on Curriculum						
New Courses Based on NSEC Research	3	5	2	3	4	17
Courses Modified to Include NSEC Research	2	3	2	3	1	11
New Textbooks Based on NSEC Research	0	0	1	0	1	2
Free-standing Course Modules or Instructional CDs	0	0	0	0	0	0
New Full Degree Programs	0	0	1	1	1	3
New Certificate	0	0	0	0	0	0
Information Dissemation/Educational Outreach						
Workshops, Short Courses to Industry	0	0	0	2	0	2
Workshops, Short Courses to Others	2	3	2	0	7	14
Seminars, Colloquia, etc.	73	88	38	66	116	381
World Wide Web courses	0	0	0	0	0	0
Academic Presentations	49	60	21	37	107	274
Industry Presentations	9	10	1	5	8	33
Science Cafes	6	8	4	7	10	35
Visiting Speakers	8	9	12	8	15	52
Community Speaking Engagements	1	1	0	2	11	15
Newsletters	5	4	3	3	0	15

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	23					23
in Peer Reviewed Conference Proceedings	0					0
in Peer Reviewed Book Chapters	8					8
Technical Reports	6					6
Working Papers	7					7
Books	2					2
Theses	2					2
in Trade Journals	1					1
Other Journal Publications	3					3
Internet	22					22
with Multiple Authors	35					35
co-authored with NSEC faculty	30					30
NSEC Technology Transfer						
Inventions Disclosed	0					0
Patents Filed	0					0
Patents Awarded	0					0
Software Licensed	0					0
Spin-off Companies Started	0					0
Degrees to NSEC Students						
Bachelors Degrees Granted	1					1
Masters Degrees Granted	7					7
Doctoral Degrees Granted	2					2
NSEC Graduates Hired by						
Industry	0					0
NSEC participating Firms	0					0
Other US Firms	5					5
Government	1					1
Academic Institutions	4					4
Other	0					0
Unknown	0					0
NSEC Influence on Curriculum						
New Courses Based on NSEC Research	4					4
Courses Modified to Include NSEC Research	0					0
New Textbooks Based on NSEC Research	0					0
Free-standing Course Modules or Instructional CDs	0					0
New Full Degree Programs	1					1
New Certificate	0					0
Information Dissemation/Educational Outreach						
Workshops, Short Courses to Industry	0					0
Workshops, Short Courses to Others	5					5
Seminars, Colloquia, etc.	98					98
World Wide Web courses	1					1
Academic Presentations	53					53
Industry Presentations	7					7
Science Cafes	12					12
Visiting Speakers	17					17
Community Speaking Engagements	4					4
Newsletters	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 a forthcoming submission of a special issue (edited by Barben and Guston) on reflexive and anticipatory governance to *Social Studies of Science*. 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 (mostly graduate students) 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) 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 being 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 (in preparation for a proposed special issue of *Social Studies of Science* on emerging technologies edited by Elena Simakova and Christopher Coenan) has begun to collect many of these responses in the community and respond to some critics that have emerged.

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 now in press a third (Hays, Robert, Miller and Bennett 2011). A fourth is well into the planning stage (Miller and Barben in preparation 2012). The two-volume *Encyclopedia of Nanoscience and Society* (Sage; Guston, editor) was published in the current year. 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.[1] 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

[1] There had been some concern about the high price of the first volume early on, but Springer has inaugurated a new print-on-demand paperback version, which will be available for $25 to people at universities that subscribe to Springer Online. This program does not assist scholars at less well-off institutions, or persons not connected to academic or other research institutions, however. CNS will maintain its bulk purchase of the *Yearbook* and will provide copies free of charge to people who are so-situated.

and undergraduate students – to nearly 500 topics in nanotechnology in society. In total, Center researchers have 9 books published, under review or under contract, five of which are primary CNS publications.

The Center's researchers have published, had accepted or submitted for review 110 peer-reviewed journal articles[2] (90 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*),
- law and ethics (*Science and Engineering Ethics*; *Journal of Law, Medicine, and Ethics*),
- communication (*Science Communication*; *Journal of Mass Communication Quarterly*; *Public Understanding of Science*; *New Media and Society*),
- other interdisciplinary specialty journals (*Appetite*; *Cities*; *Long-range Planning*) and
- specific, NSE-related audiences for
    - scientists (*Journal of Nanotechnology Research*; *Nature Nanotechnology*),
    - social scientists and humanists (*NanoEthics*) and
    - educators (*Journal of Nanotechnology Education*).

The Center has 21 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 45 book chapters, 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 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 – 983 citations as documented in Google Scholar (as of Mar 11), up from roughly 500 citations in Apr 10 and 188 citations in Apr 09. The Center's H-index has risen to 19, from 12 last year (indicating precisely 19 publications with 19 or more citations each). (This total does not include the roughly 75% of the 184 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 26 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 contributed to the completion of 39 student theses, including 15 completed doctoral theses, 3 master's theses, and 21 undergraduate honors theses, across a variety of disciplines. CNS-Biodesign fellows and others have completed three doctoral theses with the

[2] Shapira and colleagues estimate that between 2001 and 2010, some 970 articles have been published worldwide on the social aspects of nanotechnology. CNS-ASU commencing in October 2005, has thus contributed a substantial fraction of those articles.

PhD+. These numbers do not yet include five domestic and five international graduate students whose doctoral 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 data have also been provided at the request of researchers at NYU and in France.

Center activities have also helped generate additional research projects, including roughly $1.5M of associated and spin-off awards at ASU and roughly $1.8M 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 is to extend outreach 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 tests 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); and
- 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).

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; and
- Ruddles, 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.

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, 08-10;
- Scheufele (co-PI with PI Berube at NCSU), NIRT: Intuitive Toxicology and Public Engagement, $1.4M ($150K at UW), 08-10; and
- Scheufele, (consultant with PI Hallman at Rutgers), USDA CSREES National Research Initiative (NRI) Food Nanotechnology: Understanding the Parameters of Consumer Acceptance, $200K, 08-10.

CNS-ASU has been a force for institutional change at ASU and its collaborating universities. 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 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; and
- collaborated with a number of NSF (STC, ERC, IGERT and NUE), DOE (ARPA-E and Hub) and NIH proposals 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, preliminary notification given, awaiting award letter.
- Panchanathan, NSF IGERT, Person-Centered Technologies and Practices for Persons with Diabilities, ~$3M, preliminary notification given, awaiting award letter.

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 Su 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 Su 11, the DC Summer Session is expanding to three, two-week sessions.

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 the highlights of most major and some minor projects.

- 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:
  - Nanoscience occurs in a global research and funding environment. (Shapira and Wang 2010; Wang and Shapira 2011);
  - A significant change has occurred in recent years in the orientation of corporate nanotechnology activities, from research discovery to patented applications. (Shapira, Youtie, and Kay 2011);
  - Corporations use nanoscale science and engineering centers (NSECs) as a network (Rogers, Youtie, Kay 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); and
  - There is a sharp rise in active nanostructure publications in 2006, which is maintained in subsequent years, suggesting a shift in research from passive to active nanostructures. (Subramanian et al. 2010).
- RTTA 1/2 Public Value Mapping: Conducting case studies in public value mapping of nanotechnologies, CNS-ASU researchers have found:
  - Nano-based cancer therapies seem poorly situated to contribute much if anything to decreasing health disparities (Slade 2011);
  - The Bayh-Dole Act is flawed from a public value and equity perspective (Valdivia 2011); and
  - Quantitative analysis of value statements can provide credible and robust basis for policy analysis (Fisher et al. 2010).

- RTTA 2/1 Public Opinion Polling: Based on a national public opinion survey (dual frame RDD and listed households CATI survey, N=1015, conduct May-Jul 07), CNS-ASU researchers found:
    - When members of the public associates nanotechnology with specific application areas, they are more likely to take risk perceptions into account when forming attitudes about the technology (Cacciatore et al. forthcoming 2011);
    - Despite increasing nanotechnology outreach efforts over the past decade, there is a widening nanotech knowledge gap among members of the public with the least and most formal education levels (Scheufele and Corley 2010); and
    - Thinking about and reflecting upon scientific news may promote better understanding of the scientific world and may provide a more sophisticated cognitive structure for the public to form opinions about nanotechnology than factual scientific knowledge (Ho, Scheufele and Corley 2010).
- RTTA 3/1 Scenario Development
    - Historically plausibility has been conflated with probability thus making distinctions between a non-predictive, anticipatory approach to futures and approaches that seek to calculate likely futures difficult yet nevertheless critical for sophisticated foresight analysis (Pereira and Selin under development; Ramirez and Selin underdevelopment);
    - Building on prior years findings about the ambiguity and obscurity of nanotechnology and energy systems, RTTA 3 is pioneering work into non-discursive engagement practices (multi-media, experiential, etc.) in their conceptualization of and practical experiments with "material deliberation" (Davies, Selin, Gano, and Guimarães Pereira under revision for resubmission); and
    - Given the ubiquity of nanotechnology, its sub-visuality, and the uncertain societal and ethical implications, responsible innovation is thwarted on multiple levels. However, InnovationSpace's structured curriculum of intense research, creative exploration, and transdisciplinary teamwork provides a model to account for and design valuable products (Selin and Boradkar 2011, forthcoming).
- 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:
    - Ordinary citizens place a great deal of importance on issues of equality (Bal 2011);
    - While the NCTF had shortcomings, such structured deliberation can generate informed opinions, meaningful shifts in preferences, and increased trust and feelings of internal efficacy (Cobb 2011); and
    - Compared to the control group of applicants, participants remain more knowledgeable about human enhancement and believe they participate more in civic life, however participants are comparatively less active in activities associated with the development of social capital, except for in activities specifically about human enhancement (Cobb and Gano under development).
- 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).

- RTTA 4/3: Through Integration Policy Studies, CNS-ASU researchers have found:
    - in confirmation of earlier findings of Fisher and Mahajan (2006) that NSE policy makers and practitioners consistently invoke potentially contradictory values in making NSE policy statements (Fisher et al. 2010); and
    - evidence of few integrative research activities among the vast array of activities conducted by NSECs and listed on their websites (Garay and Fisher).
- TRC 1: The collected expertise embodied in the *Yearbook of Nanotechnology in Society: Nanotechnology, Equity, and Equality* (Cozzens and Wetmore 2011), derived in part from an "end-to-end" process of RTTA activities, suggests that many of the promises for and challenges to equity and equality that have been generated by previous technologies are in the process of being reproduced by nanotechnology. Additional research has also found:
    - 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 forthcoming 2011) 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 inaugural year's work in a studio course and workshops, 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 is redesigning its searchable definition of nanotechnology, which is supported by numerous programs 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:
    - As part of the Mediating Futures thrust in RTTA 3/1, Davis has built a library resource tool that enables users to sort through hundreds of annotated entries that deal with new forms of 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 and will be 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 faculty positions, most recently Selin, who is being appointed to a tenure-track position at ASU's School of Sustainability for F 11. GA Tech's Ma 10 Transatlantic Workshop also featured specific presentation and learning opportunities for early career scholars.
- At the graduate level, CNS-ASU has involved more than two dozen graduate students in its YR 6 activities. The Center completed a new studio course in the School of Sustainability which was part of a suite of activities that won Wiek an ASU President's Award for Sustainability. Graduating doctoral students are accepting jobs at elite academic institutions including UT Austin. The Center has added additional PhD+ students, and we will conduct three iterations of our DC Summer Session in Su 10 with paying subscribers. 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 introduced and continued to teach classes influenced by the Center, including "Introduction to Science and Technology Policy" for 125 undergraduates at ASU and the iTunesU course, "Science, Media and Society" at Wisconsin. 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 continued 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, and planned exhibits, among other things.
- In training for scientists and engineers, CNS-ASU has revamped its 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 relations that CNS-ASU has established in the past year are:

- the completion of planning for the 5-6 May Private Sector Engagement workshop and associated activities;
- the disclosure of InnovationSpace inventions to AZTE and other private sector contact through ISpace;
- the completion of two STIR lab studies with a private sector laboratory and follow-on publications in development;
- the participation of nanotechnology firms in the GA Tech Transatlantic Workshop, including discussions of corporate strategies and corporate responsible innovation.

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, including its constituent universities, is training in various capacities approximately one-half dozen junior research faculty and post-doctoral fellows, more than 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 it. At Wisconsin and ASU, CNS-related research is being incorporated into a number of 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. CNS has also cultivated a cohort of interdisciplinary junior scholars, one more of whom has received a tenure-track appointment.

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. Last year, we modified for 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.

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. We have focused activity on disability communities as an under-represented population through the activities of TRC 1 Equity and Responsibility and TRC 2 Human Identity, Enhancement, and Biology. We have also reached out to related professional and student audiences, e.g., Youtie gave a presentation to the National Organization for the Professional Advancement of Black Chemists and Chemical Engineers and Cozzens to an REU group affiliated with GA Tech's NNIN node. 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. 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 will be repeated in Fa 11. CNS-ASU plans to revise and resubmit an earlier failed REU in the coming year.

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. In particular, 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. The website has several functional areas, including:

- The NanoFutures site (http://cns.asu.edu/nanofutures), which invites various lay-public and expert groups to help construct and comment on nanotechnological scenarios that CNS-ASU has seeded. This site will continue to expand as users visit and develop new content themselves;
- 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 spear-headed the creation of the International Nanotechnology and Society Network (INSN; www.nanoandsociety.org), founded at ASU in Jan 05 and currently including more than one hundred members from more than a dozen nations. At the Sep 09 inaugural meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET; Guston is a founding member of the board and a member of the first and second program committees), we have decided to re-purpose INSN to deal specifically with issues of nanotechnologies, equity and development. 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 been the site of literally scores of 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 also interacts. Roughly 20% of its published, forthcoming or under review journal articles, 14 are in journals like *Nature Nanotechnology*, *Journal of NanoParticle Research*, *Journal of Nanoscience and Nanotechnology*, *EMBO Reports*, and others that are generally 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 nearly 500 presentations, roughly 60% of which were presented 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 6.

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 participated 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., the new "Future Scenarios, Anticipatory Governance, and Sustainability" (Sp 10) is driven by research interests;
        - Research frames are brought to bear on high school engagement programs in geoengineering and synthetic biology; 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 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.:
    - A RTTA 1/1 Innovations Systems Assessment project investigates female involvement in nanotechnology patenting;
    - A RTTA 1/2 Public Value Mapping project that includes 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, 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 will be 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 has hosted more than five dozen international visitors, from 20 different countries;
    - A Memorandum of Understanding with NISE Net for collaborations centered on enhancing informal science education with expertise from the societal aspects of NSE has led to numerous, ongoing, and increasingly substantive collaborations;
    - The Center is planning a Spring School on the Anticipatory Governance of Emerging Technologies, which will involve more than one dozen junior scholars;
    - CNS-ASU is co-hosting the 2011 annual meeting of the Society for the Study of Nanoscience and Emerging Technologies in Nov 11;
    - The associated STIR project leads an expanding international network of graduate students and laboratories; and
    - Wetmore is planning, in conjunction with NNIN and associated EESE projects, the first Congress on Teaching the Social and Ethical Implications of Science in Nov 11.

  - 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;
  - 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 nearly 1400 individuals;
  - CNS-ASU researchers have given nearly 500 talks across all audiences since the inception of the Center, roughly 100 in YR 6 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
    - Miller has started a blog in collaboration with NISE Net.
  - 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 in the recent year;
  - 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 in press, 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, particularly the scenes of plausible nanotechnological products that CNS-ASU has developed and vetted, create through the NanoFutures interactive website 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, create more informed citizens on important topics in nano-in-society;
  - CNS researchers are involved in three ongoing video projects, including two major documentaries;
  - Interaction with NSE researchers, including courses, training activities, workshops, laboratory collaborations, and interventions results in identifiable changes in knowledge, identity, and practice;

- CNS-ASU has had important informational and educational exchanges with decision makers, including:
  - Guston, Scheufele and Corley participated in several NNI strategic planning activities over the recent year;
  - Sarewitz is part of the ongoing bipartisan National Commission on Energy Policy task force on geoengineering;
  - Guston, Shapira, and Selin participated in the International Study of the Long-term Impacts and Future Opportunities for Nanoscale Science and Engineering, which recently 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.
  - Ga Tech RTTA 1/1 research on a variety of topics has been disseminated to many public offices:
    - Youtie "The use of environmental, health, and safety knowledge by nanotechnology researchers" to the National Environmental and Health Implications working group of the NSET subcommittee (including representation by EPA, NIH, FDA, NIOSH, USDA, DOD) June 10.

7. Highlights

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

Study Finds Flaw in Surveying Public Opinion About Science

A new CNS-ASU study highlights a major flaw in attempting to use a single survey question to assess public opinion on science issues. The study, published *in Public Understanding of Science*, found that people who say the risks posed by new science fields outweigh the benefits often actually perceive more benefits than risks when asked more detailed additional questions.

The goal of the study was to explore whether one survey question could be used to accurately measure public opinion on science and technology issues. But the researchers found that complex science issues do require multiple survey questions about risks and benefits in order to accurately measure public opinion about them.

The researchers developed two surveys, one focused on nanotechnology and the other on biofuels. In each survey, respondents were asked an overarching question: do the risks associated with nanotechnology/biofuels outweigh the benefits, do the benefits outweigh the risks, or are the risks and benefits approximately the same? Respondents were then asked a series of questions about specific risks and benefits associated with nanotechnology or biofuels.

When researchers compared the participants responses to the overarching question with their responses to specific questions, they found a significant discrepancy for people who answered the overarching question that risks outweigh benefits. Those same people actually perceived more benefits than risks when given the opportunity to respond to specific questions about risks and benefits.

For example, in the nanotechnology survey, 50 percent of the respondents who said risks outweighed benefits actually evaluated nanotechnology positively in the other portion of the survey. Similar though less pronounced results were found in the biofuels survey.

This analysis suggests that researchers in the area of public attitudes toward science must revisit notions of measurement in order to accurately inform the general public, policymakers, scientists and journalists about trends in public opinion toward emerging technologies. Oversimplified questions can result in misleading poll data that create problems for policymakers who base their decisions on those findings.

Oversimplified questions may also contribute to different polls showing widely differing results, which weakens the public's faith in surveys generally.

Learn more about the study in the CNS-ASU website library:
http://cns.asu.edu/cns-library/author

Andrew Binder,[1] Michael Cacciatore,[2] Dietram Scheufele,[2] Bret Shaw,[2] and Elizabeth Corley[3]

[1]Public Communication of Science and Technology, North Caroline State University;
[2]Department of Life Sciences Communication, University of Wisconsin-Madison;
[3] College of Public Programs, Arizona State University

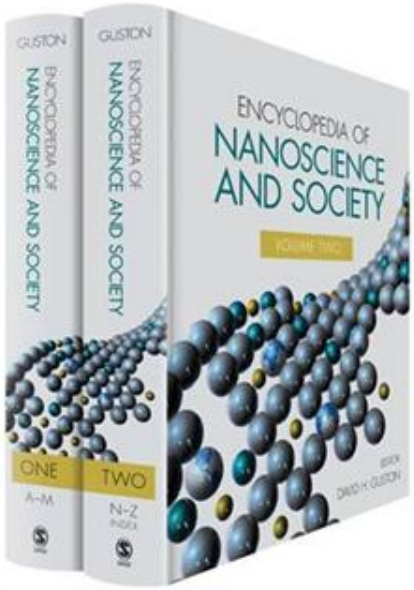
Research, education and outreach activities at the Center for Nanotechnology in Society at Arizona State University are supported by the National Science Foundation under cooperative agreement #0937591

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

Curious about the Role of Nanoscience? New Encyclopedia has Answers

Nanoscience has garnered billions of dollars of funding and has been hailed as ushering in the Next Industrial Revolution. But, for such a richly anticipated field, it has made its way into products all around us without much fanfare while popular media entertain us with visions of nanotechnology as cornucopia or Armageddon.

Somewhere in between are social scientists, ethicists and others reflecting on our understanding of the broad implications of nanotechnology, gauging its promises and risks, assessing the impacts of policy decisions, and communicating the meaning of nanoscience research. The outcome of this middle ground is the newly-released two-volume *Encyclopedia of Nanoscience and Society*, published by SAGE Publications, Inc. Edited by David H. Guston, director of the Center for Nanotechnology in Society at Arizona State University, this resource isn't designed for the scientist or engineer, but for the rest of us who have plenty of questions about nanotechnology but are afraid to ask.



The Encyclopedia contains approximately 425 entries by contributors from a variety of disciplines – sociology and psychology, economics and business, science and engineering, computing and information technology, philosophy, ethics, public policy, and more. They bring varied perspectives to the questions of nanotechnology in society in such general topic areas as:

- Ethical issues
- Social issues
- Risk assessment
- Environmental issues
- Military uses and issues
- Converging technologies
- Agriculture and food safety
- Health, safety and medical ethics
- Commercial and economic issues
- Educational and training issues
- Law, policy and regulation
- Philosophy and the human condition
- National security and civil liberties
- Technology "haves" and "have-nots"
- Computing and information technology

The *Encyclopedia of Nanoscience and Society* provides an accessible and jargon-free guide to what these issues and challenges are all about. It also includes helpful aids such as a chronology, a resource guide and a glossary.

> "It is possible that both perspectives – next industrial revolution or just hype – are correct. Nanoscience and nanotechnology could at some time emerge as the engines of one of the most spectacular transformations of human societies, but it also could be that we started down this path led more by our hopes and fears than by reason, more by a sense of adventure than a sense of responsibility. It is challenges like these that make an encyclopedia of nanoscience and society a necessity."
>
> David H. Guston

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

For more information including how to order the encyclopedia, visit the SAGE website at http://www.sagepub.com/books/Book233289?siteId=sage-us&prodTypes=any&q=encyclopedia+of+nanoscience

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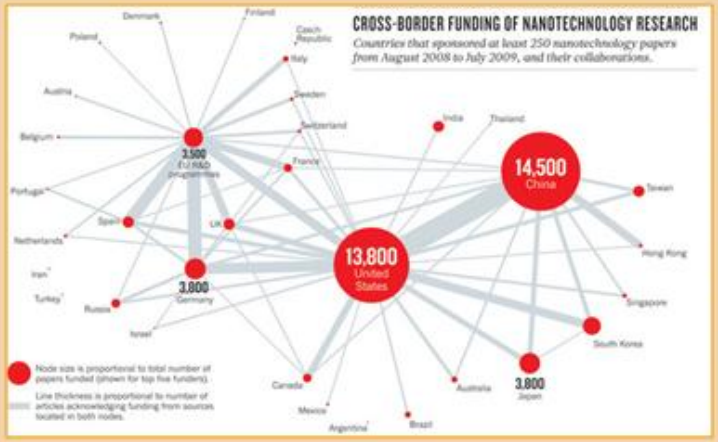
The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

Researchers Follow Money, Discover Nanotech Research Transcends Country Borders

Despite their focus on national economic competitiveness, the nanotechnology research initiatives now funded by more than 60 countries have become increasingly collaborative, with nearly a quarter of all papers being co-authored by researchers across borders. Researchers from the two leading producers of nanotechnology papers – China and the United States – have become each nation's most frequent international co-authors. These findings are reported in a CNS-ASU Comment piece in *Nature*, Volume 468.

Data-mining techniques were used to assemble a database of nanotechnology publications that allowed the CNS-ASU researchers to make comparisons across countries. More than 91,000 papers published worldwide between August 2008 and July 2009 were analyzed.



Although nanotech research from 152 nations were represented in the survey, just 15 countries produced 90 percent of the papers. The top four countries by author affiliation were the United States, China, Germany and Japan.

A subset of 61,300 papers were identified that were supported by grants. Of these, the National Natural Science Foundation of China was the top funder. Second was the U.S. National Science Foundation, followed by the Ministry of Science and Technology of China, the European Union's R&D programs, and the U.S. Department of Health and Human Services.

In 2008 alone, leading industrial nations invested over $8 billion in public funds in nanotechnology research initiatives. Countries that have launched major governmental programs to develop their national nanotechnologies as part of efforts to boost future economic growth include the United States, China, Germany, Japan and Korea.

But despite years of emphasis by governments on national nanotechnology initiatives, the researchers found that patterns of nanotechnology research collaboration and funding transcend country boundaries. For example, researchers in the U.S. and China have developed a relatively high level of collaboration and now publish roughly the same number of nanotechnology papers, although the U.S. retains the lead in quality of publications, as measured by the number of early citations. The numbers signal a significant trend, as China has taken over from European countries as America's leading international collaborator by volume in nanotechnology research.

Given the constraints of today's economic climate, growth in nanotechnology funding appears unlikely. CNS-ASU researchers suggest that countries foster more high-quality international collaborations, perhaps by opening funding competitions to international researchers and by offering travel and mobility awards for domestic researchers to increase alliances with colleagues in other countries.

Nanotech's Top 10 Funders

Organization	Sponsored papers (and % of total)	Early impact papers (% of sponsor's papers)
National Natural Science Foundation of China	10,200 (16.7)	4.7
US National Science Foundation	6,700 (10.8)	11.4
Ministry of Science and Technology of China	4,700 (7.7)	5.2
European Union (R&D programmes)	3,500 (5.8)	10.4
US Department of Health & Human Services (including National Institutes of Health)	3,100 (5.1)	15.0
Ministry of Education of China	3,100 (5.1)	4.6
US Department of Energy	3,000 (4.9)	12.5
US Department of Defense	2,600 (4.2)	12.3
German Research Foundation	2,600 (4.2)	10.2
Ministry of Education, Culture, Sports, Science and Technology of Japan	2,400 (3.9)	6.2

Dr. Jue Wang
Assistant Professor, Department of Public Administration
Florida International University

Dr. Philip Shapira,
Professor of Public Policy, Georgia Institute of Technology
Professor, Manchester Institute of Innovation Research,
Manchester Business School, University of Manchester

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 to Study the Commercialization of Graphene

The Center for Nanotechnology in Society
ARIZONA STATE UNIVERSITY

In 2010 the Nobel Prize in Physics was awarded to physicists Andrew Geim and Konstantin Novoselov at the University of Manchester (UK) for their work on graphene, a carbon material so thin that it is effectively two-dimensional. Geim and Novoselov discovered how to produce graphene in sheets that are only as thick as a single atom yet stronger than steel and more conductive than copper. These qualities make graphene sheets an ideal nano building block with groundbreaking potential applications. For example, in electronics it could perform as a semiconductor well beyond the limits of silicon-based technology. Graphene also offers promise for higher performance solar cells, LCD screens and photon sensors. Nonetheless, today graphene is still at the development stage, and its commercialization has yet to occur.

CNS-ASU team leaders at the Georgia Institute of Technology and University of Manchester have begun a study to understand the as yet undeveloped pathway to the commercialization of graphene – the processes, promises and perils. They have been undertaking field work in two of the world's leading centers for graphene development: the University of Manchester (UK) and Georgia Tech. Their project seeks to understand similarities and differences in the plans, programs and approaches to commercialize graphene-related applications in both locations. This will include examination of both the strategies for research and development and those for fostering commercialization in terms of external partnerships in the metropolitan regions of Manchester and Atlanta, elsewhere in the country, and internationally. In addition to field work, the researchers also will undertake analyses of publications, patents, funding, and corporate activities in graphene.

Map of Graphene Research Centers
(Institutions with 10 or more graphene scientific publications, 2000-2010)

Over time, the researchers plan to expand the focus of their study to other locations in the United States and around the world where graphene research and commercialization clusters are emerging. Although graphene's full impacts may take many years to materialize, the results of this research will provide real-time insights to researchers, companies, policymakers and other stakeholders keen to understand how research in specific nanotechnology domains moves into early applications, what barriers and concerns are raised, and how these are being addressed.

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

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

Will Nanotechnology Help or Harm Our Cities?
New CNS-ASU Research Theme Studies
Emerging Technology & the Future of the City
The Center for
Nanotechnology in Society
ARIZONA STATE UNIVERSITY
Discussions about the potential benefits of nano-scale science and engineering (NSE) often maintain that nanotechnologies will be crucial, if not decisive, for solving urban problems. NSE is expected to provide innovative applications in buildings, energy, infrastructures, water, transportation, security, information and so on. For example, imagine photo-voltaic materials that can cover horizontal as well as vertical building surfaces. Enhanced by multi-functional nano-scale designs, they may be able to not only capture light and convert it into electric power for their buildings, but also re-emit visible light into their buildings after dark.
Yet the vast majority of these visions of "urban nanotechnologies" are projections of isolated applications. Likewise, studies that emphasize the potential contributions of urban nanotechnologies to sustainability usually address diverse but narrowly-defined urban domains from construction to energy and water supply to transportation. Each particular application is imagined to provide benefits. The problem, of course, is that these visions are one-sided and only marginally embedded in real-world urban contexts. Such visions rarely address the complex reality of cities with their interwoven social, technical and ecological components.
Arnim Wiek
Assistant Professor
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Sander van der Leeuw
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In order to reflect critically on the potential of these nanotechnological innovations to mitigate or solve urban sustainability problems, we must understand them from within the rich and complex reality of cities. We must recognize that not all sustainability problems will yield to technology. To determine which will and which won't, we must understand the costs of nanotechnological fixes and ask whether their promised benefits justify their associated costs.
With these issues in mind, CNS-ASU has launched a new Thematic Research Cluster (TRC) dedicated to studying urban design, materials, and the built environment (aka "Nano and the City"). Its goal is to investigate the nano-enabled city of the future and address the links among NSE, the built environment, social structures and sustainability. The TRC will map out the diversity in problem perceptions, future visions, value-laden sustainability appraisals, and related implementation strategies across various stakeholder groups. Deliberative research will be conducted with various urban communities including public policymakers, business people, engineers, interest groups representatives and citizens from the Phoenix metropolitan area. Deliberative and visioning approaches that CNS-ASU has previously pioneered will be used 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. With the objective of better understanding, from a systemic perspective, supply and demand, the TRC will create a Nanotechnologies in City Environments (NICE) database. It will allow researchers to search, view and comment on urban nanotechnologies with a particular view toward their functionality, nano-scale mechanism, potential benefits and hazards, and related urban sustainability issues.
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

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).

In the first six 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. forthcoming 2011), 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 submission of a completed manuscript to Springer for volume three of the *Yearbook* in the current year, the Center has launched a new research thrust on 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 development of nanotechnology, and particularly its sustainable development, 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 within the Center, the new TRC 2 has been commencing in a nearly fully integrated manner, e.g., with RTTA 1 providing bibliometric and other data and analysis for TRC 2 consumption, RTTA 2 incorporating questions dedicated to TRC 2 concerns into the public opinion survey that will go into the field in Su 11, 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 research planning, 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 W 11-12. This plan has been set back somewhat with a decision by the ASU administration to reorganize the academic calendar and eliminate winter session. The Center is currently studying the consequences of this for the planned Winter School and is assessing the possibility of conducting the school later in Sp 12 at an attractive but reasonable off-campus site.

In addition to the strategic partnership with NISE Net that the Center has been developing for the last two years – which links education and outreach through informal science education in museums and other public settings – CNS-ASU has made video communication an important focus of the last year's activities. In addition to taping regular lectures and occasional speakers on campus, the Center has produced special video products in a number of areas, including a profile of InnovationSpace, a summary of the Plausibility Workshop, and a summary of the *Yearbook* on *Nanotechnology and the Challenge of Equity, Equality and Development*. The Center has also commissioned a short video, related in part to the Nano and the City theme, 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 stalled but is significantly slowed due to funding challenges, but a documentary film maker has also been following the associated STIR project, including conducting interviews of key personnel and shooting other footage at the recent 4th STIR workshop in Washington, DC.

CNS-ASU outreach over the last year has focused largely on developing a robust private sector outreach activity, under post-doctoral fellow Davies. She officially joined the Center with the renewal in Oct 11 and has been conducting interviews and literature reviews to actively plan the Center's first Private Sector Engagement workshop to be held 5-6 May 11. This workshop will have a mix of presentations and discussions meant 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. 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 by serving as one of the primary ASU entities collaborating with the New America Foundation and Slate.com in a series of high-profile discussion meetings in Washington, DC related to the governance emerging technologies. Former CNS-ASU doctoral student Hays, who spent part of the year as a post-doctoral fellow of the Center and part as an employee of New America Foundation, is drafting white papers on each of the four meetings, as well as organizing a similar but smaller scale series of meetings through CSPO's Washington, DC office. 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, the site visit committee asked about the apparent mismatch between the huge list of Center participants accounted for in **Section 4, List of Center Participants** and the appropriate but, relative to the participants, modestly-sized **List of Center Publications**. 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 functions and infrastructure – as a good hegemon, in other words. While we identified "growth" as an important strategic goal in our 08 Visioning Workshop, we have also limited the size and number of our formal external collaborations

(subcontracts) in our renewal and, yet, by accounting for the participants in our networking, infrastructural activities, etc., we can provide a transparent account of the reach the Center has had. This reach, importantly, 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**).

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, the PhD+, while small, is robust, 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 will be explored at the upcoming SEI Congress, to be held here at ASU in Nov 11 and co-sponsored by CNS-ASU. The associated STIR project is entering its final year, and Fisher and Wiek have submitted in Feb 11 a new follow-on project – STIR City – that links embedded research activities to sustainable through a more widespread network of sites to sustainable urban nanotechnologies. Meanwhile, the Center has achieved its goal at ASU of being a partner on all appropriate, large-scale science and engineering proposals. In the past year, CNS-ASU collaborated with two NSF ERC proposals that hosted site visits and one, Honsberg's Quantum Energy and Sustainable Solar Technologies, has received preliminary notification of funding (Guston and Miller are principals here). The Center has also collaborated with Panchanathan's IGERT on Person-Centered Technologies and Practices for Persons with Disabilities, which similarly has received preliminary positive notification and is awaiting a final award letter (Miller is principal here). Assuming these awards are funded, CNS-ASU will be partner to roughly $26M in science and engineering funding at ASU. Outside of ASU, the Center is in the preliminary stages of discussing partnerships with the Duke Center for Environmental Implications of Nanotechnology for workshops on decision-making under uncertainty and on the anticipatory governance of active nano-materials and nano-systems.

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, it has mostly been applied to nanotechnology for the obvious reasons. Nevertheless, the Center has begun to accumulate activities related more directly to other emerging technologies, including:

- outreach and engagement with high school students over synthetic biology and geoengineering, and a diversity of emerging technology topics in Science Cafes;
- collaborations and exchanges with other research centers on synthetic biology (e.g., visits to CNS-ASU by Frow and Calvert, and return visit by Guston to Edinburgh, as well as Imperial College);
- participation in high-level meetings on emerging technologies (e.g., Wetmore's attending the Asilomar conference on geoengineering); and
- proposal writing (e.g., failed proposal to NSF on anticipatory governance of geoengineering, to be resurrected in part; revised and resubmitted proposal to NSF on philanthropies and governance of emerging technologies in Africa).

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 741,000 from the Web of Science's Science Citation Index (SCI) and others from INSPEC and Compendex, covering the period 1990-2009. 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 attracted 85 citations in Google Scholar (as of March 22, 2011) and 24 citations in the Web of Science, despite its recent publication date. 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 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.

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).
- There is a sharp rise in active nanostructure publications in 2006 that is maintained in subsequent years, suggesting a shift in research from passive to active nanostructures. This work presents five active nanotechnology prototypes and suggests societal implications of this shift (Subramanian, Youtie, Porter, Shapira 2010).
- 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.
- The engagement of social science with nanotechnology demonstrates rapid growth (Shapira, Youtie, Porter 2010). Based on the development of a publication database of more than 300 social science articles that address the topic of nanotechnology, the study finds multiple dimensions of cited literature and an increase in social science citations of other social scientists' works since 2005.

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.
- 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).
- Graphene applications involve companies that specialize in the technology and those who offer a wider range of applications (Arora, Ma, Gao, Shapira, Youtie).
- 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. Preliminary 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 will release in Jun 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 and for presentation at the Nov 11 annual meeting of INFORMS in Charlotte, NC.

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

RTTA 1/1's presentation at the 2009 S.NET Conference workshop led to a publication on environmental, health, and safety in nanotechnology 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 new or forthcoming publications:

- A chapter in a forthcoming anthology on the US National Nanotechnology Initiative from a public value perspective (Boardman, Slade and Bozeman forthcoming 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 nanotechnology transfer, 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, Professor, Life Sciences Communication)
Elizabeth Corley, RTTA 2 co-leader (ASU, Associate Professor, School of Public Affairs)

Dominique Brossard (Wisconsin, Associate Professor, Life Sciences Communication)

Other Personnel – post-docs (0), graduate students (3), 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 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. RTTA 2/3 Scientists' Opinions and Values is a research theme that conducts polls of NSE researchers to understand their values regarding nanotechnologies.

Research Accomplishments and Plans, RTTA 2

As part of RTTA 2, 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 and problem-oriented research that will have applications beyond the field of nano. But it has also allowed the POV team to assist other researchers all over 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 Year 6 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. In addition to presenting RTTA 2 results in peer-reviewed journal articles and academic conference presentations, in Year 6 Corley & Scheufele also presented team research findings at multiple public venues, including:

- Boston University, Communication Research Center Speaker Series, Boston, MA
- David Lincoln Lecture Series, Lincoln Center for Applied Ethics, Phoenix, AZ
- Harvard University, Joan Shorenstein Center on the Press, Politics and Public Policy, Boston, MA
- National Academies, Space Studies Board, Irvine, CA
- National Nanotechnology Initiative, Strategic Stakeholder Workshop, Washington, DC
- National Nanotechnology Initiative, Capstone Workshop: Risk Management Methods & Societal, Ethical, and Legal Implications of Nanotechnology, Washington, DC
- Treasury Board of Canada, International Conference on Risk for Regulators, Ottawa, Canada
- Washington State University, Lanning Distinguished Lecture, College of Engineering and Architecture, Pullman, WA

Data Collections

RTTA 2 completed its last general, full-scale public opinion data collection in July 2007. The 2007 survey was a CATI survey with a combined RDD and listed household sample conducted May – Jul 07 (N=1015; AAPOR RR-3 30.6%; margin of error, +/- 3%). Questions in the survey were specifically designed or chosen to enable comparisons with a 2004 US nanotechnology survey as a baseline and with the 2006 Eurobarometer for international comparative data (the 2008 pre- and post-test surveys for the National Citizens' Technology Forum were crafted to correspond with this survey as well). The survey's content included questions about communication and information environment, strategies for processing scientific information, attitudes and values, nano literacy, perceptions of scientists, policy makers and the need for regulation, and perceptions of the risks and benefits and future developments of nanotechnologies.

Corley and Scheufele are currently preparing for a second public opinion tracking survey that will go into the field in Su 11. Data collection will focus on a large-scale experimental national study, conducted by Knowledge Networks. The large sample size budgeted for these studies will allow researchers to examine different subpopulations and geographies – serving goals of TRC 1 Equity, Equality and Responsibility by including those that have been traditionally underserved by science communication efforts (defined by gender, age, ethnicity, or other factors) and TRC 2 Nano and the City by being able to discern specific urban perspectives. Finally, the length of the instrument will provide extremely rich data for in-depth multivariate analyses on public opinion and values. These studies will therefore generate unique datasets for analysis of public opinion and values about nanotechnology. Because RTTA 2 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 researchers through the formal archiving and sharing some of data collection instruments.

RTTA 2 also completed its last national-level scientist survey in July 2007. The 2007 survey was a mail survey of leading US nano-scientists (N=363; AAPOR RR-3: 39.5%). Based on these survey results, Corley & Scheufele 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 (Corley, Scheufele, and Ho, 2009).

Corley and Scheufele are currently in the field (Apr 11) with a new national survey of leading U.S. nanoscientists. This recent scientist mail survey is being conducted by the University of Wisconsin Survey Center. The 2011 survey is distinct from the previous scientist surveys by its focus on more granular perceptions about nano risks/benefits, nano regulation, public engagement, and the ethics of nanotech laboratory practices. Corley and Scheufele worked with RTTA 1 researchers to develop the sample for the 2011 nanoscientist survey. The final sample size will be about 500-600.

While this 2011 scientist survey focuses on NSE researchers in the US, Corley and Scheufele designed it to allow for comparisons with data from other countries. Separately, RTTA 1 and RTTA 2 team members have initiated discussions with NSF to expand the scientists' survey to China and other Asian countries in the near future. RTTA 2 researchers are also exploring relationships with European and other researchers undertaking similar projects to probe opportunities for comparisons.

During YR 6, Scheufele and Corley presented results from these data at national policy and communication conferences and published the results from all three data sources (public opinion survey, media analysis, and scientists survey) in peer-reviewed journals. The major themes of these peer-reviewed results are presented below.

Risk and Benefit Perceptions

RTTA 2 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, RTTA 2 researchers 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 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, nanotech 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 groups (scientists and the public), these heuristic cues influenced public perception to a larger extent than experts' perceptions.

RTTA 2 has also examined the evolving nature of risk and benefit perceptions to conclude that as the field of nanotechnology matures, public opinion research focused on judgments of abstract risks and benefits, rather than attitudes toward specific applications, is less useful. Recent RTTA 2 research shows that individuals who associate nanotech 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 research program increasingly focuses on assessing measurement tools for the field of public opinion about emerging technologies more broadly.

Recent RTTA 2 Publications that have addressed these issues of risk/benefit perceptions include the following:

- Binder, Andrew R., Cacciatore, Michael A., Scheufele, Dietram A., Shaw, Bret R., & Corley, Elizabeth A. (2011, in press). Measuring Risks/Benefits Perceptions of Emerging Technologies and Their Potential Impact on Communication of Public Opinion Toward Science. *Public Understanding of Science*.
- Cacciatore, Michael, Scheufele, Dietram, & Corley, Elizabeth A. (2011, in press). From enabling technology to applications: The evolution of risk perceptions about nanotechnology. *Public Understanding of Science*.
- Corley, Elizabeth A. (2010). Scientists' Attitudes Toward Nano. *Encyclopedia of Nanoscience and Society*. D. Guston, ed. Thousand Oaks, CA, Sage Publications.
- Ho, Shirley S., Scheufele, Dietram A., & Corley, Elizabeth A. (2011, in press). Value predispositions, mass media, and attitudes toward nanotechnology: The interplay of public and experts. *Science Communication*.

Religiosity and Public Acceptance of Nanotech

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 U.S. with Eurobarometer surveys about public attitudes toward nanotechnology in Europe RTTA 2 researchers 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.

Recent RTTA 2 publications that have addressed these issues of religiosity and public nano acceptance include the following:

- Scheufele, Dietram A., Corley, Elizabeth A., Shih, Tsung-Jen, Dalrymple, Kajsa E., & Ho, Shirley S. (2009). Religious beliefs and public attitudes to nanotechnology in Europe and the US. *Nature Nanotechnology* 4(2), 91-94.

Widening Nanotechnology Knowledge Gaps

RTTA 2 research on the evolution of nanotech knowledge among the public over time has generated some particularly important results for nanotech outreach. In particular, RTTA 2 researchers have found that there are widening gaps in nanotech knowledge since 2004 between the least educated and most educated of the U.S. 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. 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 will 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.

Recent RTTA 2 publications that have addressed these issues of widening knowledge gaps include the following:

- Corley, Elizabeth A., & Scheufele, Dietram A. (2010). Outreach going wrong: When we talk nano to the public, we are leaving behind key audiences. *The Scientist*, 24(1), 22.
- Ladwig, P., Dalrymple, K. E., Brossard, D., Scheufele, D. A., & Corley, E. A. (2011, forthcoming). Perceived Familiarity or Factual Knowledge? Comparing Operationalizations of Scientific Understanding. *Science and Public Policy*.

Regulation of Nanotechnology

The RTTA 2 team considers regulation of nanotech 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. Recent RTTA 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. Corley & Scheufele also find 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, they 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.

The RTTA 2 team has also explored the public's perceptions about nanotech policy decisions. The results show that highly religious individuals are less supportive of funding of nanotech than less religious individuals, whereas individuals who held a high deference for scientific authority were more supportive of funding of the emerging technology than those low in deference. Mass media use and elaborative processing of scientific news are positively associated with public support for funding, whereas factual scientific knowledge had no significant association with the public's policy choices. These findings

suggest that thinking about and reflecting upon scientific news promote better understanding of the scientific world and may provide a more sophisticated cognitive structure for the public to form opinions about nanotech than factual scientific knowledge.

Recent RTTA 2 publications that have addressed these issues of nanotech regulation include the following:

- Ho, Shirley S., Scheufele, Dietram A., & Corley, Elizabeth A. (2010). Making sense of policy choices: Understanding the roles of value predispositions, mass media, and cognitive processing in *public* attitudes toward nanotechnology. *Journal of Nanoparticle Research*, 12, 2703–2715.

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

RTTA 2 is collaborating with RTTA 4/2 over the latter's policy document's database and its ability to inform the former's understanding of the public's and scientists' understandings of NSE.

RTTA 2 worked with RTTA 1 in YR 6 to develop the scientist sample for the 2011 expert survey. The sample was again based on the most highly cited nano-scientists in the RTTA 1 bibliometric database.

RTTA 2 is collaborating with RTTA 1 on a merged dataset of expert survey data and bibliometric data to explore how nano-scientists that publish in EHS fields might differ from nano-scientists that do not publish in the EHS area.

RTTA 3: Anticipation and Deliberation

Personnel: Faculty and senior participants

Cynthia Selin, RTTA 3 co-leader (ASU, assistant research professor, CSPO)
Merlyna Lim, RTTA 3 co-leader (ASU, assistant professor, School of Justice and Social Inquiry, CSPO)

Ira Bennett (ASU, assistant research professor, CSPO)
Prasad Boradkar (ASU, associate professor, School of Design)
Michael Cobb (associate professor, North Carolina State University)
David Frakes (assistant professor, Ira A. Fulton School of Engineering, ASU)
David H. Guston (ASU, professor, politics and global studies and CSPO)
Sidnee Peck (ASU, program manager, W.P.Carey School of Business)
Arnim Wiek (ASU, assistant Professor, School of Sustainability)

Other Personnel: Post-docs (1); grad students (4); undergraduates (9); visiting scholars (1)

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.

As shown in the timeline below, the major focus for YR 6 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.

<table>
<tr><th></th><th>YEAR 6</th><th>YEAR 7</th><th>YEAR 8</th><th>YEAR 9</th><th>YEAR 10</th></tr>
<tr><td>RTTA 3.1
METHODS</td><td colspan="2">FUTURE OF FORESIGHT:
PLAUSIBILITY PROJECT,
STRATEGIC INTERVIEWS,
CASE PROFILES, LIBRARY,
BOOK DEVELOPMENT,
GAMING WORKSHOP,
CONFERENCE (FEB. 2012)</td><td></td><td></td><td></td></tr>
<tr><td>RTTA 3.2
ISPACE</td><td colspan="3">NANO AND THE CITY THEMES:
ENERGY, TRANSPORTATION, INFRASTRUCTURE, WASTE;
DESIGN PORTFOLIOS</td><td></td></tr>
</table>

RTTA 3.3 PROBES			DELIBERATIVE EXPERIMENTS: PROTOCOL AND TOOLS, DESIGN AND DEVELOPMENT, EXPERIMENTS AND ANALYSIS
RTTA 3.4 TOURS		DESIGN PRINCIPLES, LITERATURE REVIEW, PILOT (NOV. 2012), DEVELOPMENT, TOURS (OCT. 2013), ANALYSIS & DISSEMINATION	

RTTA 3/1 Futures of Foresight

This section describes two major research thrusts: the more theoretical PLAUSIBILITY PROJECT and the more methodological MEDIATING FUTURES.

THE PLAUSIBILITY PROJECT

In YR 6, the Plausibility Project continued with several papers under development, conference presentations, an invited roundtable, graduate student research, and development of a policy workshop. 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 5, CNS-ASU in collaboration with the Consortium for Science, Policy and Outcomes and the Institute for Science, Policy and Innovation (University of Oxford) brought together an interdisciplinary group of scenario practitioners, science and society scholars, philosophers and historians to explore the conceptual and methodological underpinnings of plausibility and to develop an appreciation of what it is, why it matters, where its evaluated and for whom it occurs a central value.

Findings from this workshop are being explored and synthesized in several publications, examples including:

- "Reframing the Plausibility-Probability Debate" (Selin with Rafael Ramirez, University of Oxford for *Administrative Science Quarterly*): a critical examination of probability in relation to plausibility in scenario development, arguing for a broader reframing of the debate in order to improve the methodological framework.
- "Intuition and Foresight" (Selin & Pereira under preparation for *Foresight and Innovation*): In dialogue with the knowledge management, sensemaking, cognitive science, and art theory literature, we seek to understand both the qualities of intuition as well as the broader societal and political stature of intuition (e.g. privileging of different epistemic cultures and the associated costs).
- "The Signs of Fatigue in Probability and a Plausible Proposal" (Pereira & Selin for *The Journal of Risk Analysis*): Probability has become a panacea for dealing with the future in order to take decisions and implement policies in uncertain times. Yet to deal with issues that defy numbers, we look to probability and position its use and conceptualization historically in relation to statistical probability.

Plausibilistic Expectations of Nanotechnology

Selin presented varied results on her research into the role of plausibility in the development of nanotechnology in YR 6. At the annual Society for the Social Studies of Science meeting (Aug 10), she was invited to participate in a session on "STS, Sustainability and Decision Making in the Mid to Distant Futures". She also presented a more detailed look into the ways of assessing plausibility at the Society for Nanotechnology and Emerging Technologies (Sept 10). She co-organized a session at the Society for

Risk Analysis Annual meeting (Dec 10) on "Plausibility and Risk" with philosopher of science Heather Douglas, Angela Pereira (JRC-EC) and Jack Siegrest (Applied Biomathematics). This session looked across recent catastrophes, from the financial meltdown to the Gulf oil spill, where events came from outside of the risk frameworks being used to make decisions. The SRA symposium on "Plausibility and Risk" took a closer look at plausibility and its relationship to risk. Plausibility arises in studies related to the future, and is usefully deployed in planning and decision-making. This panel included Selin's interdisciplinary survey of the literature to unearth concepts akin to plausibility (trust, probability, prediction), which were used as a departure point to then examine the ways in which nano-scale scientists and engineers assess plausibility. The presentation reported on a survey conducted around nanotechnology, energy and equity where specialized nano-scale scientists and engineers were asked to critique future energy applications. Scientists were specifically asked about their hopes and concerns, the feasibility of the technology and on what basis they judgment the plausibility of the futuristic scenario. The survey results were thus a preliminary step towards unraveling the crafting of plausibility and how one scientific community approaches an assessment of future potential.

SNET Roundtable on Plausibility

In Sept 10, Selin was invited to convene a Roundtable at the SNET conference in Darmstadt. The concept of plausibility prompted the group to think about the quality of anticipatory knowledge and consider questions around trust, legitimacy and the epistemology of the future. Considering not just ways of knowing the future, but the power and mechanisms through which the future works was a central concern of the session participants. Roundtable participants were asked to explore their associations with plausibility and to delineate what is known about plausibility (state of knowledge, research results, literature and case studies) and what is unknown about plausibility (critical research questions). The rich discussion opened up three central themes: the work that plausibility accomplishes, the truthiness of plausibility, and the trials of assessing plausibility. The first theme explored the use of plausibility as a soft measure of scenarios, recognizing that "plausible belief" rather than "true justified belief" should guide an evaluation of scenarios. This line of thought gave rise to normative questions around using scenarios as justifications for action. The second theme questioned the ethical dimensions of futures work, probing the mechanisms through which plausibility can become a tool of persuasion. STS scholarship on the construction and solidification of claims is thus a relevant lens to begin to unpick how plausibility is argued and with what effects. The final theme drawn from the SNET Roundtable discussions raised some of the risks of developing finer and finer modes of assessing plausibility, such that the razor sharp gaze would destroy the richness encapsulated with the non-deterministic concept.

Graduate Student Research

Though not sponsored by CNS-ASU to address plausibility, several graduate students have been incited to take up the concept of plausibility in their research. Federica Lucivero (also a STIR student, see RTTA 4) has recently published a paper that looks at assessments of plausibility in relation to the ethical implications of molecular diagnostics. Vanessa Schweitzer, a recent graduate from Carnegie Mellon produced a chapter in her dissertation that looked to how well the IPCC has integrating futures scholarship and complicated concepts of plausibility in their scenarios work. Finally, Evan Michelson from NYU is exploring the role of foresight in nanotechnology policy and has approached Selin to participate in the RTTA 3 program by analyzing our public engagement activities.

Anticipation and Policy Workshop

Planning is underway for a workshop on Anticipation and Policy, funded by the Joint Research Centre of the European Commission in collaboration with the CNS-ASU and the School of Sustainability at ASU. This workshop, lead by Selin and CNS-ASU visiting researcher (YR 5) Angela Pereira, 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. In this July 2011 workshop, 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 deeper and 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. As part of the outcomes of this workshop, we will be producing a special issue in Foresight and Innovation Policy on these themes. Confirmed attendees include Barbara Adams (Cardiff University), Silvio Funtowitc, and Rene von Schomberg (EC).

MEDIATING FUTURES

This methodologically focused research thrust explores how more diverse mediums (visual, numerical, experiential) represent technology futures. We combine field studies, case studies and site visits to catalogue and assess scenario activities being used to improve decision-making capabilities in a variety of commercial, policy, and academic 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 will also develop 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 6 that investigate the future of foresight.

Material Deliberation

RTTA 3 has been exploring the directions public participation and deliberation might take in order to avoid the pitfalls of discourse-oriented, scientistic forms of engagement. We are engaged in ongoing thinking on how to take analytical and empirical work on public deliberation and technoscience forward and, in particular, starting to explore how we can think about the entire ecosystem of CNS-ASU activity – from education to the NCTF – in the context of contemporary deliberative theory, 'citizenly' behaviors, and anticipatory governance of technoscience. Two papers are currently forthcoming from this work:

- "Energy Futures: Anticipatory Governance in Practice" (Davies and Selin, forthcoming *Environmental Communication*): In this essay we draw on our experience of different anticipatory governance activities, and in particular the 'NanoFutures' project on energy futures, to present a reflexive analysis of engagement and deliberation. We draw out five tensions of the practice of deliberation on energy technologies. Through tracing the lineages of these dilemmas, we call out some of the implications of these tensions for the practice of civic engagement and deliberation in a set of questions for this community of scholar practitioners.

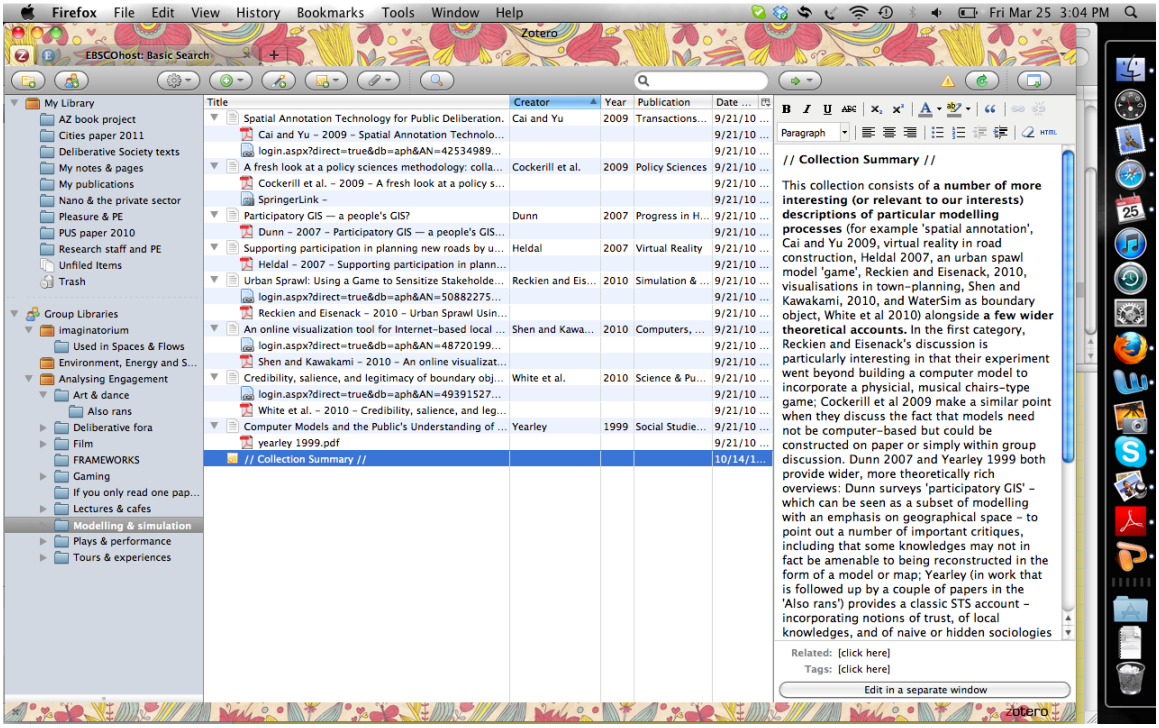
- "Citizen Engagement and Urban Change: Four Case Studies of Material Deliberation" (Davies, Selin, Gano and Pereira, under review *Cities*): Public participation in urban planning and development is a widely used process which seeks to enable better decision-making. In this paper we address critiques of such deliberation – that it relies on the discursive to the detriment of experiential, material or affective modes of expression – and describe four case studies of participation which emphasize, in different ways, 'material deliberation'. We close by recommending that future practice draws on both the techniques of these cases and on an understanding of participation as part of a wider deliberative society.

Material Deliberation Library

An important means of resourcing this thinking on 'material deliberation' has been to develop a library of publications and related materials which explore deliberation and engagement in the context of diverse formats and modalities. The library includes theoretical and empirical materials around eight key formats for public participation: 1) art and dance; 2) (traditional) deliberative for a; 3) film; 4) gaming; 5) lectures and cafes; 6) modeling and simulation; 7) plays and performance; 8) tours and experiences.

These categories were populated through literature searches within ASU library holdings, the EBSCOHost search engine, and Google Scholar. Searches were also performed so as to highlight urban participatory processes (and thus to tie in with TRC-2): for example: (art OR dance) AND (deliberat* OR

participation OR reflexivity OR future OR decision OR city OR urban). The literature thus identified was sorted, read, and summarized, with notes on each paper's broader relevance for RTTA-3 and TRC-2 included alongside the stored pdf. Each sub-library contains a summary of the main themes present in the literature in this area. The library is hosted on the online reference management service Zotero, which stores pdfs, notes, and citation details (see screengrab). It is currently in use by CNS-ASU scholars working on RTTA-3 but will remain as a resource for staff and students after the project end. It is thus an iterative, and growing, resource for exploring theoretical and practical perspectives on deliberation.



Innovations in Foresight: Strategic Interviews and Field Study

In summer of 2010, Selin conducted a field study at the Institute for the Future (IFTF) in Palo Alto, California. The IFTF is an independent nonprofit research group that works with organizations of all kinds to help them make better, more informed decisions about the future. As one of the oldest future-oriented firms, the IFTF uses a combination of tools, methodologies, and a deep understanding of emerging trends and discontinuities to work with companies, foundations, and government agencies. Selin conducted numerous interviews with IFTF scholars, participated in their strategic planning and 10-year technology forecast program, observed scenario model building workshops with governmental clients, and worked to develop collaborative projects between CNS-ASU and IFTF. Selin also presented the sustainability studio course taught with Wiek in YR 5 that, in cooperation with the City of Phoenix, worked to instill sustainable anticipatory governance in urban policies. This research stay developed connections with IFTF that have yielded a planned grant submission to NSF on futures of sustainable manufacturing (with Conz), IFTF expert participation in our Private Sector Engagement workshop and IFTF's partnership in the Climate of Uncertainty (CUE) grant proposal to NSF ISE (see Outreach section for description on CUE project). Additionally, research into IFTF's novel and innovative use of gaming platforms for crowdsourcing foresight is captured in the RTTA 3 Case Profiles (see next section).

Case Profiles

RTTA 3.1 investigates novel foresight methodologies that move beyond the discursive. This research thrust is anchored by a collection of case studies that profile key innovations in the field and put them in context with broader discussion in STS on deliberation and engagement. Led by Selin, a team of researchers (Davies, Gano, Pereira and Lim) is working to research projects and interventions which represent and interrogate futures through diverse mediums. A case development protocol standardizes our inquiries, yet we strive to present our findings through rich descriptions employing the techniques of narrative non-fiction and evocative images. Our collection is organized around mediums and includes ~ 25 case studies that explore futures mediated through Immersive theaters, museum exhibits, films, literature, tours, virtual games, prototypes, graphic illustration and simulation models. The themes we address in the cases cover a breadth from agency and identity, to expertise and scientific authority to place and power. The empirical domains addressed range from oil and climate, to water and space, to nanotechnology and stem cell research.

For an example, Lim has been examining how future-oriented architects/designers explore the virtualization of future cities, while positioning their own design within a network of media, such as 3D architectural rendering and 3D multimedia representation, that help to constitute the virtual environment. The study consists of two interrelated parts. First, she will examine the simulations of the future city within the imagination of both architectural artists and (corporate/state) authorized architects. It will observe the tendency for the city to be conceived not in terms of its solid structures but in terms of simulation, generation, and flows of information. The second part will investigate the virtualization of narrative subjects and texts, as architects and designers explore an expanding range of subjectivities outside the physical body opened by new media and information technology, as well as new mode of expression beyond 2D environment.

Gaming the Future Workshop

Building on a case profile and exploiting contacts from IFTF, in Mar 11 Selin organized a workshop on 'Gaming the Future'. As part of the RTTA 3/1 exploration of future-oriented deliberation, this workshop looked to the development of information technology and virtual gaming as trends in foresight deliberation that influence how scientific data is portrayed, the scale of foresight activities and the level of participation possible. Massively Multiplayer Games are a genre of games that connect players dispersed over space in a collective pursuit, in effect knitting a teen in Mumbai with a marketing executive in Chicago in an effort that involves shared rules, discrete tasks, problem-solving and creative inspiration. Building on the immense energy poured into such games, gaming designers are pairing with activists, NGOs and business to design and build 'serious games' in attempts to model real world problems that can be introduced to players, enticing them to collaboratively work through complex issues and rehearse potential solutions. Though less oriented towards 'play', scientist confounded by the intricacies of protein folding have build 'Fold It' to crowdsource solutions. These developments are also linked to IT enabled 'citizen science' that asks individuals to observe, collect, and analyze natural phenomenon and contribute to centralized hubs that synthesize their efforts. Thus, there are new technological developments, new practices, new modes of collaborative problem solving and different approaches to untangling complex systems that warrant further attention.

The 'Gaming the Future' workshop brought together faculty and students from different disciplinary backgrounds for a generative dialogue to share their research in relation to these themes. The workshop discussions were a start to catalyze and collate the thinking at ASU on the role of new media tools, simulations, gaming platforms to leverage understanding of complex systems and to explore our capacities to transform them. This event served as a focusing event to develop new collaborations. Joining us from outside of ASU was Ken Eklund, a game designer responsible for World Without Oil, a participatory 'pre-enactment' of an oil crisis who also gave a CNS talk in Dec 10. ASU faculty were from a range of departments, including for instance, Public Affairs, W.P. Carey School of Business, the School of Human Evolution and Social Change, and the School of Sustainability.

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.

In this book we consider practices of citizen engagement and deliberation which seek to open up the future of technology through these more performative modes. Too often consultations, town hall meetings or planning procedures – while important contributions to critically noticing the implications of technology – fail to connect with the lived experiences and embodied relationships we have with technology. Approaching the materiality of our technological landscape implies a shift from highly abstracted forms of discursive deliberation and towards the diverse mediums that present futures reflexively through new media, mixing scientific data with aesthetics and providing altogether different forms of participation.

We present a rationale for this move to mediated futures and give examples of projects and techniques that we think may help to access invisible technological dependencies, taken for granted materialities, and quotidian affections. Though a collection of case studies that explore visual, virtual, experiential, cinematic, and tangible rendering of futures, we explore what it means to enliven the future through different mediums. More importantly, however, we invite scholars, artists, futurists, citizens, policy makers and activists to join us in experimenting with engagement and towards this, we fashion these case studies as entry points and guides for others to interrogate their own futures.

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

Scenaric Devices: Nano in Everyday Life Film

RTTA 3.1 will construct a variety of scenaric devices to make concrete a variety of plausible futures of the "nano-enabled city" in collaboration with TRC 2, Urban Design, Materials, and the Built Environment thus drawing on TRC 2 co-leader Wiek's expertise in future-oriented research and methods and Lim's architectural training and intensive experience with multi-media tools. This year we focused on catalouging our existing 'scenaric devices' and are in the process of producing a short film about nanotechnology in everyday life. Working with filmmaker and architect Alex Gino, Selin is producing a film that envisions the potential risk and benefits of nanotechnology in the city. The film will highlight 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 is meant to pose the question- 'Where is your nano?'- to viewers, inviting them to reflect on the trade-offs and path dependencies raised by technological progress.

Conference/ Gallery
Planning is underway for RTTA 3's conference on the Futures of Foresight. Drawing together futurists, foresight practitioners, scholars and others involved in long term thinking, this Feb 12 conference will feature performance, poetry, lived experience/ immersive experiences, built artifacts, lectures, short films, etc. that highlight the 'best practices' of foresight and new media.

RTTA 3/2 InnovationSpace

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, Dow Corning and Herman Miller.

Since 2006, CNS-ASU has supported the work of three transdisciplinary teams annually (total of 12 students). 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) and to develop product concepts that utilize nano-enhanced solutions for ensuring equitable access to clean energy (AY 08-09). In AY 10-11, CNS-ASU is charging student teams to develop product concepts that utilize nano-enhanced solutions for addressing urban sustainability in relation to waste management, energy efficient transportation and energy awareness. This year's student teams are thus tightly aligned with the TRC2 program on 'Nano and the City'. InnovationSpace is led by Boradkar, and CNS researchers Guston, Selin, Wetmore, Bennett, and Davies each had significant interaction with the students. The three inventions this year are: 1) a system of nano-enabled products for urban commuters that can be attached to a car to harvest energy that would otherwise be wasted; 2) a nano- enhanced device that can break down electronic waste into usable metals and non-toxic waste; 3) a playground that generates electricity from movement using nano-enabled piezoelectric materials and teaches children about energy production and conservation. Outcomes from InnovationSpace include not only spectacularly detailed documentation of the student-led innovation process known as Innovation Proposals. These include summaries of user research, product renderings, engineering specifications, branding and communication strategies, ecological impact assessments and business plans. Student teams also submit invention disclosures – nine from previous years with AY 10-11 to be submitted in May 11.

In 2010 Selin and Boradkar submitted an article to the *Journal for Nanotechnology Education* that details the challenges of and experiences with using the Integrated Innovation model as an applied research platform that enables transdisciplinary teams to explore the societal and ethical implications of nanotechnology. The article will be published later this year.

RTTA 3/3 Probing Future-Oriented Deliberation

While currently unfunded, plans are underway to seek additional funding for this 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 order to coordinate with results and parallel research programs, this supplement is slated for submission Fall 2012.

RTTA 3/4: Futurescape City Tours (FCT)

This distributed, deliberative activity expands on the successes of the NCTF by increasing the experiential richness and contextual relevance of the deliberative process. Similar to the NCTF, groups of 12 citizens in six different cities will join together to 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 RTTA 3 Timeline above, the FutureScape City Tours as scheduled for Fall of 2013. However, in preparation for this event, we have been exploring the literature and contacting scholars to learn more about the use of tours in research and the practice of 'auto-ethnography'. Doctoral student Gano has also been exploring the triggers that unify the urban environmental movement, Transition Towns, in a move to document how members identify and prioritize systemic topics of concern in their local city and town infrastructures. These priorities and field observations can aid in the selection of systems, infrastructure, expertise, and physical places to include in the experiential portion of the tours.

Urban Utopias Field Trip

In anticipation of the new TRC focused on nano and the city, Selin and Gano led an exploratory field trip for conference participants during the CSPO Rightful Place of Science conference entitled Urban Utopias. In this field trip, participants explored how future cities are imagined and visualized and what such imagination means for the governance of urban spaces. The group travelled to Arcosanti an urban laboratory focused on pursuing lean alternatives to urban sprawl through innovative design with accountability in mind.

Finding Futures

We are currently planning two prototype city tours in preparation for the major FCT deliberative activity. These 'Finding Futures' city tours will occur as central activities at the Digital Society conference in Lisbon (May11) and the SNET conference (Nov11). We will engage conference attendees in an exploration of place, futures, and mundane technologies. Confronted with a series of challenges, participants will take to the streets and capture their impressions of the urban scene. Their photographic and reflective efforts will be part of an installation and gallery talk on the closing day of the conference.

Finding Futures asks participants to notice the momentous and mundane technologies that underpin the urban landscape. As part of a larger research project to define and explore 'material deliberation', we will ask participants to focus attention on the sensorial and kinetic renderings of the environment filling a gap in analytical and design tools for participatory decision making in the STS toolbox.

These early prototypes of the Futurescape City Tours will invite participants to walk a pathway in the city and ask: What happens when you look at the city as a composite of images? Does wayfinding offer a productive methodology to make the city and its contents, patterns and possibilities legible? What memories and imaginations are summoned? Participants will tour the city and seek to notice and collect their impressions of the past, present and future evident in the landscape. By visiting a remnant of the

industrial past (a defunct soap factory in Lisbon and an old mill in Tempe) participants will be asked to envisage what they might become- what would you like to see in this space in 2050? Participants will take photographs and describe their visions. To explore the present, participants will walk along a designated route and spot street signs, advertisements, shop fronts, etc. that capture the spirit of the now, noting their reasons for selection. The future will be explored by tracing the route on a map provided and considering the William Gibson quote: 'the future is already here, it's just unevenly distributed.' Participants will select three sites that point to emerging signals of dramatic change and explain their selections. The photos and impressions will be presented during the conference through an installation that showcases the discoveries and editorial comments for more in-depth discussion.

NCTF Follow-up Survey

Filling a significant gap in the current evaluation methodology for citizen engagement activities in technology assessment, Cobb conducted a follow up survey of both participants and a control group of applicants in the national citizens' technology forum (NCTF) about the use of nanotechnologies for human enhancement (HE) one year out from this event. The NCTF was a month-long structured process involving six groups of between nine and fifteen ordinary citizens who deliberated in different locations across the United States with the goal of reaching consensus about policy recommendations within their groups. Preliminary analysis suggests that compared to the control group of applicants a year following the event, participants remain more knowledgeable about human enhancement and believe they participate more in civic life, however participants are comparatively less active in activities associated with the development of social capital, except for in activities specifically about human enhancement. Cobb and CNS-ASU Doctoral student, Gano, will submit a manuscript with the working title "Empowerment and Social Learning: Long Term Benefits of Citizen Deliberation about Nanotechnologies for Human Enhancement" reporting results from this survey to the *Journal of Policy Analysis & Management* Special Symposium on Science Policy and the Science of Science Policy in May 11.

Other Collaborations:

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

- Collaboration with University of Bergen and University of Lancaster scholars in a European project Epistemic Networks on Emerging Technologies which 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.
- Museum exhibition 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 (See Outreach section).
- With CNS-ASU colleagues, submission of grants on diverse emerging technologies (vaccines, geoengineering, energy) with Selin's contribution focused on extending RTTA 3 research on foresight methodologies.

- Planned submission of a grant to NSF STS with Conz to develop a new platform for public deliberation about the future of emerging technologies around food security, decentralized energy production, and the built environment. We seek to 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.

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

RTTA 3/1 is deeply involved in the activities of TRC 2, including co-organizing the Nano and the City speaker series with ASU's Design School, creative direction for the Nano in Everyday Life film, and working to streamline our foresight approaches.

RTTA 3/1 enrolled faculty from RTTA 4 in the March Gaming workshop.

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 (16), undergraduate students (4), post-docs (4)

Goals. RTTA 4/1 documents the influence of CNS-ASU research and engagement activities on the knowledge, values, and choices of NSE researchers and others. RTTA 4/2 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 studies 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, 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 Program, Accomplishments and Plans.

RTTA 4/1: Annual Interviews
In order 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. 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 Sp 06 and subsequent rounds in Sp 07, Sp 08, Sp 09 and Sp 10/Fa 10.

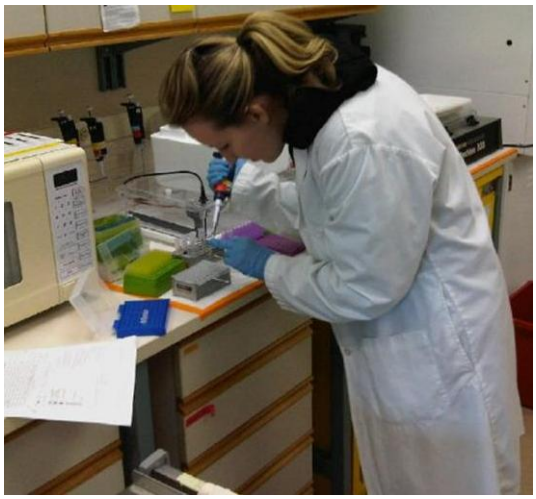
In the previous year, the annual interviews expanded the sample frame beyond the Biodesign Institute to include the School of Life Sciences, the College of Engineering, the School of Design, and other academic units on two ASU campuses. Despite these gains in breadth, overall response rates were significantly lower, which may be due to interview fatigue or other factors. Moreover, CNS capacity to follow-up and to conduct interviews had also declined. In response, in Y6 we hired doctoral student Trinidad and in Fa 10 focused on training 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. A total of 14 natural science and engineering respondents were interviewed for the Y6 annual interviews. The plan for Y7 annual interviews is for the graduate student to build up to conducting on her own significantly higher numbers of interviews. To that end, she has already begun conducting Sp 11 interviews and she is planning to conduct more during Su and Fa 11.

RTTA 4/2: Laboratory Engagement Studies

CNS-ASU has created a set of laboratory studies and engagements. These 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 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; and of Fisher in the Lindsay lab. This year, we report on the following integrative laboratory studies and engagements, which CNS-ASU continues to conduct from the previous two years: STIR and Tubes in the Desert.

The STIR Project

Fisher is PI and Guston Co-PI on the Socio-Technical Integration Research (STIR) project. STIR coordinates a set of twenty comparative, international, intervention-oriented ethnographies in North America, Western Europe, and East Asia. The project trains a group of ten doctoral students ("STIRers") in Fisher's midstream modulation framework and integrative decision protocol in order both to conduct socio-technical collaborations and to assess the policy and political relevance of their outcomes. In addition to this core group of 10 STIR fellows, an additional 10 STIR associates are active in the project. In total, project participants consist of fifteen doctoral students (Antonio Calleja-Lopez, University of Seville; Shannon Conley, ASU; Paul Ellwood, University of Leeds; Steven Filpse, Delft Technical University; Birgitte Hansen, Copenhagen Business School; Byoungyoon Kim, Rensselaer Polytechnic Institute; Federica Lucivero, University of Twente; Christine Luk, ASU; Robin Phelps,University of Colorado; 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), one masters student (Bastien Miorin), and four post-docs (Dorothy Dankel, Ana Delgado, Hannot Rodriguez, and Daan Schuurbiers).



The project formally began in Sp 09. Since then, STIR laboratory engagement studies have been completed in the Curtiss, Johnson, Lindsay, Seo, Vermass, Westerhoff and related laboratories at ASU alone. Two of these were completed in Y6. Beyond ASU, STIR engagement studies have commenced or been completed in 16 additional laboratories around the world. In total, 22 studies have been completed, with more underway and planned at ASU and elsewhere around the world.

Typical project findings continue to produce 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: For instance, laboratory researchers have realized that there are inconsistencies in their views about the role of science in society.

Changes in practice: For instance, 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: For instance, 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 one student investigator.

	Social Science	**Site 1**	**Site 2**	**Physical Science**
US Investigators	STS	Tempe	Hong Kong	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. These three intertwined dimensions can be seen, for instance, in the four project workshops Fisher has organized. In Jan 09, a 3-day training workshop was held at ASU, bringing together 16 faculty members (5 international, 3 natural science and engineering), 14 doctoral students (6 international, 1 natural science), and one private sector research manager (natural science). In Jul 09, a second workshop in Norway spanned 4 days, during which 12 doctoral students (7 international) presented, discussed and developed their initial findings under the guidance of 2 faculty members. Workshop discussions were intensive and in-depth, and included extended meditations on the concept of responsible innovation as well as plans for publications and follow-on meetings. In Y6, two further workshops were held: one in Aug 10 in Japan and one in Feb 11. In Aug 10, a two-day workshop brought together 11 doctoral students (7 international) and 4 faculty members (3 international). This workshop focused on developing student narratives and included presentations, discussions, breakout groups, and critical feedback on student drafts from additional senior scholars who were not able to attend the workshop in person. The workshop also allowed students to practice and receive critical feedback in advance of the public presentations they gave at the 4S annual meeting a few days later.

Also in Y6, in Feb 11, the fourth STIR project workshop was held at the Woodrow Wilson International Center for Scholars in Washington, DC. This workshop brought together policy makers, laboratory directors and doctoral students in the humanities, social sciences, natural sciences and engineering. It was open to the public and was webcast (it has since been archived on the WWIC website). It brought together 38 participants from over a dozen nations, numerous disciplinary affiliations, and both policy and non-governmental organizations - as well as many more public attendees and online viewers. Formal participants on the agenda included 10 graduate students (5 international, 4 natural science and

engineering), 2 postdocs (1 international, 1 natural science), 4 science policy actors (3 international)—including a European Commission officer, an executive officer of the Norwegian Research Council, and the CEO of Genome Canada—5 laboratory directors (2 international), the director of the WWIC Science, Technology and Innovation Program, and PI Fisher and co-PI Guston. Not only were STIR doctoral student presentations on their work able to be made to both policy and general public audiences through this event, they were also presented in collaboration with bench scientists and directors from the laboratories, who were research participants in the project and who have hosted two years of STIR laboratory engagement studies. The workshop included breakout groups and exercises designed to envision the sustainable continuation of the STIR project beyond its current funding cycle. Fisher is working with a project sub-committee to produce a white paper for this purpose.

In addition to the four workshops, PI Fisher has conducted: regular lab meetings with doctoral investigators; regular mentoring sessions (face-to-face and via skype) 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. He has also made a number of public and professional presentations on the project. Fisher has further collaborated with several project participants on the development of multi-authored publications (Schuurbiers, Calleja, Ellwood, Zhu, Phelps), mentored several others for single- and multi-authored publications (Conley, Schuurbiers, Calleja, Luk, Kim), and collaborated and/or mentored project participants regarding numerous presentations. He serves on the dissertation or masters thesis committees of several STIR graduate investigators (Conley, Calleja, Phelps, Theys, van Oudheusden); has worked on several single and multi- authored publications involving non-investigator participants (Guston, Miller, Biggs, Lindsay, Jie) and non-project participants (Mitcham, Mahajan, Lightner) on work relevant to the project; has organized several conference panels on STIR (for 4S and SNET); has sought both additional and supplementary funding to support project activities.
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 Office of International Science and Engineering. Additionally, through a national and international network that PI Fisher has cultivated since joining CNS-ASU in Aug 06, STIR project funded and unfunded collaborators 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.

The STIR Project has to date produced 22 publications, including 6 journal publications and 6 book chapters. Several more journal publications are in preparation, and plans are being made for an edited volume.

Tubes in the Desert

While the formal portion of the "Tubes in the Desert" project ended abruptly in 09 due to non-renewal of funding to the Biodesign Institute by British Petroleum, research based on Tubes has continued and expanded. Two major DOE awards led to the creation of Lightworks at ASU, an overarching framework for several centers involved in alternative energy research. CNS-ASU continues to collaborate closely with two of the new projects: the Center for Bioenergy and Photosynthesis (CBP) and the Laboratory for Algae Research and Biotechnology (LARB). The goal of both the projects is to maximize lipid production and secretion - along with the production of other valuable co-products such as food and dyes. However, the projects differ in a fundamental way; CBP is relying on a particular genetically-modified strain of cyanobacteria, Synechocystis 6803 and LARB is developing a catalog of naturally-selected algae. One of the CBP biology doctoral student researchers, Allen, continues her role as a CNS-ASU fellow. CNS-ASU is also co-funding Conz to observe the new projects, interact with project members (including faculty and graduate students from the ASU College of Law) on relevant societal aspects, and perform research on other aspects of the project such as how the story of the new transition is being told by its participants. To date, Conz has successfully embedded himself in the projects including the siting

and implementation of a demonstration-scale LARB rooftop photobioreactor at the INTEL Nanofab plant in Chandler, which is successfully recycling CO2 flue gas and producing algae. Conz presented his work at several conferences, including two organized by a Phoenix community- based non-profit, Desert Biofuels Initiative, which aims to bring together actors from industry, academia, regulatory agencies, and other publics. In Jan 10, Conz participated with two principals from the Polytechnic project at the CNS-ASU Science Cafe. A manuscript by Conz, Bhadra and Moore is expected from the Tubes project in Su 11.

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 are the Ethics in the Lab project and the DC Summer Session, reported on in **Section 11 Education**.

RTTA 4/3: Integration Policy Studies

RTTA 4/3 conducts a number of integration policy studies that characterize, map and assess the integration of societal dimensions into nanotechnology policy and R&D processes in the US and Europe. Ongoing RTTA 4/3 projects currently include:

1. Research by Garay, under the supervision of Fisher, on the nature of societal aspects of nanotechnology research and integration at the Nano-scale Science and Engineering Centers (NSECs). This project led to a poster at the 08 Gordon Research Conference on Science and Technology Policy. In May 09 Fisher received an award from the NNIN SEI that funded Garay to conduct fieldwork at a number of co-located NSEC and NNIN sites. During Sp and Su 10, Garay conducted site visits and fieldwork. He is currently analyzing interviews to learn how program leaders and others understand, practice and experience socio-technical integration as mandated in US federal legislation.
2. Last year, we reported that Fisher, Slade, Anderson and Bozeman used a database of over 1,000 documents from Congress, the NSF, and NSF funded NSE laboratories to identify and analyzed a wide range of public value statements. Their analysis revealed a multifactor structure of public values that has been consistently cited by a range of actors in an NSE research policy network, demonstrating that quantitative analysis of value statements can provide a credible and robust basis for policy analysis. Their results, which represented a connection to RTTA 1, was published in *Scientometrics* under the title, "The Public Value of Nanotechnology?" in 2010.
3. Rodriguez, in collaboration with Fisher and Schuurbiers, has undertaken a large scale, systematic and interpretive analysis of hundreds of STEM research calls in European framework programs (FPs 5, 6 and 7) to track the pervasiveness of socio-technical integration in the European R&D system. They identify a variety of modalities in which integration of the humanities and social sciences can occur, and initially find an increase in integrated projects that may correspond with the rise of nanotechnology as a research policy focus. They have had a chapter accepted for publication and are currently preparing a manuscript for journal submission.
4. Laurent and Fisher are revising a paper on "Integration Discourses" that presents the results of a research project that analyzed US federal nanotechnology policy documents from 2001-2006. In seeking to understand how various actors define and justify socio-technical integration, they identify three distinct visions of science and society that underlie prescribed roles for social scientists and members of the public in the US nanotechnology enterprise.

Continuing Integrative Outcomes

CNS-ASU's research collaboration with the Lindsay laboratory achieved momentum in Dec 07 with the Photon project, in which Fisher combined RTTA 4/2 midstream modulation and STIR approaches and from RTTA 1/2 Public Value Mapping (PVM). Several offshoots have continued to grow out of the Photon project:

1. Previously, we reported that the Photon project led to Fisher's becoming an honorary SMB research affiliate and that
2. as a result of an Apr 08 workshop that Fisher organized to explore the relation of public values to the group's research, participating NSE faculty experienced "breakthrough" and "useful" research ideas. These results were since reported in a letter in *Nature*, which has been cited by both natural and social science sources.
3. The Photon workshop led Fisher, Anderson and Renolds to create in Su 08 a large database of policy documents in order to map public values across science policy prescription and implementation processes as expressed by major contributors to the NSE policy discourse. Fisher, Slade, Anderson and Bozeman consequently used this database to conduct PVM of nanotechnology policy authorizations and allocations using quantitative analysis during Su 09. The results of their research appeared in the 2010 *Scientometrics* paper.
4. CNS-ASU researchers plan use the Photon database in additional planned projects: a collaboration with Corley, who spans RTTAs 2 and 4, on content analysis methods in parallel to RTTA 2's media content analysis of nanotechnology; and an RTTA 4/3 qualitative study that follows up on the results reported in *Scientometrics*.
5. The Photon project also formed part of the inspiration for an RTTA 1/2 PVM project led by Sarewitz and co-led by Fisher that is currently being revised for resubmission to the NSF SciSIP program.
6. In Dec 10, Fisher presented the results of the Photon project in a paper that was competitively selected for inclusion in an OSTP/NSF workshop on the Science of Science Measurement. The paper introduced the new approach of "Public Value Integration" (PVI).
7. Doctoral student Luk took a class on quantum mechanics from Lindsay and, under Fisher's direction, completed a laboratory engagement study with a separate laboratory project, for one of her two STIR case studies; and, in Feb 09, Fisher introduced graduate student Calleja to the Photon project team as the participant-observer attached to the project. Calleja since went on to complete a laboratory engagement study involving members of the Photon project as one of his paired studies for the STIR project, which he has presented on in two international academic conferences.

CNS-ASU collaborated with Johnston in the Nov 07 Medical Diagnostics project, also affiliated with RTTA 3/1, and run by Selin. Previously, we reported on outcomes from this scenario development workshop that included a report (Selin 2008), a change in one participating graduate student's research, and a request by a former staffer of the President's Council of Advisors on Science and Technology (PCAST) to share the full report with then current PCAST members. Since then, an additional offshoot has grown out of the Medical Diagnostics project: Lucivero joined the Johnston laboratory and conduct the second of her two STIR-related studies.

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 student (including the planned documentary), and also of a video pod-cast that will feature the STIR and PVM projects as a result of a supplemental grant awarded to Sarewitz and Fisher. 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, Fisher and Wiek have submitted a proposal to expand STIR into the urban context for nanotechnology governance. This project

would incorporate STIR and midstream modulation activities into up to 12 field sites that are intended to link together university, private, government and NGO actors who are anticipated to be involved in the emergence of nanotechnological trajectories in the Phoenix area.

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

The major accomplishment of TRC 1 in the past year has been the publication of *Nanotechnology and the Challenges of Equity, Equality and Development*, the second volume in CNS-ASU's Yearbook of Nanotechnology in Society series. During Spring and Summer TRC 1 leaders Wetmore and Cozzens put the final touches on the volume and it was subsequently published in November 2010. The second yearbook represents two years of research and writing by TRC 1 and is a showcase for the ways in which CNS-ASU brings together people from different disciplines to develop collaborative projects. The yearbook authors include twelve scholars from around CNS-ASU. The book provides a wide variety of analyses based on experience with other technologies, plus early indications from nanotechnology, of the probability that nanotechnologies will increase inequalities and inequities, plus suggestions for changing directions and conditions to reduce or eliminate that risk.

Since the final manuscript was submitted to Springer Publishing, 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 last summer to focus these efforts on two country case studies: the United States and South Africa. Asking these questions in the. U.S. is an obvious responsibility of the Center. South Africa was chosen as an example of a developing country with NSE programs explicitly focused on benefits for poor communities, and because of existing connections and preliminary field work. Within these countries research is further focused on water and energy applications to look closely at the fields which have 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, not supported under the center. Thomas Woodson has been carrying the water analysis with support from his NSF graduate fellowship.

Thus far most work has been devoted to desk research on local developments and contexts, using already published materials in order to get a sense of the landscape as well as identify laboratories, policy bodies, and civil society actors for later interviews. The Georgia Tech team has created a methodology using intensive literature review to identifying relevant nano applications in each of the three areas. They have applied systematic search strategies to find nanotechnology articles from the RTTA1 database in their technology areas. Posters were presented at the CNS All-Hands meeting reporting early results in each of the three areas. In each case, what has happened in the field since 2005 is compared with the areas

identified in Salamanca-Buentello[3] et al.'s 2005 article as important to reaching the Millennium Development goals, a set of objectives adopted by the international development community to be achieved by 2015. The analyses show a significant mismatch between what nano could have done, according to the earlier analysis, and what it has actually explored.

TRC1's current analysis is laying the foundation for fieldwork this summer in South Africa. Cozzens and Wetmore will lead a small group of graduate students to South Africa to gather onsite information about the efforts that the government, corporations, and NGOs are taking to develop and deploy nanotechnologies for both commercial and social benefit The South African nanotechnology program has two branches: an "industry cluster" doing research to help current and future South African businesses in their quest for competitiveness, and a "social cluster" aimed at providing benefits for poor households and communities. The TRC1 research group will conduct interviews in laboratories and meet with officials to probe the status of these goals on the ground. They will also look for South African low-income communities to participate in activities that parallel what TRC1 will be doing with TRC2 in the Gateway community in Phoenix.

The South Africa research project will be conducted in several phases. One of the next anticipated phases is an education component to help American researchers who want to develop pro-poor technologies develop the skills and perspectives needed to succeed. To this end we have been working with the National Nanotechnology Infrastructure Network (NNIN) to co-sponsor a program in South Africa. For the past three years the NNIN has sponsored a Winter School for graduate students in the sciences and engineering at various sites in India (CNS faculty Wetmore and Bennett served on the first two iterations as professors specializing in helping students understand the social implications of research, and graduate student Woodson was a participant in the third). These programs not only exposed students to the latest developments in a specific field of nanotechnology, but also gave them the chance to experience a developing country and interact with local people. TRC 1 faculty have convinced the NNIN to approach colleagues in South Africa about doing the next Winter School there. Cozzens is currently working with NNIN administrators on the details.

In addition to the South Africa research project, TRC 1 faculty and students have been engaged in a number of other projects linking TRC 1 to other parts of CNS. Wetmore and Postdoctoral Scholar Harsh have been working with Wiek and Foley to strengthen the equity component in TRC 2'swork in the Gateway community. TRC 1 will become more involved in that project as it develops and may end up using lessons from it to help structure the pro-poor projects in South African cities.

Three TRC1-produced chapters are on their way to press. Cozzens has prepared a chapter for Neslihan Duda's forthcoming book: *Making it to the Forefront: Nanotechnology-A developing country perspective* Cozzens's chapter is on the distinctive dynamics of nanotechnology in developing countries. She argues that on their current trajectories, nanotechnologies will deepen North-South divides, but that there are alternative pathways. Woodson has drawn on his work with TRC1 to co-author a chapter on nanotechnology in India for that book; his co-author is Vrishali Subramanian, a student formerly supported by CNS-ASU. Their chapter reviews Indian nanotechnology initiatives and private sector activity, and asks whether India is pursuing pro-poor nanotechnologies. (The answer is that there is no systematic evidence that this is happening, although there are a few anecdotal examples.) Cortes has used some of this work to prepare a chapter on Nanotechnology in Chile which will be included as part of the book: *Nanotechnology in Latin America* to be published by the ReLANS network. His chapter presents an update of the Chilean scientific capacity in nanotechnology, in particular evaluating the S&T policies over the last decade to fund nanotechnology research and increase human capital.

[3] Salamanca-Buentello, Fambio, 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).

Postdoctoral Scholars

Postdoctoral scholar Matthew Harsh has been working to characterize the strategic orientation of private sector and regulatory actors related to water and energy. Harsh presented this work at the Winter School on Emerging Nanotechnologies in Grenoble, France. The paper, co-authored with graduate student Woodson, uses TRC 1 data on nanotechnology applications for water. Harsh and Woodson, along with graduate student Cortes and Soumonni are working on comparative analysis with private sector research on nanotechnology for energy and agri-food applications. This work will be presented at the Third Annual Conference of the Society for the Study of Nanoscience and Emerging Technologies in a panel organized by CNS Private Sector Engagement Coordinator Davies. Harsh also has a chapter in press for the edited volume *The Handbook of Informal Governance* which compares inequalities in decision-making in agricultural biotechnology and nanotechnology in Africa.

Graduate Students

Graduate student Valdivia, advised by Guston, made progress on his doctoral research motivated by questions of equity that are central to TRC 1. The research offers a critical analysis of several fundamental premises that have driven innovation policy in the US. Of particular interest to TRC1 is the premise that economic growth induced by innovation trickles down to all sectors and is, in general, widely distributed. Two studies take issue with this premise. One is a critical review of economic growth models to show that the single attention on growth comes at the neglect of distribution, while both processes take place at the same time. This study puts attention to an explanation of wage disparities that emerge due to asynchronous actions on the public and private sectors, as research funding lags behind the adoption cycles of a new technology. This is of interest to the governance of nanotechnology considering that these technologies are at the early stages of the adoption cycles. The second study discusses distributional consequences of technology transfer policy showing that the safeguards implemented to balance the profit incentive with the public interest have gradually lost grip resulting in business practices that inordinately concentrate social benefits of innovation. Valdivia expects to complete his dissertation in Su 11.
Doctoral student Bal, advised by Cozzens and supported in previous years by TRC 1, reported results of the equity theme in the National Citizens Technology Forum in the *Yearbook*. Public participation can lead to science and technology policies that are not only legitimate but also fair if they give voice to the citizens who will be affected by the outcomes of the policies. Bal is using the NCTF data to examine how the voices of various participants were heard in the deliberations and recommendations of the NCTF participants. Bal's dissertation will analyze the influences of societal inequality on the power dimension of interaction with a citizen panel, using NCTF data from the Atlanta and Berkeley sites.

Graduate student Thomas Woodson, advised by Cozzens and supported by an NSF graduate fellowship and working with TRC1, is still doing exams, but planning a dissertation using TRC1 concepts and comparing South Africa and India. He and Cozzens will be presenting a political economy perspective on the TRC1 data at an upcoming conference on the political sociology of science and technology at Rensselaer Polytechnic Institute in April. Woodson is also gathering data to analyze brain drain and brain gain in nanotechnology in South Africa for a poster presentation at the Atlanta Conference on Science and Innovation Policy in September.

Graduate student Rodrigo Cortes, advised by Cozzens and supported through her work at Georgia Tech, is developing a dissertation proposal to examine the roles of multinational corporations in the effects of agri-food applications of nanotechnology in developing countries.

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 nanotechnologies 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. The links between TRC 1 and TRC 2 continue to evolve to make sure that equity issues are included in TRC 2's analysis and public demonstrations about the history and development of cities. Finally, the second *Yearbook* (Cozzens and Wetmore 2011) includes articles written by scholars from across CNS-ASU in the "end-to-end" fashion.

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 Director, School of Human Evolution and Social Change; Dean, School of Sustainability)

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

Personnel – graduate students (2), 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:

Academic Year – 1
Speaker Series. TRC 2 is a new thematic research cluster, officially begun with the Center's renewal in Oct 10. Nevertheless, some supported activities – most notably the graduate studio course and the database, both reported on below – began in the prior year. In F 10, under TRC 2 co-leader Wiek and Phoenix Urban Research Laboratory (PURL) coordinator Rothman, the "Nano in the City" Speaker Sessions commenced. This lecture series surveyed a variety of issues, concerns and approaches to the role of emerging technology in general, and nanotechnology in particular, in the future of the built environment. Speakers examined the potentials and hazards of new and upcoming materials and technologies, strategies to implement new technologies in an equitable and sustainable manner, the economic impact of nanotechnology as it relates to urban development, and ways of better understanding cities through the use of technology. Each speaker gave a formal public presentation and led an informal discussion open to ASU faculty and students as a way of fostering interdisciplinary conversation and promoting further collaboration at ASU. This series was designed as a precursor to a cross-disciplinary studio run by the CNS and the Design School.

Speakers in the series were:

- Peter Yeadon (Decker Yeadon): "Nanovation: Innovation via Nanotechnology," 24 Sep 10. This presentation introduced attendees to the broad field of nanotechnology, and focused on ways in which architects and designers are beginning to pursue innovation through nanotech advancements.

- Steven Moore (UT Austin): "Codifying the Future: Sustainable Design & the Built World," 28-29 Oct 10. Dr. Moore's lecture focused on societal aspects of new technologies and the concept of sustainability, and presented ideas on how to implement technological advances in the built environment in a democratic, equitable and ecological manner through codes and policy.

- Francesco Calbrese (MIT): "Modeling Urban Mobility Using Pervasive Technologies," 2 Dec 10. A research scientist at MIT's SENSEable City Lab and head of their Network and Society project, Dr Calbrese presented research on the digital datasets produced by mobile communication devices and other networked devices that can gather and/or transmit data, and how this can be used to understand the social and physical fabric of urban environments.

- Maj Munch Andersen (Technical University of Denmark): "Green Nano-Innovation: Evolutionary Perspectives & Visions of Nano & the Green City," 4 Mar 11. Taking an "innovation systems perspective," Munch Andersen interrogated visions for a green nano city. By linking such visions with a more general discussion of evolutionary perspectives of nanotechnology, she explored the intersections between technology development, sustainable development, economic development, and urban ecology.

- Mitchell Joachim (Planetary One): "Planetary One: What Are Our Ecological Goals for the Future City," 1 Apr 11. Dr. Joachim presented his design research speculating on alternative futures for our cities based on innovative and ecologically driven technologies, and examined the importance of and methods for visualizing radically different future scenarios.

NICE Database. Continuing work begun in the previous year, two undergraduate students under the direction of Wiek implemented a structured data collection for the "Nanotechnology in City Environments" (NICE) database. The NICE database is an expert-reviewed metabase of academic research, public reports, advertising materials, technical specification, and theorized implementation of nanotechnology captured in an urban context. The database will be compiled by undergraduate and graduate students and reviewed by experts with layman's terms summarizing the technological applications. The NICE database will catalogue nanotechnology applications with particular attention being paid to functionality, mechanisms, potential benefits, potential hazards, urban domain, development stage, and substitution properties. As a resource for CNS-ASU, as well as other interested scholars, professionals, and the general public, there will be different levels of NICE users ranging from expert reviewers to contributors and general users seeking knowledge about nanotechnology.

Reconciling Supply and Demand Workshops. To address the first research goal of mapping the diversity of problem perceptions and begin to make progress on reconciling the "demand" for solutions to urban sustainability problems with the "supply" of current and prospective nanotechnology, Wiek and graduate students Foley and Withycombe organized workshops with relevant ASU faculty and students in Jan 11 and Feb 11.

The specific goal of the first workshop was to understand the urban context into which nanotechnology is emerging. We focused our investigative lens on the Phoenix metropolitan area, an urban region of four hundred square miles with more than four million residents. We facilitated a structured discussion on urban sustainability syndromes (as opposed to symptoms) that are present and are likely to remain so into the short-term (over the next five year). The workshop elicited and documented expert statements on such urban sustainability syndromes in Phoenix as childhood obesity, air pollution, urban head island, social segregation. It then prioritized these syndromes and constructed causal diagrams for the five most important ones.

The second workshop brought NSE experts from different disciplinary backgrounds together to discuss nanotechnology in urban contexts, specifically as it pertains to energy systems, novel materials, water and waste treatment technology, environmental toxicology and risk assessment, transportation systems, and bioengineering. We elicited participation from a wide spectrum of disciplines in an effort to structure a broadly focused yet technically grounded workshop. The explicit goals of the workshop presented to the

participants were: 1) Reviewing "Urban Nanoscape" produced by the research team through nanotechnology profiles from the NICE database; 2) Generating a prioritized list of the most promising urban nanotechnologies; 3) Identifying potential positive and negative impacts and; 4) Building an urban nanotechnology governance community across ASU.

The workshop structure provided the context, orientation, and content for a collaborative and engaged participation. Comments and critics of the data entry per applications of the NICE database were received and constructive feedback on the goal, focus, and differentiation attributes of the metadata structure was provided. The final activity prompted a robust and highly interactive discussion on the positive and negative aspects of nanotechnology applications as become embedded within various socio-economic communities and conditions.

In the process of accomplishing these goals, the workshop pursued many of the larger TRC 2 and CNS objectives, including: 1) training undergraduate and graduate students in collaborative workshop preparation, execution, and synthesis; 2) translating, in real-time, information between and among independently oriented disciplinary actors; 3) exploring new ideas, disseminating information and seeding future engagement through constructive and coherent activities; 4) framing the research through the orientation of urban sustainability in a context both available and understandable to the participants, to which they could contribute their expert perspectives; 5) building new bridges across campus to disciplines previously not engaged within CNS; and 6) creating trust for engaging participants in a longer-term iterative research agenda.

Ongoing Research & Education

Since TRC 2 initiated research activities prior to the official renewal, on-going research areas originated prior to F 10 are continually being developed. In particular, TRC 2 has commenced a tightly integrated set of research and teaching activities at the scales of both the Phoenix Metropolitan Area and the community/neighborhood level.

The first of these projects operating at the Phoenix level began in Sp 10 and continued F 10. "The Future of Phoenix – Crafting Sustainable Development Strategies" integrated research and education to explore the intersections of sustainability and anticipatory governance in urban settings. The work has been conducted in collaboration with the City of Phoenix and includes graduate student workshop-courses as well as academic thesis research. This use-inspired research project is embedded in the local governance of the City, while simultaneously being directed toward developing theory and methods relevant to the research programs and educational goals of CNS-ASU and the School of Sustainability at ASU. It is thus an interdisciplinary research project that is not only relevant today but also seeks to establish a long standing platform of collaboration between urban-focused research at ASU and the decision makers who have a stake in such research. The graduate workshop-courses are coordinated, intensive, real-world educational program that supports student learning of urban dynamics, sustainability principles in practice, foresight and contemporary modes of planning. Co-instructors Wiek and Selin structured the initial workshop-course in Sp 10 to enable students to learn theory and methods in a dynamic and integrated fashion and have supported their skills development through concentrations on facilitation, engagement, teamwork, project management and communication. From this course, the research team under the leadership of Wiek co-produced with staff from the Phoenix City Planning Department (who had approached CNS-ASU about anticipatory governance) the next *Phoenix General Plan Hearing Draft* for review and consideration by the City Council. This workshop-course serves as a model for subsequent "Nano and the City" studios that draw students into practical, community-based projects in such a way to enrich their scholarly training with empirical work. Future plans are being co-developed with staff in the Phoenix Planning Department. More about the initial workshop-course is reported in both the **Education** and **Awards** sections.

A second project, operating at the community/neighborhood level, was initiated by Wiek in F 10 and continues through Sp 11. Graduate students from the School of Sustainability conducted a "Community-Focused Sustainability Assessment" in F 10 that explored the principles and methods of sustainability science through community-based research in Phoenix. Students engage with stakeholders in two disparate communities within Phoenix to conduct exploratory research on problem constellations and perceptions. Community members, business owners, and a broader stakeholder network contributed to mapping urban sustainability syndromes within the neighborhoods. This graduate workshop-course was a coordinated, intensive, real-world educational program that supported student learning of urban dynamics, sustainability principles in practice, foresight and contemporary modes of sustainability assessments. While the content of the course was largely focusing on the "demand" for solutions to urban sustainability problems, it is also the case that the course further developed our understanding of the most pressing urban sustainability problems, initiated the discussion about potential nanotechnology application to the superfund site in central Phoenix, and expanded our network of urban communities willing to further collaborate with CNS TRC 2. More about this workshop-course is reported in the **Education** sections.

The third of these projects operating at the community and metropolitan scale is related to the Motorola 52nd Avenue (M52) Superfund site. The activities performed a current state analysis at the community/neighborhood level including the historical contamination pervasive within one of the study areas. 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. This involves connecting with the community in three respects: 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 to connect the community to governmental agencies and the business sector in productive and goal-oriented ways that should consider nanotechnology-based remediation techniques that are novel and may regulatory barriers for consideration; fourth the projects seeks to build 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 nanotechnological remediation options). All research activities are guided by the principles of anticipatory governance. Public engagement goes beyond unidirectional information and consultation, it engages community and stakeholders in the co-production of knowledge which is of relevance to the community (willingness to support and act upon). While the cleanup process is of primary interest to the community in the short-term, the long-term future perspective is equally important to secure the community's health and well-being on site for generations to come. 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.
Presentations summarizing many of these preliminary activities have been given by Wiek at the 2011 Resilience conference and by Guston at the 2010 S.NET annual meeting, at the Department of Geography at Durham University, UK, and at the 2011 8th Annual US-Korea NanoForum on Nanotechnology for Sustainability.

Future Research Plans

Finally, to conclude the current year's analytical focus, we will conduct a study to better understand existing and potential capacities for how different actor groups might participate and collaborate more reflexively in the governance of nanotechnologies (Renn and Roco, 2006). For investigating such governance structures, including distributed roles, responsibilities, and capacities for choice and action, we will use a methodology that combines actor network analysis with perception and cross-perception

analysis (Wiek et al., 2007). The methodology has been developed and empirically tested to identify critical constellation in the governance network related to deviations between self- and cross-perception regarding actor roles, responsibilities, and capacities. In the face of complex causes and solutions to urban sustainability challenges, different perspectives are almost inevitable among diverse stakeholders. Such divergent views are critical causes of conflicts and present a formidable barrier to effective nanotechnology governance. We are currently preparing a series of interviews with key stakeholders to elicit perceptions and cross-perception of governance roles, responsibilities, and capacities for choice and action. The interviews will lead up to a deliberative workshop that aims to explore coordinated and collaborative arrangements for nanotechnology governance in cities.

Technology diffusion modeling and forecasting has traditionally been a linear representation of commercialized product adoption (Meade & Islam 2006). Evaluation of the emergence of nanotechnology is currently being conducted with real-time technology assessment methodology (Guston & Sarewitz 2002). Technological innovation, diffusion, and governance modeling, in a reflection of observed phenomena, can be illustrated in non-linear, multi-dimensional models (Robinson 2009). Assessment of actor networks influencing nanotechnology governance, their actions, roles/responsibilities, and self-perception and cross-perception can be conducted through initial interviews, followed by consensus-building workshops (Wiek et al 2007). Our intent is to assess the actor network operating within the metropolitan area while documenting empirically based prominent case studies of nanotechnology diffusion into urban environments around the world. This research will rely upon individual interviews within the network actors and community-oriented focus groups, followed by a consensus-building workshop.

With an eye toward the upcoming academic years, TRC 2 will conduct a participatory scenario study in Center YR 7, integrating results from recent nanotechnology scenario studies (e.g., Wiek, et al. 2008, Wiek et al. 2009, Selin and Hudson, 2010). RTTA 3 will support TRC 2 with novel methods for effectively constructing, communicating, and visualizing future states and development paths. TRC 2 will apply these methods to create socio-technical scenarios of the nano-enhanced city (reference year 2035) that are diverse, plausible, and meaningful. We will involve stakeholders from the Phoenix metropolitan area in various deliberative processes. In collaboration with ASU's InnovationSpace, we will conduct an undergraduate studio course that develops imaginative concepts and prototypes of nano-products relevant to the nano-enhanced city. 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 (cf. Kahan et al. 2008, Selin 2008, Wiek et al., 2009). 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.

In the third phase, we will 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. With MCAs we can 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 of 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.

Ensemble-ization

Within the first half of the academic year one for TRC 2, Wiek has sought to collaborate across CNS. During the annual All-Hands Meeting in January 2011, discussion in the plenary routinely focused on aligning interests between RTTA 1, 2, 3, and 4 and TRC1 with TRC 2. From that early exploration collaborative efforts have begun. Between RTTA 1 and TRC 2, graduate students Sanjay Arora and Rider Foley are coordinating an effort to leverage bibliometric research with the systemic current state analysis of urban environments. RTTA 2 and TRC 2 saw initial research and review of historical polling data between Doo-Hoon Choi and Rider Foley. Future polling questions will be coordinated between co-leaders Wiek and Scheufele (RTTA 2). Since TRC 2 will be fully engaged with scenario focused research in the second academic year, initial planning meetings between Wiek and Selin (RTTA 3) are on-going. In a joint effort to expand CNS' capacity in Socio-technical Integration Research, Wiek and Fisher (RTTA 4) submitted a proposal to NSF on "Socio-technical Integration Research: The Urban Context for Emerging Technologies (STIR City)." The project (if funded) would support three graduate students who would perform their integration research in three sites each across three sectors: academic and two of the three private for-profit, private not-for-profit, or governmental. The project will 1) adapt the original STIR protocol for use in multiple sectors, 2) train doctoral students to apply the protocol in each sector, 3) facilitate the students' access to and support their research in each site of their "rotation," and 4) hold workshops that will facilitate learning among the cohort but also facilitate learning among the sites in the rotation. Each student will also focus on a particular NSE-related research field that may be important for the specific innovation context in the Phoenix metropolitan area, e.g., water, energy, and urban heat island/built environment. To integrate and develop synergies between TRC 1 and TRC 2, graduate student Rider Foley from TRC 2 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 nanotechnologies in developing and developed countries. These early efforts facilitated by CNS director Guston during annual meetings, coupled with bi-monthly CNS lab meetings that result in seeding and encouraging the growth of research-oriented partnerships across the Center.

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.

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. In terms of Center leadership and faculty involvement, the Center also 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.

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 6 review, three women serve among the six renewal PIs (Corley, Meldrum, Youtie) and five women of eleven among the RTTA and TRC research program leaders (Corley, Cozzens, Lim, Selin, Youtie), for a total of eight of seventeen Center leaders (47%). Of these individuals: Corley began as an assistant professor and faculty researcher and is now an 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 an assistant research 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 seventeen (12%) – 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: Since its inception, the Center has 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.

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 include 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%).

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 assistant research professor and has become a research program leader. At the end of Yr 6, the Center has two active women postdoctoral researchers out of six (33%).

Center progress in enhancing the racial and ethnic diversity of its postdoctoral researchers has been less 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 two in Yr 6 (2 of 6, 33%). Unfortunately, the Center has not increased the number of Hispanic, 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 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 6, the Center has thirty-six women (36 of 74, 49%), fifteen Asian or Asian American (15 of 74, 20%), two African American (2 of 74, 3%), and six Hispanic (6 of 74, 8%) active graduate students. In addition, Center degree programs and certificate/training programs have involved twenty-eight women (28 of 57, 49%), one African American (1 of 57, 2%), seventeen Asians (17 of 57, 30%), and four Hispanic (4 of 57, 7%) students.

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, collectively, is also comparable to 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%) and three Asian or Asian American undergraduates (3 of 8, 38%). At the end of Yr 6, the Center has eight women undergraduate students (8 of 16, 50%) and two Hispanic undergraduate students (2 of 16, 13%).

Plans Going Forward

While the Center has performed strongly on diversity during its first six years, meeting and, in some 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 includes three elements:

1. Arizona State University has recently hired a new Hispanic faculty member in the School of Politics and Global Studies (Ramirez) whose work focuses on public attitudes about science, technology, and the environment. We will approach him with regard to interest in involvement in CNS. In addition, ASU has in the past held competitions for targeted Hispanic faculty hires to enhance diversity. If another competition is announced, CSPO will submit a proposal.

2. Arizona State University has a faculty member who works in the area of science, technology, and the law (Tsosie) who is Native American. ASU also has a highly successful American Indian Policy Institute with two Native American policy 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.

3. The Center will actively seek other opportunities to involve faculty from underrepresented groups in its activities.

Postdoctoral Researchers: As among faculty, the Center has had strong success in improving the gender diversity of its postdoctoral researchers but has had considerably less success with ethnic and racial 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 to seek to improve on our prior inability to hire postdoctoral researchers from diverse racial or ethnic backgrounds.

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.

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 the previous years, for example, CNS has taught a 7-week course on nanotechnology in society (described in the **Outreach** section) to 24 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, three of the students participating the CNS Su 09 DC Summer Session, and two participated in the Su 10 DC Summer Session. We plan to continue to engage this group of students and any new students who join the Hispanic Research Center.

2. To date, the focus of diversity planning at CNS at the graduate student level has been primarily at ASU. We plan to expand our efforts 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. We had hoped to
enhance the number of undergraduate students from diverse backgrounds involved in CNS activities through an REU program, which we submitted as a supplementary grant, but which was unfortunately not funded. As a partial substitute, Cozzens at GA Tech gave a talk on "Nanotechnology and Society," based on the Miller et al. (2007) report, to approximately 35 REU students affiliated with the NNIN node there. 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 educating science and engineering graduate students in the social implications of their work. In Nov11 CNS-ASU will host the first major conference on this subject.

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 (Science and Technology Studies), 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 TRC 2).

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

- In Aug 11, Selin will begin a tenure-track position shared between ASU's School of Sustainability and the Consortium for Science, Policy and Outcomes.
- Six others 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; and Slade at the Hull College of Business at Augusta State University with an affiliation with the Medical College of Georgia.
- 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 leads the private sector engagement activity, 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-related 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 with Cozzens, and Bennett edited with Hays, Robert and Miller the third volume. Barben is editing with Miller the fourth volume.

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. Many of these students have drawn on CNS research to develop their theses. In the reporting year, the Center has been training:

- At ASU, nine doctoral students:
  - Conley (Politics and Global Affairs), who has completed her STIR research;
  - Valdivia (Public Affairs), who is defending his TRC 1-related thesis, "Equity Considerations in the Assessment of the Bayh-Dole Act," in Apr 11;
  - Milleson (Philosophy), who is publishing a chapter in the third volume of the *Yearbook*; (confirm w/ Clark);
  - Lidberg (HSD), who has worked on the TRC 2 NICE Database and has also been interning with the Arizona State Legislature;
  - Bhadra (HSD), who has been working with Conz and Moore on a manuscript about the Tubes in the Desert project;
  - 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 a follow-on manuscript to the NCTF project, and who has taken a professional position at Amherst College;
  - Trinidad (HSD), who has been assisting both Fisher on RTTA 4 interviews and Wetmore and Bennett on integrative educational activities;
  - Luk (HSD), who has completed her second year paper on STIR research; and
  - Moore (HSD), who has been working with Conz and Bhadra on a manuscript about the Tubes in the Desert project.
- At ASU, four master's students:
  - Anderson (Public Affairs), who completed his master's degree in May 10 and is publishing a chapter in the third volume of the *Yearbook*;
  - Calleja-Lopez (Politics and Global Affairs) , who completed his master's degree in May 10 and is… check with Erik
  - Nulle (Global Technology and Development), who completed her master's degree in May 10 and is publishing a chapter in the third volume of the *Yearbook* (confirm with Clark); and
  - Wheelock (Liberal Studies), who consults with the Center on its graphic design work.

- Current updates on earlier students include:
    - Panjwani, who completed her master's thesis in Mathematics and Statistics in May 07 and who has manuscript related to her thesis has been revised and resubmitted to a journal (Greenwood, Wang, Selin, and Panjwani under review).
    - 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, and is now serving as a post-doctoral fellow with Center at ASU's Washington, DC office.

- 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. Several 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 will complete his dissertation this summer and has accepted a tenure-track position at University of Texas at Austin; and Dalrymple, who will also finish this summer and has accepted a tenure-track position at 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-refereed publications published by RTTA 2 include graduate student authors. In Su 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.

- 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 Sp/Su 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 continue as a post-doctoral fellow with the RTTA1 group for AY 11-12. 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 (Sp 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.

- Other graduate students at University of New Hampshire (Barr, Sociology), North Carolina State University (Ndoh and Willingham, Public Administration), and University of California, Berkeley (Barandiaran and Philbrick, Environmental Sciences) were all involved in the organization, conduct and analysis of the National Citizens' Technology Forum. Philbrick and Barandiaran (2009) have published on their activities and have contributed multiple entries to the *Encyclopedia of Nanoscience and Society*.

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, trains and mentors fifteen doctoral students (Antonio Calleja-Lopez, University of Seville; Shannon Conley, ASU; Paul Ellwood, University of Leeds; Steven Filpse, Delft Technical University; Birgitte Hansen, Copenhagen Business School; Byoungyoon Kim, Rensselaer Polytechnic Institute; Federica Lucivero, University of Twente; Christine Luk, ASU; Robin Phelps,University of Colorado; 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), one masters student (Miorin), and four post-docs (Dankel, Delgado, Rodriguez, Schuurbiers). As a result of STIR-related work, Fisher also serves on graduate committees of Calleja-Lopez, Conley, Phelps, Theys, Van Oudheusden and has provided formal feedback to the graduate advisors of 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 three Biodesign Fellows: Tomasz Kalinowski (Biodesign; Halden lab) has been working to develop informal science education videos on nanotechnology. Jennifer Watkins (Chemistry and Biochemistry; Wachter lab) has been helping to run the Science Café program. Rebecca Allen (Biodesign; Curtis lab) is working with RTTA 3 to develop energy scenarios.

CNS-ASU has recently expanded the Fellows program to attract students from ASU's Ira A. Fulton Schools of Engineering. Beginning in Sp 11, the Center took on its first Fulton School Fellow Moran (Engineering, Posner lab). Moran will be working with the recently created Informal Science Communication Program and other Center activities. The Center will take a second CNS-Fulton Fellow in F 11.

CNS-ASU has also attracted additional PhD+ students, not affiliated with the CNS-Biodesign or CNS-Fulton Fellows program, including Sreekar Krishna (Center for Cognitive Ubiquitous Computing).

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 for years 6-10.

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 grant, on which Wetmore is a co-PI.

In one activity, Bennett participated (for a third year) in the Biological Design Graduate Program's core course, Fundamentals of Biological Design II. After participating in the nine-credit fall semester course for the first two years, the faculty involved realized that Bennett would have more impact in the spring course, which focuses on applications. Throughout the semester, five faculty present to the class. 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 have resulted in two new Biodesign Fellows, Kalinowski and Allen.

A second CNS/EESE collaboration involves laboratory engagement. During F 09 and Sp 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 F 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 F 09 Wetmore was asked to consult on the development of a similar program at the University of Rothenburg in Germany. In Su 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.

The evaluation data generated under the EESE is quite 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 EESE grant to be awarded to develop macroethics modules for the online CITI program.

In Su 10, CNS-ASU conducted two separate sessions of "Science Outside the Lab: A Policy Dis-Orientation" for NSE doctoral 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 new model for the program relies on students and their advisors to secure the funding that will cover the expenses of the program. We secured enough students with funding to run two two-week sessions – including students not only from ASU but from half a dozen universities across the country. After participating in CNS immersion projects, taking multiple courses, and being mentored by Bennett and Wetmore, NSE graduate student Punarvasu Joshi and School of Life Sciences student Jenny Brian have gained the skills, knowledge, and enthusiasm about the social and political implications of nanotechnology to serve as student leaders in the two 10 DC Summer Sessions.

In Su 11, CNS-ASU plans three sessions of the program. Bennett will head the effort. CNS faculty Wetmore, CNS post-doctoral fellow Harsh, and former CNS post-doctoral fellow Delborne, will assist with one session each. The 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 will be dedicated to these two PSMs.

In F 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 are sent to the museum to present once a month.

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. This course is currently being taught by Bennett as a required course in the degree program.

This past year Wetmore collaborated with Patrick Phelan to develop and run a new Professional Science Masters in Solar Power Engineering and Commercialization. The curriculum of this new 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 is currently teaching a 1-credit required graduate level course on Solar Energy Policy with Mike Pasqualetti. All seven students enrolled in the first semester of 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 has established ten graduate courses at ASU:

- "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. Support for the continuation of this course is included in Harsh's recently resubmitted NSF proposal.

- Wetmore created a new course in Sp 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 Fa 10 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.
- "Science Policy for Scientists and Engineers" has been taught by Bennett, Posner, and Wetmore nearly every semester for the past three 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. These courses are being evaluated under the EESE grant to determine how well they help young scientists and engineers understand the micro- and macro-ethical aspects of their work. The interactions with the students in the course yielded the first CNS-Fulton Fellow, Moran.
- "Energy and Energy Policy," taught by Bennett in Sp 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.
- "Governing Emerging Technologies," taught in F 08 and F 09 through the School of Politics and Global Studies by Guston and in F 10 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.
- "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 (F 07, S 08, F 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 Sp 06 and Sp 07 but not in the current reporting year;
- "Nanotechnology: Law and Regulation," was taught by Marchant in the Sandra Day O'Connor School of Law. 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. The course was offered in prior and current reporting years.
- "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 is 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 Sp 11, ASU awarded the course its President's Award for Sustainability.

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 the scenario-based solar-to-fuels workshop, the anticipatory governance visioning workshop, CNS-ASU All-Hands meetings, and other CNS-related activities at ASU.

While the vast majority of classroom-oriented activities at CNS-ASU have occurred at ASU, in Su 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 W 10 and Hays' Human Enhancement and Democracy class in Su 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, three InnovationSpace/CNS-ASU students are completing honors theses – two in the Carey School of Business and one in the Fulton Schools of Engineering.

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 of Nanotechnology in Society*;
- 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 of Nanotechnology in Society* 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 also trains undergraduate interns, who work on research or other projects in collaboration with CNS faculty. CNS has supported ten undergraduate student interns since the last annual report: Eric Beeler (TRC 2, Nano and the Future of the City/workshop projects), Ian Griffith (Outreach support, e.g., videography and editing), Catherine Hoke (Private Sector Engagement project/workshop, RTTA 3 book project), Ben Lowenstein (anticipatory governance concepts), Keith Martin (Outreach support, e.g., videography and editing), Colin McDonald-Smith (Energy workshop), Jaron Reed (RTTA 3/1 plausibility project, Benn's nano-silver outreach activities, TRC 1 Yearbook, and web development), Laura Rodriguez (RTTA 1 database entry, Evan Taylor (TRC 2, Nano and the Future of the City/database development project), and Daryl Traylor (Encyclopedia, nano legislation, evaluation of S.NET workshop).

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," and "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 W 10 as a 3-credit online course with interactive and video-enhanced oral exam modules. In Sp 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.

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 waste management, energy awareness and urban mobility. (See **Section 9 Research Program [RTTA 3/2]** for further explanation).

K-12 Education. In a previous reporting year, CNS-ASU described the development of a graduate course that provides 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 Sp 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 Cafes, held monthly 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. Three years ago, 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 all five annual CNS All-Hands Meetings held to date, 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). 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 Su 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.

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 Su 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 & Social Research Council that brought two researchers, Jane Calvert and Emma Frow, from the University of Edinburgh to ASU for three weeks in F 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 F 10 and Harsh and Wetmore will be visiting in Su 11 to learn more about the activities in Edinburgh and further spread the education work being done at CNS-ASU.

In Sp 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 listen to policymakers and the public.

The interest being generated by the CNS-ASU educational programs and the ever increasing push to ensure that scientists and engineers are educated in the social and ethical implications of research convinced CNS-ASU faculty that a major dissemination program needed to be launched. Therefore, in Nov 11 CNS-ASU will sponsor a Congress on Teaching Social and Ethical Implications of Research. This Congress will bring together a wide array of these educators to share the programs, materials, assessment methods, and experience they've already developed as well as serve as an opportunity to collaborate on new strategies to help scientists and engineers understand the social and ethical implications of research. We currently have confirmation that the NNIN will hold its annual SEI education meeting in conjunction with the Congress. We anticipate that the Congress will draw over 50 participants. The Congress will be held a few blocks away from and immediately after the annual meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET). The Congress is jointly sponsored by two NSF EESE grants, as well as ASU's NNIN node.

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	2	2					2							
Masters	12	6	6				7	5						
Doctoral	12	5	7				10	2					1	
Enrolled in NSEC Degree Minors														
Undergraduate														
Masters														
Doctoral														
Enrolled in NSEC Certificate Programs														
Undergraduate														
Masters	1		1				1							
Doctoral	30	16	14			1	19	10					3	
Practitioners taking courses														
Enrolled in NSEC Programs														
Undergraduate														
Masters														
Doctoral														
Practitioners taking courses														
K-12 (Pre-college) Education														
Teachers														
Students														
Total	57	29	28	0	0	1	39	17					4	

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	2	2					2							
Masters	8	4	4				7	1						
Doctoral	11	5	6				11	1					1	
Enrolled in NSEC Degree Minors														
Undergraduate														
Masters														
Doctoral														
Enrolled in NSEC Certificate Programs														
Undergraduate														
Masters	1		1				1							
Doctoral	28	14	14			1	18	9					2	
Practitioners taking courses														
Enrolled in NSEC Programs														
Undergraduate														
Masters														
Doctoral														
K-12 (Pre-college) Education														
Teachers														
Students														
Total	50	25	25	0	0	1	39	11	0	0	0	0	3	0

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 6, we have worked to develop more extensive ties to the private sector, as well as to reach new audiences through video production.

Derived from priorities established in YR 4's Visioning Workshop (Selin 2008), education and outreach coordinator Gano and assistant director of outreach Selin launched in YR 5 a new media initiative, focused efforts on developing collaborations with NISE Net, and supported the development of new programs across the Center to bring anticipatory governance to new audiences. In YR 6, we continue these efforts and have also ramped up our Private Sector Engagement activities with the hire of Sarah Davies. Davies's doctoral research examined practices of public engagement, and since her PhD in 2007 from Imperial College, London, her work has focused on public engagement with emerging technologies and on the governance of nanotechnology. She now coordinates the Center's private sector engagement and is exploring the ways in which actors in the private sector constitute responsibility.

COLLABORATIONS WITH THE NANOSCALE INFORMAL SCIENCE EDUCATION NETWORK (NISE NET)

Over the past two years the CNS – NISE Net collaboration has ramped up considerably. CNS-ASU and NISE Net partners continue to work to develop products and programs that integrate the societal dimensions of nanotechnology in order to enhance the presence of social science research in NISE Net activities. The collaboration explores the role that science museums should play in anticipatory governance by positioning NISE Network partners to engage with questions about social, legal, ethical implications of developing nanotechnology. These activities broaden and deepen the capacity of science museums to shape and contextualize broad public knowledge about the role of science and emerging technologies in society. These collaborative activities represent initial steps in constructing an in-depth initiative in anticipatory governance education to enhance key ideas and skill in both formal and pre-college education and informal science education. Further, closer collaboration with NISE Net expands upon CNS-ASU's concept of "ensemble-ization." CNS-ASU faculty continue to collaborate on a regular basis with NISE Net participants and are formalizing their ties. For instance in F 10 Bennett, Miller, and Wetmore were appointed NISE Net Content Steering Group Advisors to help integrate more social implications into the network's projects. Miller serves on the NISE Net Board of Directors. NISE Net partners have a strong, reciprocal presence in many CNS-ASU activities, events and programs as detailed in the following section.

CNS/NISE Net collaboration in the Rightful Place of Science Conference, ASU
In May 10, ASU hosted a gathering of scientists, journalists, ethicists, humanists, playwrights, exemplars, scholars, practitioners, and next generation leaders to rethink the role of science in society (see http://cspo.events.asu.edu/). The conference explored how science and technology can most effectively contribute to an improved quality of life for all, and which inquiries, communities, and institutions can advance our ability to engage the transformative power of science and technology. As part of the

program, our NISE Net collaborators led two Table Top Salons, small discussion groups to generate contributions to the developing research, education and outreach agenda to enhance linkages between scientific and technological research and beneficial societal outcomes. Rae Ostman of the Science Center in Ithaca, NY led a discussion on University-Museum Partnerships for Engaging the Public in Science and Society, and David Sittenfeld of the Museum of Science, Boston, led a discussion on Participatory Technology Assessment in the 21st Century: Including the Lay Public in Scientific Decision Making (summary at http://cspo.events.asu.edu/?p=799).

CNS/NISE Planning meeting

Following the Rightful Place of Science conference, CNS and NISE representatives met for a ½ day planning session to discuss: 1) revamping Nanodays activities and products, including the co-developed societal implications posters that were prototyped at Nanodays in YR 5; 2) planning for the anticipatory governance meeting described in detail below; 3) CNS consultation on the development of the next cycle of tabletop exhibits with the challenge to introduce societal implications in brief demonstrations or in stand-alone activities; 4) considering how to incorporate ideas and practices associated with scenarios about the future in informal science settings; 5) proposals for additional projects; and 6) planning for joint proposals to professional and scholarly meetings in the coming year. Action items across these six areas drove development for the NISE/CNS collaboration during YR 6.

NISE Net Annual Meeting 2010

Bennett, Wetmore, Miller, Selin and Gano attended the NISE Net annual meeting in Sep 10. This year, CNS researchers were fully integrated into the annual meeting programming, joining panels of ISE practitioners and science and social science researchers. Bennett led a Nano 101 session, Miller and Wetmore led **Engaging the Public in Societal Issues, and Miller, Selin, and Gano presented in the session Exploring The Uncertain Nanotech Future: Lessons in Anticipatory Governance.**

NISE Net involvement in CNS-ASU All-Hands Meeting

NISE Net organizers reciprocally attended the Jan 11 CNS-ASU All-Hands meeting. On the morning of the first day, NISE and CNS-ASU partners held an ad hoc session on planning the anticipatory governance workshop. The first day also included a "matinee" presentation of nanovod and other video media projects highlights by education and outreach coordinator Gano and an evening outreach panel by Selin. NISE partners held a lunchtime roundtable discussion about their SEI activities.

Anticipatory Governance Workshop

NISE Net and CNS-ASU conducted a joint planning workshop on Anticipatory Governance at ASU in Tempe, AZ on 9-12 Feb 11. The goal of workshop was to explore the role citizens could play in concept of anticipatory governance. Key questions included: What skills, knowledge, and frameworks do they need to be effective? How can we prepare citizens, within the fields of formal and informal education? What materials, techniques and processes work best for conveying/transferring/enhancing these skills in a museum context?

Although the promises of emerging technologies may be limitless, the long-term societal and environmental implications are unclear. Thirty attendees with representatives from each group considered the concept of anticipatory governance, or the ability of society and institutions to seek and understand a variety of inputs to manage nanotechnology and other emerging technologies while such management is still possible. The participants explored what this means for decision-makers of all shapes and stripes in the context of formal and informal science education across activities, settings, and engagements.

Anticipatory governance entails a range of different skills: (1) the skill to identify places in society where the future is being fashioned (which, of course, is everywhere, but some places may be more influential than others) or where decisions or choices are being made that may have significant implications for the

future; (2) the skill to anticipate (but not predict, which assumes too much certainty) potential futures that might result from decisions or choices; (3) the skill to reflect on what is likely to be both desirable and undesirable about potential futures, perhaps (albeit not necessarily) in dialogue and deliberation with others; and (4) the skill to transform those reflections into ideas about how to alter the decisions and choices we are making today to—hopefully—invent different futures. CNS-ASU participants developed a "matrix" tool for mapping knowledge and skills associated with the components of anticipatory governance (anticipation; engagement; science, technology and society; and decision-making). NISE Net participants developed a lifecycle model of decision-making to include citizens playing various roles in society (Citizen Consumers/Parents; Citizen Professionals; Elementary / Middle School; Pre-College, College, Continuing). Participants divided into the four lifecycle groups and used the matrix tool to develop ideas for activities, programs, and partnerships.

Outcomes: A joint, ad hoc group will create/edit material to support the communication of anticipatory governance learning objectives and content ideas in ways related to the NISE Net concept map and learning framework, including examples of ISE activities that support anticipatory governance learning. Bell and Guston will explore potential connections with professional organizations for government leaders/workers, business leaders, and media, to identify opportunities for interaction at professional meetings or others places to which these professionals go for learning or to get ideas related to their work. They will also prepare an article about anticipatory governance and informal education for an upcoming volume of the *Yearbook*. The two groups will also organize collaborative activities on anticipatory governance for the S.Net 2011 conference.

In addition, working groups were established to:

- Develop exhibit and programming around visualizing energy and plausible futures;
- Discuss the idea of a short course on anticipatory governance for media professionals;
- Explore the concept of a "nano grocery store" exhibit;
- Develop a concept for a cell phone application to illustrate the big ideas in nanotechnology in society;
- Create a program on nanotechnology and food at the Science Museum of Minnesota;
- Craft a concept for a nationally scaled Kids Citizen Action Camp that supports anticipatory governance learning objectives; and
- Further the integration of anticipatory governance concepts in the NanoDays kit.

Nano and Food Project:

In preparation for the planned National Science Café (organized through the Museum of Life and Science), Bennett, Harsh and Trinidad worked closely with NISE Net Programs Committee to develop a presentation of nanotechnology and food applications that accounts for the ethical, social and environmental implications. This project involved the entire CNS-ASU community in vetting a presentation. Bennett, Harsh and Trinidad consolidated the concerns raised in a CNS lab meeting devoted to brainstorming key issues around nanotechnology in food into a series of questions. The SEI-oriented questions were made available to the NISE Net community and while the National Science Café did not gather the momentum required to launch, our Nano and Food material has nevertheless been taken up in a Science Café hosted by the Museum of Science, Boston.

NISE Net Content Map

CNS-ASU researchers contributed language to revise and shape the societal implications component of the NISE Net Content Map, a blueprint for programs and activities development in the NISE Net renewal period, 2010-2015.

Nanotechnology Mini-Exhibit Development

The CNS-ASU collaboration with NISE Net to develop table top exhibits has evolved into a larger project to design several 300 square foot museum installations. These installations will cover a range of topics from nanotechnology in the home, the balance of public investment in nanotechnology, and the light refracting qualities of morpho butterflies. Intended as stand-alone installations that require no staff monitoring, these exhibits have been reviewed by Bennett to ensure accurate and helpful framing of societal issues. About 50 of these installations will be built and made available primarily to museums that have little nanotechnology content.

Nano and Society FAQ

Building on the key themes outlined in Miller et al. (2007) as benchmarks for effective consideration of science and society issues around emerging technologies, CNS/NISE contacts began thinking about how to develop a capacity among museum educators/facilitators to answer the "so what" questions they receive when working with visitors using NISE Net materials. NISE partners aggregated "societal implications" questions from staff at network institutions. During Fa 09, CNS-ASU researchers developed narrative answers and examples for a set of 15-20 questions. This working document became the basis for a set of six prototype posters and 2-sided handouts, with details appropriate for public dissemination and for informing museum staff, which were tested and evaluated during NanoDays 2010 by several partner institutions. Themes included:

- Does nanotechnology belong in toys?
- Will nanotechnology improve living conditions around the world?
- Would you use a dangerous technology?
- What's hidden in your sunblock?
- Are you being tracked?

These materials have been evaluated and are included in the 2011 NanoDays kit distributed to museums and other informal science education hubs around the country. The posters and brochures received very positive evaluations at the test sites and many sites, including the Smithsonian Institution's National Museum of American History, continued to use the materials after NanoDays was over. The Smithsonian's Spark!Lab laminated the posters and pamphlets and uses them on a daily basis to engage the parents as the children watch live demonstrations. Large-scale hard copy versions of the posters are included in all 200 NanoDays boxes that have been distributed around the country for NanoDays 2011.

The posters and brochures continue to be a success, but can only answer a handful of the questions that the general public frequently asks at science museums. To supplement them, CNS-ASU researchers including Wetmore, Selin, Davies, and Guston have developed a series of Nano and Society Frequently asked Questions and Answers. These FAQs are advertised in a number of places in the materials produced for NanoDays 2011 (including the posters) and are posted at: cns.asu.edu/nanoquestions/faqs.

NanoDays 2011

As in previous years, CNS-ASU participated 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 sponsored 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 200,000 visitors and in the official NanoDays event hosted at the Arizona Science Center. The demonstrations covered many aspects of NSE, including how size affects a material's properties using quantum dots, how to visualize things at the nano-scale, and how to suit up to enter a nanomaterials clean room. While a fun, educational experience for the children and adults that visited the demonstrations, it was also useful for the students who had to (often for the first time) distill complicated technical information down to its simplest explanation. The prototype NISE/CNS posters and handouts were also exhibited at both sites.

Museum-based Spin-off Activities

Over the last two years, CNS-ASU's collaborations with NISE Net have flourished into more extensive contacts within the science museum community. In Feb 10, we held a planning meeting with key professionals to discover how to design ISE experiences that capture technology futures. This exploratory meeting was followed up with a visit by Miller and Gano to Science Museum Minnesota in Apr 10 where they developed ideas tied to SMM projects. Outcomes of these meetings include the now funded Climate Education Partnership (PEI) and the proposed Climate of Uncertainty Grant.

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

CNS-ASU associate director Miller is co-principal investigator on a team that recently received from NSF an award (# 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 Climate Change Education Partnership (CCEP) in collaboration with Arizona State University, Museum of Science-Boston, University of Virginia, Colorado School of Mines, and the Phoenix Union High School District. This award focuses on the impacts of climate change for engineered systems. The goal is to catalyze and transform engineering education in K-12, science museums, and undergraduate engineering departments to prepare current and future engineers, policymakers, and the public to meet these challenges.

In coming decades, climate change and society's responses to it will require enormous transformation of the nation's technological infrastructure. Current US education falls short of preparing the country for this challenge. Educational platforms must focus on the multiple, complex interactions between engineered systems and the Earth's climate system. At the same time, transformation raises societal challenges, including trade-offs among benefits, costs, and risks, and opportunities for building public trust, confidence, and engagement. New education must integrate technical and normative learning, knowledge, and skills, in formal and informal educational venues.

This partnership will develop a comprehensive vision focused on three themes: (1) climate impacts on engineered systems and their adaptation; (2) changes in engineered systems required to mitigate greenhouse gas emissions; and (3) the creation of novel technological systems to engineer the Earth's climate system. Cutting across themes, it will examine challenges of: (1) governance; (2) justice; (3) sustainability; and (4) public engagement and trust.

Climate of Uncertainty grant proposal to NSF

The Science Museum of Minnesota (SMM), in partnership with the Consortium for Science, Policy and Outcomes (CSPO) at Arizona State University, the Institute on the Environment (IonE) at the University of Minnesota, and the Institute for the Future (IFTF) in Palo Alto, CA has proposed 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. Selin is a co-PI.

Uncertainty presents not only scientific challenges but social, political and economic quandaries as well. To address these challenges in an informal science education effort, Climate of Uncertainty will use scenario planning both as an exhibit development tool and a framework to consider climate change and its impacts. Scenario planning's two distinctive qualities map well to climate change education for the public: (1) scenario planning creates and considers multiple, equally plausible futures; in educational terms, this provides an alternate framework to unproductive public debates that pit climate change predictions against one another; and (2) scenario planners craft coherent narratives about those plausible futures to help decision-makers and others formulate actions; coherent stories are a best practice of public education and are critical to framing climate change and its impacts for public consideration.

Climate of Uncertainty assembles a wealth of expertise to develop new tools for how to communicate scientific uncertainty to public audiences and how to create exhibitions and online experiences grappling with plausible futures. SMM estimates that at least three million people will see the Climate of Uncertainty exhibition during its tour to at least 15 U.S. science museums and centers.

BROADER ENGAGEMENT PROGRAMS AND ACTIVITIES:

MOS Provocative Questions
Scheufele serves on an advisory committee for Museum of Science's Provocative Questions project funded by NSF. This project designs, develops, and tests exhibit prototypes to build visitors capacities to engage in discussions of socio-scientific issues, particularly those related to the numerous human-biology and health-related socio-scientific issues present in their lives today. The purpose of this small-scale project will be to explore the feasibility of designing un-facilitated museum exhibit experiences that engage museum visitors in activities where they recognize the components of socio-scientific arguments, evaluate them, and pose arguments of their own.

Future Tense Initiative
Sean Hays, a CNS-ASU post-doctoral fellow, has been embedded at the New America Foundation, where he helped established a joint initiative known as Future Tense in collaboration with Joel Garreau, of the New America Foundation and ASU's Sandra Day O'Connor College of Law. The Future Tense initiative was a series of events, co-created by ASU, NAF, and Slate.com, designed to engage with the public and policymakers in Washington, DC. The initiative hosted four major events over the last year. The first explored the implications of biodesign and robotics in the military. The second looked at the various political and socio-economic consequences of geoengineering. The third event included the political and policy implications, but also reached beyond into the ethics and morality of radical life extension. Finally, the fourth event examined the governance of emergent technologies in general, but through the specific context of synthetic biology. The events were well attended by both policymakers and the public, and each event included participants from the policy establishment. One outcome from these activities will be a series of four white papers authored by Hays exploring four different aspects of the governance of emergent technology, expected to be completed in F 11.

New Tools for Science Policy
CNS-ASU is leveraging the CSPO DC office to reach out to policy audiences. In Dec 10, Hays organized "New Tools for Science Policy," where Guston and Sarewitz described the new conceptual tools of RTTA and anticipatory governance to an intimate audience of primarily executive agency program managers and analysts at the Government Accountability Office. The next event in this series, in Apr 11, will focus on the governance of Do-It-Yourself synthetic biology, drawing in representatives from the

Department of Health and Human Services, the American Association for the Advancement of Science, and the Federal Bureau of Investigation to engage with two prominent members of the DIY biology community. In May 11, art and culture as forms of soft governance for science and technology will be explored in a moderated discussion between Reverend Monsignor Marcelo Sànchez Sorondo, Chancellor of the Pontifical Academy of Sciences, and Dr. Greg Graffin, a professor of evolutionary biology and the lead singer for Bad Religion, one of the most successful punk rock bands in history.

The Biggest Issues for the Smallest Stuff

In YR 6, CNS co-sponsored with ASU's Sandra Day O'Connor College of Law a conference on nano-regulation. Noticing that the regulation of nanotechnology is shifting from hypothetical possibilities to real issues for companies in many industries, questions around what regulation will mean for policy, business, and law come to the fore. The conference, presented by *Jurimetrics: The Journal of Law, Science, and* Technology, featured top national and international experts from government, industry, non-governmental organizations, the insurance industry and academia, including Steve Owens, assistant administrator at the Environmental Protection Agency, Robert Falkner of the London School of Economics and LSE Global Governance, and the Center's co-PI Corley. Several CNS-ASU graduate students were also in attendance.

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. Attendance increased for several fall cafes to between 90-100 people, and the cafes continued to use their format innovation – pairing a social scientist or humanist with a natural scientist or engineer. Cafés are now coordinated by the outreach coordinator and moderated by CNS-Biodesign Fellow Watkins. This year, the series developed programs collaboratively with additional ASU schools and departments interested in organizing speakers, including the School of Earth and Space Exploration through Professor Ariel Anbar and the Sigma Xi. In addition to outreach and informal education opportunities, the Science Cafes operated by CNS-ASU provide continuing education credits to in-service teachers.

Integrated promotion of Science Café events in the Phoenix metro area continued through the online events list and associated subscription listserv. Though the online event listing audience is still small, the page views have broadened promotion for these events with over 2500 views in its first year. The site advertises Science Cafes in the Phoenix area in conjunction with the Arizona Science Center's Biotech talks series and the ASU Sigma Xi Science Café, held in Tempe. The web-based events list also features short video clips from recent CNS-ASU Science Cafés: http://phoenixsciencecafe.wordpress.com/. The site also serves as a digital archive of the digital version of CNS-ASU café fliers generated for each evening. This new web presence series augments the existing visibility the cafes receive on the WGBH Science Café web site (www.sciencecafes.org). The shared online announcement vehicle reflects the CNS-ASU strategy to embed the Science Café events into the larger informal science education and cultural community in the Phoenix metro area.

Noteworthy cafes include the September café co-hosted with Sigma Xi with ASU faculty Stone and Kimbell entitled *Who Are You Calling Neanderthal? Tracing Our Ancient Ancestors* that drew over 80 participants. A second popular café in December *You are What You Eat, America's*

Relationship with Food, with ASU Biochemists Hendrickson and Lefler, was also standing room only. The closing café of the season in May will deal with the nano-silver-related topic of antimicrobials.

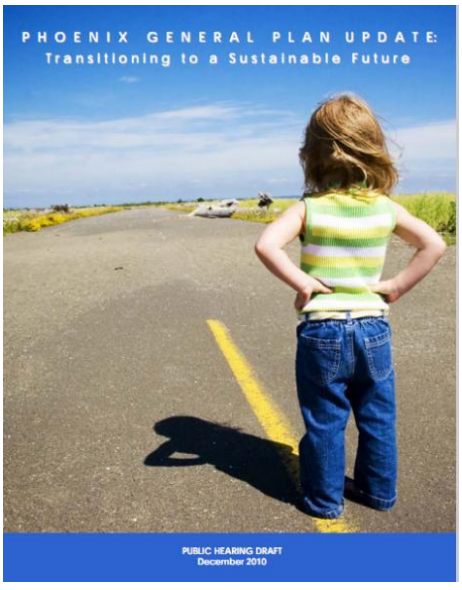
Informal Science Communication Program

During YR 6, 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 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. To date, organizers have conducted two, four-hour training sessions for new program initiates to introduce participants to social and ethical dimensions of informal science communication and to assist them in developing several practical demonstrations that are appropriate for working with all age groups at the Arizona Science Center. Beginning in Mar 10 and coinciding with a physical renovation of the main lobby area, ASU students and program organizers spent one session a week at the Science Center interacting with visitors. Faculty leads Thornton, Wetmore, and Bennett, post-doc Harsh, staff Gano, and student leaders Joshi and 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. Participants receive reimbursement for transportation and lunch. 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 Center has received enthusiastic feedback from museum program organizers and visitors in the opening weeks of this program and has plans to continue it into the coming year. In addition, Laura Martin, director of Science Interpretation at the Science Center, has recently asked CNS-ASU to collaborate on a grant application to NOVA to develop museum presentations and displays on material science. This past year the program also contributed to the Arizona Science Center's "Making Stuff" weekend in Feb 11. CNS-ASU faculty Wetmore served on the program's steering committee. During the event, CNS-ASU sponsored two days worth of graduate student presentations and an Informal Science Education Training workshop for graduate students at the museum. Over the two days, students interacted with over 500 visitors.

Anticipatory Governance in the City of Phoenix

In Sp 10, Wiek and Selin developed a collaboration with City of Phoenix to inform and update the City's General Plan. This effort involved a School of Sustainability graduate studio course, a half-day workshop with over 100 community stakeholders, and numerous research projects delivered to the City to aid in their implementation of sustainability planning and anticipatory governance. In addition to building the capacity of both city administrators and ASU students to think longer term and systematically, the collaborative process and the studio results have received broad attention and have been vividly discussed in numerous hearings, coaching sessions, and conferences over the last year. They also stimulated controversial and constructive discussions among different stakeholder groups with respect to



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technological innovation and governance regimes. The studio results have been vetted through several peer-review rounds. The most prominent result of these collaborative efforts is the incorporation of studio results into the General Plan Hearing Draft (see picture right), which is currently under review and will be presented for public vote at a later stage.

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, network partners have conducted several small-scale demonstration citizen engagement projects about emerging technologies at several home institutions including geoengineering, nanotechnology, and synthetic biology. The nature of ECAST and CNS-ASU's involvement with it are directly derived from the partnership between CNS-ASU and NISE Net and represent 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.

In particular, CNS-ASU collaborated with CSPO – its host center at ASU – to conduct two Citizens' Engagement Programs with High School Students, in the Washington, DC area (see http://www.cspo.org/projects/highschooldeliberation/). Bennett and CSPO's Mahmud Farooque organized two programs, one in geoengineering (F 10) and one in synthetic biology (Sp 11), that prepared a group of students from the Thomas Jefferson High School for Science and Technology, called on them to prepare study the issues and prepare testimony, and then testify before a mock congressional paper composed of substantive and policy experts in the respective areas.

Presentations to Public Audiences

CNS-ASU researchers have made numerous presentations to public audiences, including some 48 cumulatively to specifically policy audiences and 50 to lay audiences. Beyond those mentioned above, highlights in YR 6 include:

- Wetmore presented with students at the Arizona Science Center on "Basic Science and Nanotechnology Applications (Apr 10).
- Guston and Woodbury presented "Life Saver or Privacy Invasion? Indentifying Disease Before Symptoms" to the Spirit of the Senses salon (Nov 10).

Presentations to Policy and Professional Audiences

- Corley presented "Public Attitudes about Nanotechnology Regulation." Paper Presentation. Biggest Issues for the Smallest Stuff: Regulation and Risk Management of Nanotechnology, Phoenix, AZ (March 11)
- Guston presented "Reflections on Anticipatory Governance of Nanotechnology: Meanings for the Regulatory Environment" at the Toward Regulation of Nanomaterials: Conversation between academia, industry, law, and government, University of Notre Dame, South Bend, IN (May 10).
- Wetmore presented "Opportunities for Engaging with the Public." Asilomar International Conference on Climate Intervention Technologies, Pacific Grove, CA (Mar 10).

INTEGRATION PROGRAMS AND ACTIVITIES

STIR Workshop/Woodrow Wilson International Center for Scholars
In Feb 11, the fourth STIR project workshop was held at the Woodrow Wilson International Center for Scholars in Washington, DC. This workshop brought together policy makers, laboratory directors and doctoral students in the humanities, social sciences, natural sciences and engineering. It was open to the public and was webcast (it has since been archived on the WWIC website). It brought together 38 participants from over a dozen nations, numerous disciplinary affiliations, and both policy and non-governmental organizations - as well as many more public attendees and online viewers.

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.

The 2011 annual NNIN SEI coordinators meeting will be held in Tempe Nov 11 in conjunction with numerous other meetings constituting the Congress on Societal and Ethical Issues (SEI) Education for Scientists and Engineers. The other meetings at this time are the S.NET annual meeting (co-hosted by CNS-ASU and CNS-UCSB), two NSF-funded Ethics Education in Science and Engineering (EESE) projects ("Integrating Microethics and Macroethics in Graduate Science and Engineering Education: Development and Assessment of Instructional Models" and Introductions to the Conduct of Socially Responsible Research: Developing and Assessing Macroethics Modules for the Collaborative Institutional Training Initiative (CITI) Responsible Conduct of Research (RCR) Courses"), the NSEC SEI coordinators meeting, and the Nanoscale Informal Science Education Network (NISE Net) meeting on SEI initiatives.

Hispanic Research Center
CNS-ASU continues its productive partnership with the Hispanic Research Center. Preparations are underway for another 7-week short course entitled "Introduction to Making STEM Research Socially Relevant," planned for Fa 11. HRC funded two students in Jun 10 to attend the DC summer session.

Research Integration Presentations
CNS-ASU researchers have made a cumulative 52 presentations to audiences with a specifically technical orientation. Beyond those mentioned above, highlights in YR 6 include:

- Youtie "The use of environmental, health, and safety knowledge by nanotechnology researchers" at Nano@Tech (Oct 10).
- Guston "Anticipatory Governance of Emerging Technologies," to the Imperial College, London Institute for Systems and Synthetic Biology, London, UK (Nov 10).
- Fisher hosted the 4th STIR workshop in Washington, DC (Feb 11).

COLLABORATIONS WITH ACADEMIC COLLEAGUES

Emerging Technology and the Future of the City Lecture Series
In order to build up shared understandings and approaches with the Design School at ASU, in YR 6, CNS-ASU launched a lecture series that surveyed the future of the built environment and the role of emerging technologies in urban transformation. As described more fully in **Section 9 Research Program (TRC 2)**, speakers examined the potentials and hazards of new and upcoming materials and technologies, strategies to implement new technologies in an equitable and sustainable manner, the economic impact of nanotechnology as it relates to urban development, and ways of better understanding cities through the use of technology. More than 330 faculty, students and others attended the lectures over the year.

NanoDay@ SPP: Nanotechnology and Societal Implications Research Day
In Sep 10, Shapira, Porter and Youtie hosted a "NanoDay" to share and discuss their research on the societal implications of nanotechnology. Presentations by faculty and students in Public Policy, International Affairs, and Enterprise Innovation Institutes dealt with issues of commercialization, policy, equity and equality.

Society for the Study of Nanoscience and Emerging Technologies (S.NET)
In Oct 10, CNS-ASU faculty participated in the second annual meeting of the Society for the Study of Nanoscience and Emerging Technologies (S.NET) in Darmstadt, Germany. Youtie gave a keynote presentation "Silos or systems in emerging science domains." Shapira presented "Innovation System Dynamics and the Globalization of Nanotechnology Innovation." Selin presented on "Plausibilistic Reasoning on Nanotech Futures." Guston presented on "Nano and the City." Shapira and Youtie took part in the National Comparisons roundtable, Guston took part in the roundtable on green nanotechnology, and Selin led a roundtable on Plausibility. CNS-ASU and CNS-UCSB will host the 2011 SNET annual meeting in Tempe, AZ. Guston and Harthorn are the conference co-chairs, and Selin and Youtie are on the program committee.

Anticipatory Governance: Building Strong Collaborations
In Nov 10 Selin and Harsh organized a methods-oriented workshop at ASU to explore the challenges and dilemmas arising from collaborations among natural scientists, social scientists and humanities scholars. The morning session was sparked by several short, provocative presentations organized around the anticipatory governance framework of integration, foresight and engagement. Guston introduced anticipatory governance, Fisher and visiting researchers Dankel and Delgado (University of Bergen) presented integration programs, Frow (visiting from University of Edinburgh) and Selin presented on foresight and Calvert (University of Edinburgh) and CNS-ASU's Davies presented on engagement. In the afternoon, a panel discussion on Building Interdisciplinary Collaborations included natural science collaborators Jonathan Posner (Fulton School of Engineering, ASU) and Astrid Lagreid (The Norwegian University of Science and Technology).

Reconciling Supply and Demand TRC 2 Workshops
TRC 2 held two workshops in YR 6 that brought together diverse faculty from around ASU to map the 'demand' for solutions with the "supply" of current and prospective nanotechnology. In addition to translating, in real-time, information between and among independently oriented disciplinary actors and exploring new ideas, disseminating information and seeding future engagement through constructive and coherent activities, these workshops built new bridges across campus to disciplines previously not engaged within CNS.

ASU Resilience Conference

In Mar 11, CNS-ASU scholars Selin, Guston, Wetmore and Wiek organized a panel on "Sustainable Anticipatory Governance: Understanding Resilience, Obduracy and the Long Term in Theory and Practice." The panel explored how the concepts of anticipatory governance and sustainability have strong

common objectives rooted in greater reflexivity, producing valuable societal outcomes, and care for future generations. Anticipatory governance arose as a conceptual framing in the context of technology assessment and the need to think about the broader ethical, political and cultural dimensions of socio-technical systems early and often – before systems become locked in and less amiable to change. Sustainability science also has a nuanced approach to transition processes with a normative commitment to futures thinking. Both approaches pay attention to rigidities in over-determined systems and seek levers for evoking change towards better outcomes. Path dependency, obduracy, long-term change and promoting societal learning are key ingredients consistent with both approaches. In spite of the similarities, the difference in focus of the two (technology vs. environment) may result in different research methods and ontologies. This panel looked into the similarities and differences in the concepts and work to articulate a coherent link between these parallel perspectives. It then shifted gears to describe the ongoing efforts in applying and testing both concepts through a collaborative research project between Arizona State University and the City of Phoenix planning department. It also explored achievements as well as challenges and suggest pathways forward that can be carried out in diverse settings.

Transatlantic Workshop on Nanotechnology Research and Innovation Policy
Shapira and Youtie collaborated with the European Union Center of Excellence at Georgia Tech to hold the EU-US Transatlantic Workshop on Nanotechnology Research and Innovation Policy in Mar 10. The three-day event included speakers from the United States, Canada, China, the United Kingdom, Denmark, Finland, France and the Netherlands. CNS faculty Youtie, Shapira, Porter, Lobo and Bennett figured prominently as presenters, panelists and session chairs. Managers at the Georgia Tech Marcus Nanotechnology Center were actively involved with RTTA 1/1 researchers in the planning of this workshop, the director was a keynote
speaker, two nanotechnology company users of the center's equipment were featured speakers, as was the Vice Consul for Science and Innovation of the British Consulate-General. A symposium issue of the *Journal of Technology Transfer* published in 2011 resulted from this workshop.

Presentations to academic and professional audiences
CNS-ASU researchers have made 279 cumulative presentations to collegial academic and professional audiences. Beyond those mentioned above, highlights in YR 6 include:

- Porter, and Carley (Nov 10) presented "Three Generation Research Knowledge Tracking" and Rogers (Nov 10) presented "Citation analysis of nanotechnology at the field level" at the American Evaluation Association Conference, San Antonio, TX
- Selin, Harsh, and Fisher presented in Tokyo at the Society for the Social Studies of Science annual meeting (August 2010).
- Binder, Cacciatore, Scheufele, Shaw and Corley presented "Measuring Perceptions of Emerging Technologies: Errors in Survey Self-Reports and their Potential Impact on Communication of Public Opinion Toward Science" at the Annual Convention of the Association for Education Journalism and Mass Communication, Denver, CO (Aug 10).
- Porter, Guo, Huang and Robinson presented "Forecasting Innovation Pathways: The Case of Nano-enhanced Solar Cells" at the International Conference on Technological Innovation and Competitive Technical Intelligence, Beijing (Dec 10).

COLLABORATIONS/INTERACTIONS WITH INDUSTRY AND OTHER SECTORS

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 6 inventions to ASU's technology transfer arm,

Arizona Technology Enterprises (AZTE) and at the end of the year plan to 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.

CNS Private Sector Engagement

The coordination of CNS-ASU's private sector engagement is funded through a supplemental grant. While CNS-ASU has had a successful outreach and engagement program – particularly to the general public on the one hand and academic NSE researchers on the other – it has not yet succeeded in creating sustained interactions with the private sector. The supplement therefore is based around adding a post-doctoral researcher – Sarah Davies, hired in Oct 10 – whose primary duty is to build the Center's private sector contacts and coordinate its outreach to and engagement with them. A principal goal for Davies has been to reconceive the role of the Center's Nano Industry Liaison Committee (NILC) and, in the course of a variety of tasks supporting private sector engagement across the Center's activities, recruit a new, more active and more effective Private Sector Engagement Committee (PSEC). In addition to these specific tasks, Davies will enable other CNS-ASU programs to collaborate more closely with the private sector, e.g., to allow workshops from across the Center to more effectively recruit private sector participants and interact with private sector laboratories included in the associate STIR study. Davies is also coordinating with groups like the NanoBusiness Alliance in the US and the Arizona NanoCluster locally, and the Nanotechnologies Industry Association and the Business and Industry Advisory Committee to the OECD in Europe to ensure that CNS-ASU perspectives are represented to private sector audiences.

The main foci of activity have been to map and conceptualize CNS-ASU's private sector engagement, and to forge relationships with key nano private sector actors on the national and regional/local levels, leading up to a private sector workshop which will take place in May 11. Key activities include:

- *Inventory of existing CNS-ASU private sector engagement.* As has been detailed in previous reports, CNS-ASU has had a significant degree of engagement with nano industry and business, though this has largely been uncoordinated. Key points of contact have included workforce assessment studies; the disclosure of InnovationSpace inventions to AZTE and other private sector contact through ISpace; the completion of a STIR lab study with two private sector laboratories and follow-on publications; and the involvement of a number of individuals based in the private sector in CNS-ASU deliberative activities. Given these existing contacts, Davies' first activity was to inventory past and current activities and individual contacts and to explore how these might be developed. Through an email call to all of CNS-ASU, previous annual reports, and discussions with project leaders, Davies developed a spreadsheet showing points of contact between CNS-ASU and the private sector since the Center's inception. The spreadsheet includes details of the individual or organization engaged with, the activity and workstream this fell under, and the CNS-ASU staff who facilitated this. Some 40 points of contact were identified, from text-mining firms to Friends of the Earth, with varying degrees of formality and extent of engagement. The spreadsheet is searchable and sortable and represents an easily updated account of CNS-ASU private sector contacts which can be used to resource new research activities.
- *Organization of private sector workshop.* A key focus for this work was the re-conceptualization and organization of the NILC and PSEC. After extended discussion with senior CNS-ASU personnel, it was deemed expedient to keep these groups as flexible as possible so that they might develop alongside CNS-ASU's research with and outreach to the private sector. The creation of a static NILC, then, has been put on hold in favor of a workshop which will build CNS-ASU's reach into the private sector and which can help refine the aims and desired sites of private sector engagement. The main emphasis in the Center's private sector outreach has therefore been the

planning and organization of the May 11, which will bring together a range of CNS-ASU's existing private sector contacts, other key actors in nano industry and not-for-profit organizations, and CNS-ASU researchers. A PSEC may then be developed from those present; alternatively, the workshop may become an annual event bringing together both those with sustained interaction with CNS-ASU and new contacts with interests relevant to the coming year's research. The workshop is designed to bring together a wide range of private sector actors, including those from both national and state level organizations and from fields including business, law, private policy research, computing and high-tech industry, housing and architecture, and development-oriented NGOs. The one-day event will showcase the private sector relevance of CNS research and invite responses to and discussion of it. A major theme will be the ways in which anticipatory governance can be understood and applied in different private sector contexts. The workshop will therefore double as a contact and network building device, offering CNS-ASU an opportunity to build its interactions with key private sector actors, and as a research-oriented space to explore the meaning of anticipatory governance in different sites of nanotechnology's development.

- *Contact and network building.* In addition to the more formal activities detailed above, informal meetings, conversations and networking have also been a focus, particularly on the local (Arizona) level. Highlights include a meeting and site visit at Intel's Chandler production plant, conversations with representatives of the Arizona Technology Council and the Arizona Nano Cluster, and meetings with representatives of other local firms such as Honeywell and Axon.
- *Involvement in scholarly and policy-oriented debates*. Efforts have been made to both boost the profile of private sector-based research within CNS-ASU and to use CNS-ASU expertise within wider private sector-relevant debates. In particular, Davies, as the private sector engagement coordinator, will be contributing to an international conference on "Responsibility in Nanotechnology" (University of Padua, Italy, Jun 11) and is organizing a panel on "Nanotechnology and the Private Sector: Innovation, Governance, and Regulation" at the upcoming S.NET annual meeting (Tempe, Nov 11). CNS-ASU private sector outreach is therefore being consolidated through engagement in scholarly debates around the responsible development of nanotechnology.
- *Involvement in "STIR City" NSF proposal***.** Contacts developed in the course of local network building were used in the preparation of an NSF grant, "STIR City" which will, if funded, involve student placements within a number of local high-tech and planning and architecture firms and NGOs.

A number of key outputs are anticipated for the period up to Oct 11:

- *Workshop transcripts and report.* The May private sector workshop, which will explore how notions of anticipatory governance can be used in the private sector, will be audio-recorded for research purposes, and a public report written up from it.
- *Video interviews with key private sector actors.* Short interviews will be carried out with a number of workshop participants around private sector perspectives on responsible development and anticipatory governance. These will be video recorded and produced for the CNS-ASU website.
- *Contacts database.* Based on the inventory and on the contacts made over the last year, an updatable and searchable database will be developed for internal CNS-ASU use. This will be updated regularly to reflect CNS-ASU private sector outreach and for use as a continual resource in engaging with private sector actors.

Presentations to private sector/industrial audiences

CNS-ASU researchers have made a cumulative 28 presentations to audiences with a specifically private sector/industrial orientation. Beyond those mentioned above, highlights in YR 6 include:

- Selin (May 10) presented on "The Future of Organizing Scenarios" at the Organizational Design Forum annual meeting, Denver, CO.
- Guston (Oct 10) conducted a webinar on "Emerging Technologies and Sustainability" for the Consultative group on Biodiversity with the Center for Genetics and Society.
- Youtie (Dec 10) delivered "Anticipating developments in nanotechnology commercialization" at The Potential Economic Impacts of Nanoelectronics, Federal Reserve Bank of Dallas and the Semiconductor Industry Association, Austin, TX.

DOCUMENTARY AND VIDEO/MEDIA PROJECTS:

CNS-ASU's new 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.

Nano-Vods
Gano has made progress extending the reach of the Occasional Speaker and Science Café Series by producing and syndicating digital video captured at live events. A format, graphics and workflow for producing video features ranging from two to ten minutes in length, called Nano-vods, were produced. To date, the production team has edited ten nanovods that are now viewable in the video playlist embedded 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 Fa 09 Plausibility Project workshop, has been added. Another piece featuring interviews with the authors contributing to the second volume of the *Yearbook* premiered during Su 10 and is also available through the publisher, Springer. 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
Frank Theys, a Belgian filmmaker based in Holland, has secured funding for a documentary that will film life, work, and probing discussions about new emerging technologies in laboratories around the world. The film, *Lab Life*, is slated to feature STIR students working in the lab and has received invitations from STIR laboratories but is awaiting the next crop of students. In YR 6, Theys began filming STIR activities during their DC workshop. This documentary will be 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.

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, Selin is working to produce a film oriented around exploring the potential risk and benefits of nanotechnology in the city. The film will highlight 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 is meant to pose 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 may explore the use of the final video in spearheading a contest 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 66 international scholars, students, and policy practitioners from over 20 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, we don't count Meulin (Canada), Billerbeck (Switzerland), Bowman (Northern Ireland) or ten other international visitors who attended the fourth STIR project workshop 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 some form of support from Georgia Tech); Kim (Korea), Luk (Hong Kong), Stavrianakis (UK) and Zhu (China), who 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 between two and four 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 count Naranjo (Ecuador) and Hosono (Japan), but not the other five scholar-practitioners who comprised the same South American and Japanese delegations, respectively.

In YRs 1-5, CNS-ASU was visited by forty-nine 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 each 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 6, seventeen visitors who fit the three criteria specified visited CNS-ASU, including:

1. Maj Munch Andersen – Technical University of Denmark
2. Jane Calvert – University of Edinburgh, Scotland
3. Dorothy Jane Dankel – University of Bergen, Norway
4. Ana Delgado – University of Bergen, Norway
5. Ulrich Fiedler – Institute of Technology Assessment, Austria
6. Emma Frow – University of Edinburgh, Scotland
7. Silvio Funtowicz – European Commission, Italy
8. Noela Invernizzi – Federal University of Parana, Brazil
9. Astrid Lagreid – Norwegian University of Science and Technology, Norway
10. Federica Lucivero – University of Twente, the Netherlands
11. Bastien Miorin – Institut d'Etudes Politiques de Grenoble, France
12. Rune Nydal – Norwegian University of Science and Technology, Norway
13. Angela Guimaraes Pereira – European Commission, Italy
14. Simon Pfersdorf – Institut für Technikfolgenabschätzung und Systemanalyse, Germany
15. Jeong Yim Seo – Ewha Womans University, Korea
16. Peter Weingart – Bielefeld University, Germany

17. Galo Naranjo – Technical University of Ambato, Ecuador

CNS-ASU visitors consist of faculty, students, policy practitioners and private sector practitioners who come from eleven countries. At least eight YR 6 visitors have developed or published articles that cite Center published research or otherwise grew out of their interactions with the Center. Five have returned for follow-up visits, six have participated in Center activities organized elsewhere in the world, and at least three have hosted Center researchers who were visiting them in their native countries. Seven participated in an Oct 10 ASU workshop on Anticipatory Governance. Six are collaborators on the separately-funded STIR project.

Seven YR 6 visitors are faculty from academic institutions in Europe or South America. From a survey conducted in 09, we learned from faculty visitors that CNS-ASU has "a presence and high reputation in Europe," that it conducts "theoretically ground-breaking work," and that the Center is seen as a major hub for international networking. One visiting faculty member has reported that "in the many conferences, seminars and meetings we had in several Latin American Countries, CNS-ASU appears as a key reference and is seen as our US principal center for studying recommendations, pursuing academic endeavors, and making intellectual contacts." When a delegation of Japanese researchers "had a chance to visit the CNS-ASU was certainly the place to visit" (on so-called "not-to-miss" list). These visitors stated that collaborating with CNS-ASU was "considered strategic" for their institutions and was viewed as "of importance to our research projects."

Several of our YR 6 visitors were students. Two are involved in the STIR project, and one has made plans for a third visit. In general, all visiting graduate students receive mentorship from CNS-ASU researchers and have opportunities to present and to publish. From their accounts given in 09, we learned that CNS-ASU has provided students with formative experiences and opportunities for development. One student wrote that "the rewarding nature" of CNS-ASU's "gratifying and productive" research environment led to gains "both professionally and personally." Another reported that the ASU-based STIR workshop "influenced my thinking regarding my own research interests in the management of emerging technologies." Another states that CNS-ASU is considered to be the "best place in US for someone who is interested in innovative TA concepts, both in my view as well as in the view of people from the German TA community."

Four of the international visitors to the Center in YR 5 were policy practitioners: two work for a publicly funded technology assessment institution and two hold positions in the European Commission. At least one has hosted Center faculty within his home country and has returned for multiple follow-up visits. From the 09 accounts of policy practitioner visitors we learned that CNS-ASU is seen around the world as offering value in the public sphere. One practitioner wrote that "CNS-ASU is well known in the Netherlands for being one of the most important institutes in America for studying the relationship

between nanotechnology and society." Another reported that interactions with CNS-ASU "provided a knowledge and theory base which dramatically increases the rigor of environmental science-policy research emerging in Australia." A third stated that "we will benefit from a closer, less informal, collaboration given the competence and experience accumulated by the CNS-ASU."

Sample publications or publishing activity in YR 6 by international visitors to the Center, at its ASU and Georgia Tech locations, and that stemmed from or were shaped by their interactions with CNS-ASU include:

1. Davies, S.R., Selin, C., Gano, G., and Guimarães P.A. Under revision. "Citizen Engagement and Urban Change: Four Case Studies of Material Deliberation." *Cities.*

2. Goorden, L. and M. Deblonde. 2011. "Navigating in Nanospace: Presentation of an integrated roadmap." Final Report of the project, Nanotechnologies for Tomorrow's Society (NanoSoc). University of Antwerp, March.

3. Guo, Y., Huang, L., and Porter, A.L. 2010. "Research Profiling: Nano-enhanced, Thin-film Solar Cells." *R&D Management* 40 (2): 195-208.

4. Horst, M. Forthcoming, 2011. "Taking Our Own Medicine: On an Experiment in Science Communication." *Science and Engineering Ethics* 17(3).

5. Huang, L., Guo, Y., and Porter, A.L. 2010. "Identifying the emerging roles of nanoparticles in biosensors." *Journal of Business Chemistry* 7(1).

6. Huang, L., Peng Z., Guo, Y., and Porter, A.L. 2011. "Characterizing a Technology Development at the Stage of Early Emerging Applications: Nanomaterial-enhanced Biosensors." *Technology Analysis & Strategic Management* 23(5).

7. Laurent, B. Forthcoming, 2011. "Scholarly intervention in public engagement: The example of nanotechnology policy in France." *Science and Engineering Ethics* 17(3).

8. Pei, R., Youtie, J, Porter, A.L. Forthcoming, 2012. "Nano-biomedical Science in China: Growth and Challenges." *Technology Analysis and Strategic Management.* 24(3).

9. Pei, R, Porter, AL. Forthcoming, 2012. "Profiling Leading Scientists in Nano-Biomedical Science: Interdisciplinarity and Potential Leading Indicators of Research Directions." R&D Management.

10. Porter, A.L., Guo, Y., and Chiavetta, D. 2010. "Tech Mining: Text mining and visualization tools, as applied to nano-enhanced solar cells." *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*.

11. Ravetz, J. 2010. "Climategate: Plausibility and the blogosphere in the post-normal age." Blog post, February 9. Available: http://wattsupwiththat.com.

12. Schuurbiers, D. Forthcoming, 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(3).

13. Schuurbiers, D. 2009, March. "In Amerika. A tryptic on daily life at ASU." *TU Delta, the weekly magazine of Delft University of Technology*.

14. Schuurbiers, D. 2008. "Ethics in Action." Awarded the Mekelprize 2008 for PhD students of the Platform for Ethics and Technology.

15. Schuurbiers, D. and Fisher, E. 2009. "Lab-scale intervention." *EMBO Reports*, 10(5): 424- 427.

16. Schuurbiers, D., Osseweijer, P. and Kinderlerer, J. 2009. "Implementing the Netherlands Code of Conduct for Scientific Practice—A Case Study." *Science and Engineering Ethics.*

17. Smits, R.; van Merkerk, R.; Guston, D.H.; and Sarewitz, D. 2010. "Strategic Intelligence: The Role of TA in Systemic Innovation Policy" in *The International Handbook of Innovation Policy*. Northampton, MA: Edward Elgar.

18. te Kulve, H. and Rip, A. Forthcoming, 2011. Constructing Productive Engagement: Pre-engagement Tools for Emerging Technologies. *Science and Engineering Ethics* 17(3).

19. van Oudheusden, M. Forthcoming, 2011. Questioning "Participation": A Critical Appraisal of its Construction in a Flemish Participatory Technology Assessment. *Science and Engineering Ethics* 17(3).

20. Wang Qian, Zhu Qin & Li YiYun. 2010. "Philosophical Reflections on the Management of Nanotechnological Risks." *Chinese Science Bulletin* 55(00): 0-8.

YR 6 visits also led to or coincided with several instances of knowledge transfer, dissemination, and application. These include the co-hosting of the third STIR project workshop in Japan by Yoshizawa. We also hosted two postdocs working on the Reflexive Systems Biology, which is funded by the Norwegian Research Council and incorporates integration and foresight methods developed by the CNS-ASU, and in which both Fisher and Selin participate as senior collaborators. The project is led by Roger Strand. At the fourth STIR project workshop, Frank Theys began filming for a 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. For its third workshop in Aug 10, the STIR project brought together 15 participants, including eleven doctoral students and four faculty members from nine countries; and for its fourth workshop in Feb 11, STIR brought together over 38 participants, including 10 graduate students from 7 countries, 2 postdocs from 2 countries, 6 science policy practitioners from 3 countries, 6 laboratory directors from 4 countries, 4 private sector practitioners from 2 countries and 8 faculty members from 3 countries.

Plans for future visits and international events hosted by CNS-ASU are underway. We have a number of new and returning international visitors currently planning visits including, Gong Chao (Dalian University of Technology, China), Cecilie Glerup (Copenhagen Business School), Maja Horst (Copenhagen Business School), Miao Liao (Tsinghua University, China), and Federica Lucivero (University of Twente, the Netherlands). Glerup and Liao are each planning multiple-month visits in connection with the STIR project.

14. Personnel

In October 2010, CNS-ASU implemented some modest personnel changes associated with its renewal.

The Center is managed by a Director (Guston), an Associate Director (Miller), who focuses on education and outreach, and an Executive Committee composed of the center's PIs. In the reporting year, we have changed the slate of PIs to represent changes both at ASU and with the Center's priorities. Guston, Miller, and Corley still represent the societal dimensions research interests, and we have added Dietram Scheufele (Wisconsin) and Jan Youtie (GA Tech) to recognize the deep partnership with those subcontracting institutions. Deirdre Meldrum, recently Dean of the Ira A. Fulton Schools of Engineering, has replaced Alan Nelson as co-PI to acknowledge our shifting agenda to include greater collaboration with engineering faculty.

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

CNS-ASU has three full-time staff: Regina Sanborn, Program Manager, who reports to the Director, Michelle Iafrat, Administrative Associate, who reports to the Program Manager, and a Program Coordinator position, that reports to the Program Manager. In Aug 09, the Center hired doctoral student, Gretchen Gano, on a 75% staff line as its Education and Outreach Coordinator. While still an ASU student and a CNS-ASU affiliate, Gano accepted a professional job at Amherst College, which is why the Program Coordinator position is currently unfilled. This position, which has been recast as a full-time position, will focus on developing the Center's outreach and education programs and activities, including electronic media and event coordination.

CNS-ASU has a set of team leaders for each of its major RTTA and TRC research programs. These leaders are spread across CNS-ASU 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

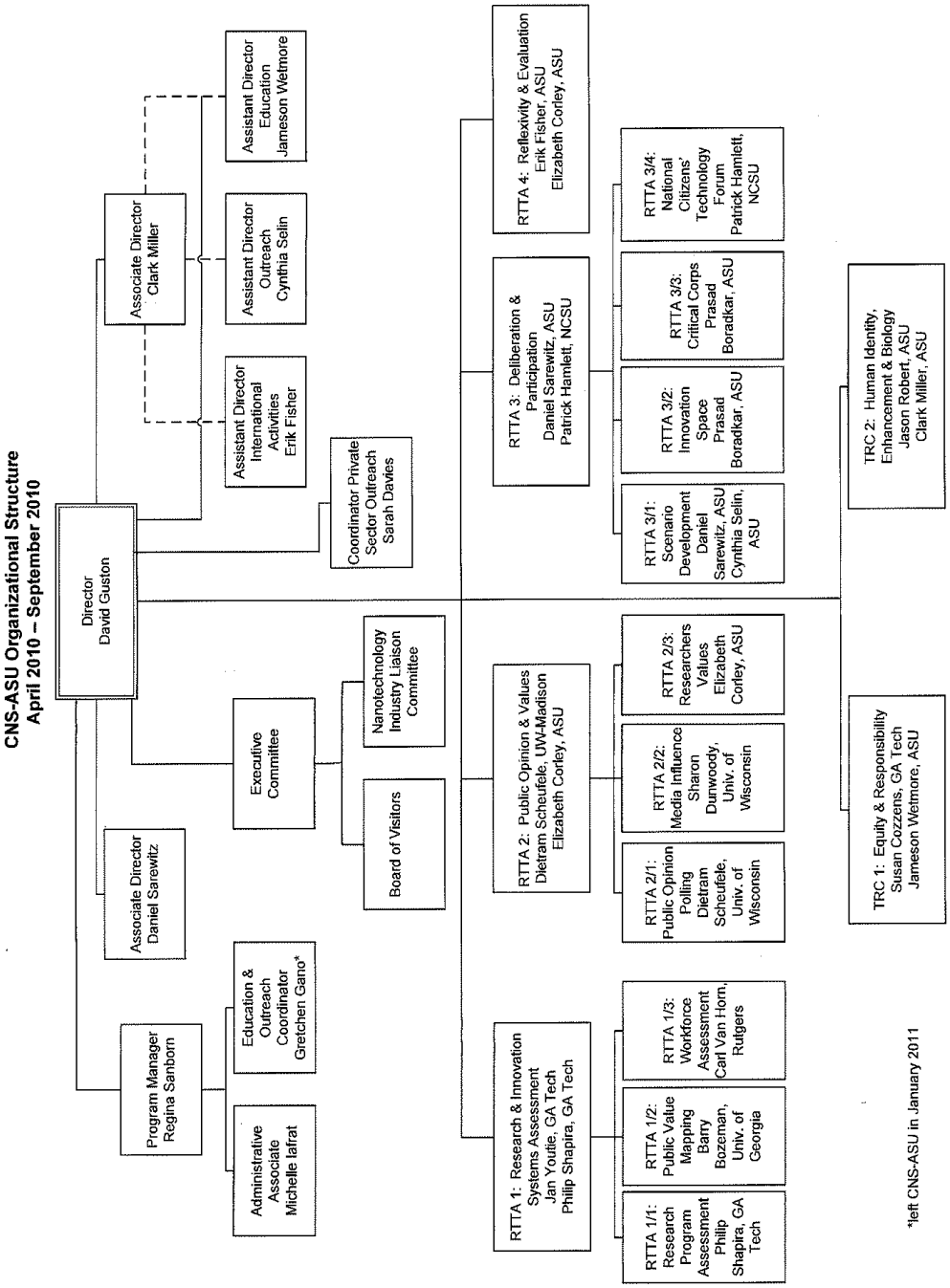
Given these changes and the rigor of establishing a new TRC, Guston reinstuted regular monthly telephone communications among the leadership in Fa 10. CNS-ASU also communicates internally through a regular lab meeting, held every other week, for personnel at ASU, and regular lab meetings held at similar intervals among the Wisconsin and GA Tech groups. 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 coming year, CNS-ASU will hold it All-Hands meeting 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.


CNS-ASU Organizational Structure
April 2010 – September 2010
Director
David Guston
Associate Director
Clark Miller
Assistant Director
Education
Jameson Wetmore
Assistant Director
Outreach
Cynthia Selin
Assistant Director
International
Activities
Erik Fisher
Coordinator Private
Sector Outreach
Sarah Davies
Associate Director
Daniel Sarewitz
Program Manager
Regina Sanborn
Education &
Outreach
Coordinator
Gretchen Gano*
Administrative
Associate
Michelle Iafrat
Executive
Committee
Nanotechnology
Industry Liaison
Committee
Board of Visitors
RTTA 1: Research & Innovation
Systems Assessment
Jan Youtie, GA Tech
Philip Shapira, GA Tech
RTTA 2: Public Opinion & Values
Dietram Scheufele, UW-Madison
Elizabeth Corley, ASU
RTTA 3: Deliberation &
Participation
Daniel Sarewitz, ASU
Patrick Hamlett, NCSU
RTTA 4: Reflexivity & Evaluation
Erik Fisher, ASU
Elizabeth Corley, ASU
RTTA 1/1:
Research
Program
Assessment
Philip
Shapira, GA
Tech
RTTA 1/2:
Public Value
Mapping
Barry
Bozeman,
Univ. of
Georgia
RTTA 1/3:
Workforce
Assessment
Carl Van Horn,
Rutgers
RTTA 2/1:
Public Opinion
Polling
Dietram
Scheufele,
Univ. of
Wisconsin
RTTA 2/2:
Media Influence
Sharon
Dunwoody,
Univ. of
Wisconsin
RTTA 2/3:
Researchers
Values
Elizabeth
Corley, ASU
RTTA 3/1:
Scenario
Development
Daniel
Sarewitz, ASU
Cynthia Selin,
ASU
RTTA 3/2:
Innovation
Space
Prasad
Boradkar, ASU
RTTA 3/3:
Critical Corps
Prasad
Boradkar, ASU
RTTA 3/4:
National
Citizens'
Technology
Forum
Patrick Hamlett,
NCSU
TRC 1: Equity & Responsibility
Susan Cozzens, GA Tech
Jameson Wetmore, ASU
TRC 2: Human Identity,
Enhancement & Biology
Jason Robert, ASU
Clark Miller, ASU
*left CNS-ASU in January 2011

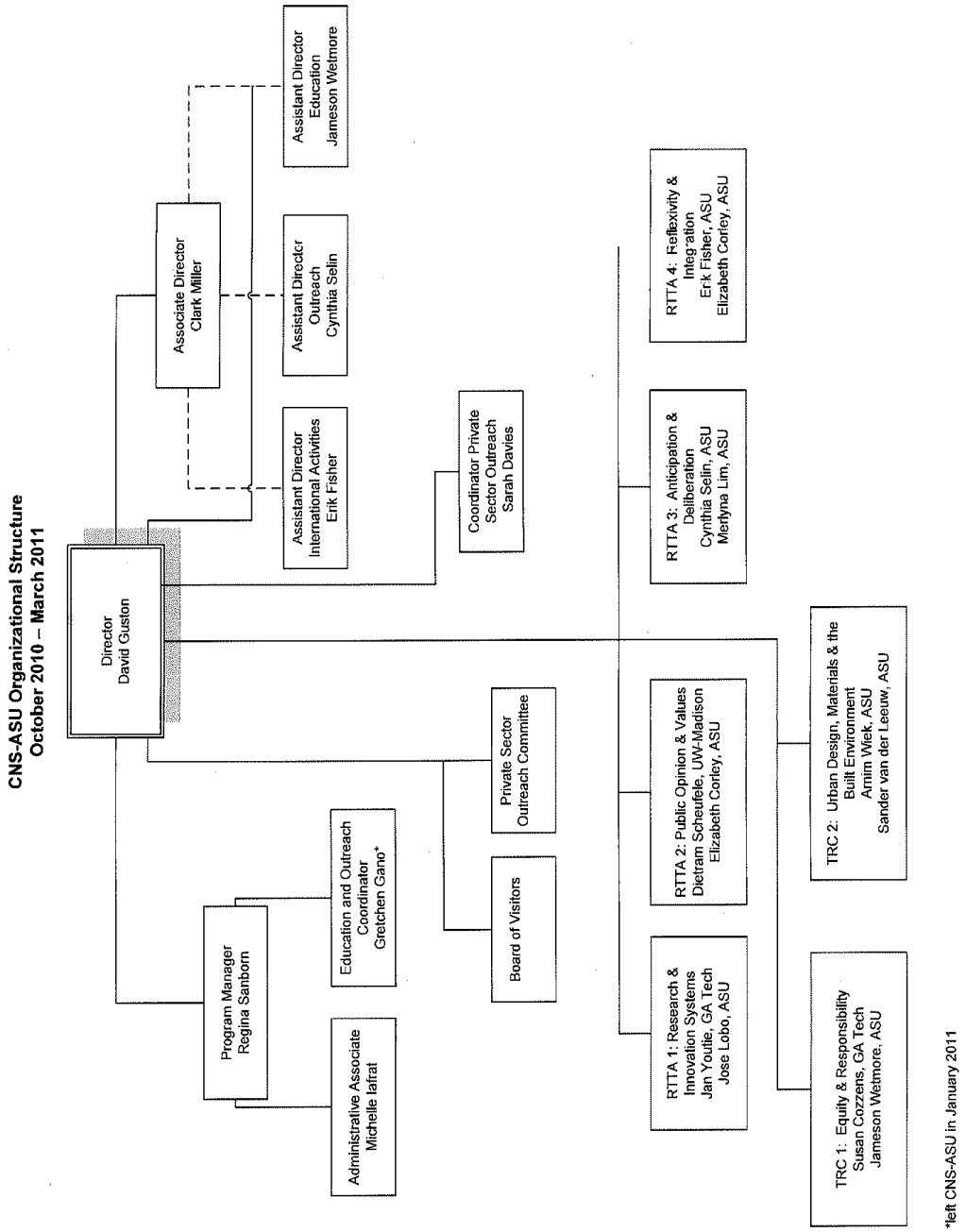

CNS-ASU Organizational Structure
October 2010 – March 2011
Director
David Guston
Associate Director
Clark Miller
Assistant Director
Education
Jameson Wetmore
Assistant Director
Outreach
Cynthia Selin
Assistant Director
International Activities
Erik Fisher
Coordinator Private
Sector Outreach
Sarah Davies
Program Manager
Regina Sanborn
Administrative Associate
Michelle Iafrat
Education and Outreach
Coordinator
Gretchen Gano*
Private Sector
Outreach Committee
Board of Visitors
RTTA 1: Research &
Innovation Systems
Jan Youtie, GA Tech
Jose Lobo, ASU
RTTA 2: Public Opinion & Values
Dietram Scheufele, UW-Madison
Elizabeth Corley, ASU
RTTA 3: Anticipation &
Deliberation
Cynthia Selin, ASU
Merlyna Lim, ASU
RTTA 4: Reflexivity &
Integration
Erik Fisher, ASU
Elizabeth Corley, ASU
TRC 1: Equity & Responsibility
Susan Cozzens, GA Tech
Jameson Wetmore, ASU
TRC 2: Urban Design, Materials & the
Built Environment
Arnim Wiek, ASU
Sander van der Leeuw, ASU
*left CNS-ASU in January 2011

Table 4A: NSEC Personnel, Irrespective of Citizenship

Personnel Type	Total	Gender		Citizenship Status / U.S. Citizen or Permanent Resident — Race						Mixed-incl.	Mixed		Other Non-US	*Ethnicity Hispanic	Disabled	% NSEC Dollars
		Male	Female	NA	PI	AA	C	A	NA,PI,AA	C,A	Not Provided					
Director	1	1					1									0%
Asc. Dir.	1	1					1									0%
Team Leaders	11	6	5	1			9	1					1			50%
Staff	3	0	3				3									100%
Collaborators	158	105	53	1			142	15					3			0%
Research																
Post Docs	6	4	2				4	2								50%
Doc/Mas. Students	101	60	41				70	31					11			100%
Undergraduate Students	40	25	15	1		1	30	8					4			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	**321**	**202**	**119**	**3**	**0**	**1**	**260**	**57**				**0**	**19**	**0**		

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

Personnel Type	Total	Gender		Race					Mixed-incl.	Mixed		Other Non-US	*Ethnicity Hispanic	Disabled	% NSEC Dollars
		Male	Female	NA	PI	AA	C	A	NA,PI,AA	C,A	Not Provided				
Director	1	1					1								0%
Asc. Dir.	1	1					1								0%
Team Leaders	11	6	5	1			9	1					1		50%
Staff	3		3				3								100%
Collaborators	131	91	40	1			117	13					5		0%
Research															
Post Docs	5	4	1				3	2							50%
Doc/Mas. Students	51	26	25				50	1					1		100%
Undergraduate Students	29	17	12	1		1	27						3		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	**232**	**146**	**86**	**3**	**0**	**1**	**211**	**17**				**0**	**10**	**0**	

15. Publications, Patents and Press

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

Books

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

2. ‡**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.

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

4. ‡**Guston, David H.** (ed.). 2010. *Encyclopedia of Nano-science and Society (two volumes)*. Thousand Oaks, CA: Sage Publications.

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

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

7. ‡**Hays, Sean**, **Jason S. Robert**, **Clark A. Miller** and **Ira Bennett** (ed.). Forthcoming, 2011. *Yearbook of Nanotechnology in Society, Volume III: Nanotechnology, the Brain, and the Future*. New York, NY: Springer.

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

9. **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**. Forthcoming, 2011. "Retrospective View of the U.S. National Nanotechnology Initiative." *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**. Under review, "Journalistic Coverage of Nano Neuroscience." *The Handbook of Nanotechnology in Society*.

6. ‡**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.

7. ‡**Cozzens, Susan** and **Jameson Wetmore**. "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.

8. ‡**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.

9. ‡**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.

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

11. ‡**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).

12. ‡**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.

13. ‡**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.

14. ‡**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.

15. ‡**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.

16. ‡**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.

17. ‡**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.

18. **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.

19. ‡**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.

20. ‡**Harsh, Matthew**. 2011. "Equity and Participation in Decisions: What can Nanotechnology Learn from Biotechnology in Kenya." *Yearbook of Nanotechnology in Society, Volume II: Nanotechnology and the Challenges of Equity, Equality, and Development*, eds. Susan Cozzens and Jameson Wetmore, 251-269. New York, NY: Springer.

21. **Hogle, Linda F.** 2008. "Emerging Medical Technologies." *The Handbook of Science and Technology Studies, Third Edition*, eds. Edward J. Hackett, Olga Amsterdamska, Michael Lynch and Judy Wajcman, 841-74. Cambridge, MA: MIT Press.

22. Johnson, Deborah G. and **Jameson Wetmore**. 2008. "STS and Ethics: Implications for Engineering Ethics." *The Handbook of Science and Technology Studies, Third Edition*, eds. Edward J. Hackett, Olga Amsterdamska, Michael Lynch and Judy Wajcman, 567-82. Cambridge, MA: MIT Press.

23. ‡**Karinen, Risto** and **David H. Guston**. 2010. "Toward Anticipatory Governance: The Experience with Nanotechnology." *Governing Future Technologies: Nanotechnology and the Rise of an Assessment Regime*, eds. M. Kaiser, M. Kurath, S. Maasen and C. Rehmann-Sutter, 217-232. Dordrecht, The Netherlands: Springer.

24. ‡**Kay, Luciano** and **Philip Shapira**. 2011. "The Potential of Nanotechnology for Equitable Economic Development: The Case of Brazil." *Yearbook of Nanotechnology in Society, Volume II: Challenges of Equity, Equality, and Development*, eds. Susan Cozzens and Jameson Wetmore. New York, NY: Springer.

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8. ‡Fremling, A. 2008. *SCIO: An Innovative Health Product that Uses Nanotechnology to Monitor for Cancer*. Undergraduate Honors Thesis. Barrett Honors College, Arizona State University. Tempe, AZ.

9. **Gallo, Jason**. 2008. *Speaking of Science: The Role of the National Science Foundation in the Development of the United States Information Infrastructure*. Doctoral Dissertation. Media, Technology and Society, Northwestern University, Evanston, IL.

10. Hall, Hannah. 2011. *Nanotechnology Applications in Urban Sustainability: An Innovative Solution to Electronic Waste Management*. Undergraduate Honors Thesis. Innovation Space, Arizona State University, Tempe, AZ.

11. ‡**Hays, Sean**. 2009. A Genealogical Examination and Grounded Theory of the Role of Human Enhancement Technology in American Political Culture. Doctoral Dissertation. School of Politics and Global Affairs, Arizona State University, Tempe, AZ.

12. ‡**Ho, Shirley S.** 2008. *Value Predispositions, Communication, and Attitudes Toward Nanotechnology: The Interplay of Public and Experts*. Doctoral Dissertation. Philosophy, University of Wisconsin, Madison, WI.

13. **Lappe, Jason**. 2009. *Photoreactivation and Positive Cell Selection for the Directed Evolution of Proteins*. Doctoral Dissertation. Chemistry and Biochemistry, Arizona State University, Tempe, AZ.

14. ‡Lee, C. 2009. *Innovation in Nanotechnology Services and Products: Strategic Marketing Plan*. Undergraduate Honors Thesis. Barrett Honors College, Arizona State University. Tempe, AZ.

15. ‡**Leung, Ricky**. 2007. *Doing Nanotechnology in 21 Century China*. Doctoral Dissertation. Sociology, University of Wisconsin, Madison, WI.

16. ‡Lidberg, Shannon. 2008. *Examining Potential Futures: A Designers Toolbox for Identifying Potential Social and Cultural Implications*. Master's Thesis. School of Design, Arizona State University, Tempe, AZ.

17. ‡Lohmeier, Stephanie. 2008. *Innovation Space: Nanotechnology for Human Health*. Undergraduate Honors Thesis. Barrett Honors College, Arizona State University. Tempe, AZ.

18. ‡Lougee, M. 2009. *Bridging Technology and Environment to Provide Shelter for Natural Disaster Victims*. Undergraduate Honors Thesis. Innovation Space, Arizona State University. Tempe, AZ.

19. ‡Lowder, Jessica. 2008. *Creating Sustainable Solutions with Nanotechnology, Energy, and Equity for Natural Disaster Victims*. Undergraduate Honors Thesis. Innovation Space, Arizona State University, Tempe, AZ.

20. ‡Lull, Madeline. 2008. *Innovation Space Strategic Marketing Plan for Braille PDA*. Undergraduate Honors Thesis. Barrett Honors College, Arizona State University. Tempe, AZ.

21. **Maricle, Genevieve**. 2008. *Shaping Science: How to Turn Science Studies into Science Action*. Doctoral Dissertation. Environmental Studies, University of Colorado, Boulder, CO.

22. ‡McIntosh, Daniel. 2008. *Integrated New Product Development for Nanotechnology*. Undergraduate Honors Thesis. Barrett Honors College, Arizona State University. Tempe, AZ.

23. ‡Mellinger, Michelle. 2011. *Innovation Space and The Center for Nanotechnology in Society: Creating an Educational Energy Harvesting Playground*. Undergraduate Honors Thesis. Innovation Space, Arizona State University, Tempe, AZ.

24. Merkerk, Rutger van. 2008. *Intervening in Emerging Nanotechnologies: A CTA of Lab-on-a-chip Technology*. Doctoral Dissertation. Innovation & Environmental Sciences, University of Twente, The Netherlands.

25. ‡Milford, Richard. 2008. *A Dialog on Nanotechnology and Religion: New Methods in Public Engagement*. Undergraduate Honors Thesis. Barrett Honors College, Arizona State University. Tempe, AZ.

26. ‡**Panjwani, Azra**. 2007. *The Psychological Impact of Mass Surveillance on Society: A Quantitative Approach*. Master's Thesis. Department of Mathematics, Arizona State University, Tempe, AZ.

27. Philbrick, Mark. 2010. *Operationalizing Anticipatory Governance: Steering Emerging Technologies Towards Sustainability*. Doctoral Dissertation. Graduate Division, University of California, Berkeley, Berkeley, CA.

28. Pirtle, Zach. 2007. *Democratizing Nanotechnology: Intersecting the Philosophy of Science with Science Policy*. Undergraduate Honors Thesis. The Barrett Honors College, Arizona State University. Tempe, AZ.

29. ‡Sandler, Shane. 2011. *Nano-piezoelectrics for Energy Generation*. Undergraduate Honors Thesis. Innovation Space, Arizona State University, Tempe, AZ.

30. ‡Schnell, Dusana. 2008. *Innovation Space: Creating Sustainable Solutions with Nanotechnology, Energy and Equity for Native Americans Living Off the Electricity Grid*. Undergraduate Honors Thesis. Innovation Space, Arizona State University. Tempe, AZ.

31. **Schuurbiers, Daan**. 2009. *Social Responsibility in Scientific Practice*. Doctoral Dissertation. Department of Biotechnology, Delft Technical University, Delft, The Netherlands.

32. ‡Shaw, T. 2007. *An Innovation Space Addendum: An Analysis and Critique of the Dialog Design, with the Presentation of Alternate Designs and Implications*. Undergraduate Honors Thesis. The Barrett Honors College, Arizona State University. Tempe, AZ.

33. ‡Shih, Tsung-Jen. 2009. *Public Opinion and Nanotechnology: Linking Psychological and Cultural Factors in Constructing an Integrated Theory of Public Understanding of Science*. Doctoral Dissertation. School of Journalism and Mass Communication, University of Wisconsin, Madison, WI.

34. ‡Silverman, A. 2007. *Healing the Blind? Perspectives of Blind Persons on Methods to Restore Sight*. Undergraduate Honors Thesis. The Barrett Honors College, Arizona State University. Tempe, AZ.

35. **Spadola, Quinn Acelia**. 2008. *Novel Approaches to DNA Sequencing*. Doctoral Dissertation. Department of Physics, Arizona State University, Tempe, AZ.

36. ‡**Tang, Li**. 2010. *U.S.-China Scientific Collaboration and the Role of Knowledge Moderation in Nanotechnology Development*. Doctoral Dissertation. School of Public Policy, Georgia Institute of Technology, Atlanta, GA.

37. ‡Tassielo, L. 2009. *Undergraduate Honors Thesis*. Innovation Space, Arizona State University, Tempe, AZ.

38. ‡Verdiani, J. 2008. *Undergraduate Honors Thesis*. Innovation Space, Arizona State University, Tempe, AZ.

39. ‡**Wang, Jue**. 2007. *Resource Spillover from University to High Tech Industry: Evidence from New Nanotechnology Based Firms in the U.S*. Doctoral Dissertation. School of Public Policy, Georgia Institute of Technology, Atlanta, GA.

Presentations

1. **Allenby, Braden**. August, 2006. "Schumpeters Next Wave: Convergence of Nanotechnology, Biotechnology, Information Science, and Cognitive Science." Chaired and contributed to the session. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

2. Anbar, Ariel and Michael E. Smith. February 19, 2010. "The End of Earth: If Not in 2010, Then When." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

3. **Anderson, Ashley A.**, **Dietram A. Scheufele** and **Dominique E. Brossard**. May, 2010. "Trust in Scientists: The Role of Media in Establishing Trust in Sources of Information about Nanotechnology." Presentation. Annual Convention of the World Association for Public Opinion Research, Chicago, IL.

4. **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.

5. **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.

6. **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.

7. **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.

8. **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.

9. **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.

10. **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.

11. **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.

12. **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.

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

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

15. **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.

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

17. **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.

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

19. **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.

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

21. 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.

22. 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.

23. **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.

24. **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.

25. 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.

26. 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.

27. 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.

28. 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.

29. 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.

30. 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.

31. ‡Cacciatore, Michael A., Doo-Hun Choi, **Dietram A. Scheufele** and **Elizabeth A. Corley**. Under review, "Unpacking the Relationships Between Religiosity, Deference to Scientific Authority and Support for Nanotechnology: A Structural Equation Modeling Approach." Paper submission. 3rd annual S.NET Conference, Tempe, AZ.

32. 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.

33. 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.

34. **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.

35. **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.

36. 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.

37. **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.

38. **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.

39. **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.

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

41. 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.

42. **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.

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

44. **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.

45. **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.

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

47. **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.

48. **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.

49. **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.

50. **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.

51. **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.

52. **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.

53. **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.

54. **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.

55. **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.

56. **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.

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

58. **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.

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

60. **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.

61. **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.

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

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

64. **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.

65. **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.

66. 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.

67. 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.

68. 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.

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

70. **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.

71. **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.

72. **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.

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

74. **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.

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

76. **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.

77. **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.

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

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

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

81. **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.

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

83. **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.

84. **Fisher, Erik.** May, 2009. "Inquiry and Nanotechnology." *Human Practices Workshop.* University of California at Berkeley. Berkeley, California. 18 May 2009.

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

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

87. **Fisher, Erik**. January, 2009. "STIR Project Overview." *STIR Workshop 1: Constructing Foundations*. Arizona State University. Tempe, Arizona. January 17-19.

88. **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.

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

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

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

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

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

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

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

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

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

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

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

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

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

102. **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.

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

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

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

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

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

108. **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.

109. **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.

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

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

112. **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, October 28-31.

113. **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, December 4.

114. **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.

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

116. **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.

117. **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.

118. 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.

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

120. **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.

121. 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.

122. 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.

123. 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.

124. 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.

125. **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.

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

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

128. **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.

129. **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.

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

131. **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.

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

133. **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.

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

135. **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.

136. **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.

137. **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.

138. **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.

139. **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.

140. **Guston, David H.** December, 2009. "Anticipatory Governance at the Center for Nanotechnology in Society." Lecture. ESRC Critical Public Engagement Seminar. Durham University, Durham, UK.

141. **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.

142. **Guston, David H.** October, 2009. "Genealogies of Anticipatory Governance." Presentation. Annual Meeting of the Society for Social Studies of Science, Washington, DC.

143. **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.

144. **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.

145. **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.

146. **Guston, David H.** June, 2009. "Anticipatory Governance of Emerging Technologies." Presentation. NINE Summer Students Program. Sandia National Laboratory, Sandia, NM.

147. **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.

148. **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.

149. **Guston, David H.**, et al. March 09, 2009. "Nanotechnology and the Public: Data for Decision Makers." Briefing. U.S. Congressional Nanotechnology Caucus, Washington, DC.

150. **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.

151. **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.

152. **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.

153. **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.

154. **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.

155. **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.

156. **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.

157. **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.

158. **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.

159. **Guston, David H.** April 04, 2008. "Governing Emerging Technologies." Presentation. Arizona Institute of Nanoelectronics opening ceremonies, Tempe, AZ.

160. **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.

161. **Guston, David H.** November, 2007. "Toward Anticipatory Governance of Emerging Technologies." Presentation. Special Series on Science and Public Policy, Brown University, Providence, RI.

162. **Guston, David H.** November, 2007. "Governing Emerging Technologies." Presentation. Spirit of the Senses Salon, Phoenix, AZ.

163. **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.

164. **Guston, David H.** December, 2006. "Anticipatory Governance of Emerging Technologies." Presentation. Monthly meeting of the Arizona Nanotechnology Cluster, Tempe, AZ.

165. **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.

166. **Guston, David H.** August, 2006. "Anticipatory Governance of Emerging Technologies." Presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

167. **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.

168. **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.

169. **Guston, David H.** April, 2006. "Social Science Engages Nanotechnology." Invited talk. Virginia Tech, Blacksburg, VA.

170. **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.

171. **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.

172. **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.

173. **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.

174. **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.

175. **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.

176. **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.

177. **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.

178. **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.

179. **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.

180. **Hays, Sean**. March, 2009. "Transhumanism, Anti-humanism, and Nietzsche's Overman." Presentation. Human Enhancement & Nanotechnology, Western Michigan University, Kalamazoo, MI.

181. **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.

182. 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.

183. **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.

184. **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.

185. **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.

186. **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.

187. **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.

188. **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.

189. **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.

190. **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.

191. 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.

192. 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.

193. 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.

194. 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.

195. 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.

196. 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.

197. **Johnston, Stephen** and **Joan McGregor**. September, 2006. "Predicting Your Medical Future (Doc-in-a-Box)." CNS-ASU Science Cafe, Changing Hands Bookstore, Tempe, AZ.

198. 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.

199. **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.

200. **Kavazanjian, Edward** and **Tim Lant**. April 15, 2011. "Disasters in Arizona: Are We Prepared." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

201. **Kay, Luciano**. October, 2009. "The Emergence of Nanotechnology Enterprise in Brazil." Presentation. 2nd Manchester International Workshop on Nanotechnology, Society and Policy, Manchester, UK.

202. **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.

203. **Kay, Luciano**. May, 2009. "Developing Nanotechnology in Latin America." Poster presentation. NSF Site Visit for CNS Renewal, Tempe, AZ.

204. **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.

205. **Kay, Luciano**. January, 2009. "Nanotechnology Research Networks in Brazil." Poster presentation. CNS All Hands Meeting, Tempe, AZ.

206. **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.

207. **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.

208. **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.

209. **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.

210. 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.

211. Ladwig, P., 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.

212. **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.

213. 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.

214. 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.

215. 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.

216. Lidberg, Shannon. March, 2008. "Examining Potential Futures: A Designer's Toolbox for Identifying Potential Social and Cultural Implications." Presentation. ST Global Conference, Washington, DC.

217. **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.

218. **Lindsay, Stuart**, **Roy Curtiss** and **David H. Guston**. May 18, 2007. "Forbidding Science: Are There Things We Just Shouldn't Know." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

219. **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.

220. **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.

221. **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.

222. **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.

223. **Maricle, Genevieve**. January, 2008. "The State of Policy and Socio-Economic Research." Presentation. American Meteorological Society Annual Meeting, New Orleans, LA.

224. **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.

225. **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.

226. **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.

227. McKeon, Patrick. September 23, 2008. "State-Level Nanotechnology Policy Initiatives and Implications for Georgia." Presentation. Nano@Tech, Georgia Institute of Technology, Atlanta, GA.

228. McKeon, Patrick. 2008. "State-Level Nanotechnology Policy Initiatives and Implications for Georgia." Presentation. Fresh Perspectives on Economic Development, Atlanta, GA.

229. **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.

230. 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.

231. 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.

232. 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.

233. **Miller, Clark A.** September, 2010. "Readying Citizens for Anticipatory Governance: A Challenge for Science Museums." Presentation. NISE Network Meeting, San Francisco, CA.

234. **Miller, Clark A**. March, 2010. "Innovation: Thoughts on Science, Technology, Transformation, and Valuation." Talk. Manifolds-A Social Innovation Symposium, Fergus, Canada.

235. **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.

236. **Miller, Clark A.** March, 2009. "Imagining the Future: Can Science Fiction Help Us Govern Technology." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

237. **Miller, Clark A.** 2009. "Themes in Nanotechnology in Society Research." Talk. Nanoscale Informal Science Education Annual Meeting, San Francisco, CA.

238. **Miller, Clark A.** 2009. "Nanotechnology: Environment, Health, and Safety." Talk. Semiconductor Environment, Safety, and Health Association, Scottsdale, AZ.

239. **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.

240. **Miller, Clark A.** December 09, 2006. "Boundary Organizations: Strategies for Linking Knowledge to Action." Presentation. Workshop on Boundary Organizations, Tempe, AZ.

241. **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).

242. **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.

243. **Miller, Clark A.** June, 2006. "Think Differently! Strategies for Success in Nano." Presentation. Food Research Institute, University of Wisconsin-Madison, Madison, WI.

244. **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.

245. **Miller, Clark A.** March, 2006. "Nanotechnology in Society." Presentation. Ohio State University, Columbus, OH.

246. **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.

247. **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.

248. Moore, Ana. September 27, 2006. "Renewable Energy Through Photosynthesis." Talk. CNS-ASU Science Cafe, Friendly House, Phoenix, AZ

249. Newman, Nils. November, 2006. "Nanotechnology Research Mapping and Assessment." Presentation. STI Indicators Conference, Leuven, Belgium.

250. 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.

251. 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.

252. 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.

253. Philbrick, Mark. September, 2009. "Operationalizing Anticipatory Governance: Steering Emerging Technologies Towards Sustainability" Presented at the inaugural meeting of the Society for the Study of Nanoscale and Emerging Technologies, Seattle, WA, 8-11 September 2009.

254. Philbrick, Mark. 2009. "The National Citizens' Technology Forum: Lessons for the Future" (presented at the annual meeting of the Society for the Social Studies of Science, Washington, DC, 28 October – 1 November 2009).

255. **Porter, Alan L.** December, 2010. "Profiling and Knowledge Tracking." Presentation. Chinese Academy of Sciences Library, Beijing.

256. **Porter, Alan L.** November, 2009. "Assessing Nanotechnology: Research Metrics and Maps." Presentation. American Evaluation Association Annual Conference, Orlando, FL.

257. **Porter, Alan L.** August, 2009. "Locating Nanotechnology among the Disciplines, Nano @ Tech."

258. **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.

259. **Porter, Alan L.** October, 2007. "Public Lecture." Institute for S&T Information, Beijing, China.

260. **Porter, Alan L.** November 15, 2006. "Mining Patents and Research Publications to Improve Technology Management: Nano Illustrations." Presentation. 2nd PATINEX Conference, Seoul, South Korea.

261. **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.

262. **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.

263. **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.

264. **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.

265. **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.

266. **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.

267. **Porter, Alan L.** and **Jayesh Patil**. March, 2007. "Where Is Nano Going?" Presentation. Nano-Giga Challenges, Phoenix, AZ.

268. **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.

269. **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.

270. **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.

271. **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.

272. **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.

273. **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.

274. **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.

275. **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.

276. **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.

277. **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.

278. **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.

279. **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.

280. **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.

281. **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.

282. **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.

283. **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.

284. **Robert, Jason S.** January, 2009. "Technology and Human Enhancement: Whats the Connection." Presentation. Midwestern University, Glendale, AZ.

285. **Robert, Jason S.** June, 2007. "Braving the Brain." Presentation. Canadian Bioethics Society, Toronto, Canada.

286. **Robert, Jason S.** May, 2007. "Cyborgs, Ratbots, and Bionic Humans: Wiring Brains to Machines." Presentation. Discovery Center, Halifax, Nova Scotia, Canada.

287. **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.

288. **Robert, Jason S.** April, 2007. "Problematizing Enhancement." Presentation. Dartmouth College, N, Hanover, NH.

289. **Robert, Jason S.** February, 2007. "Braving the World of Neurotechnology." Presentation. Health Law Institute Seminar Series, Dalhousie University, Nova Scotia, Canada.

290. **Robert, Jason S.** October, 2006. "Brain Repair and Neural Enhancement." 4S Conference (Society for Social Studies of Science), Vancouver, Canada.

291. **Robert, Jason S.** October, 2006. "Nanotechnology, Neurotechnology, and Society." Presentation. Institute of Nanotechnology Symposium, Northwestern University, Evanston, IL.

292. **Robert, Jason S.** October, 2006. "Forbidden Science Boundaries on New Emerging Science and Technology." Presentation. Jewish Women's Symposium, Tempe, AZ.

293. **Robert, Jason S.** August, 2006. "Controversial Science, Controversial Scientist." Presentation. NABIS Conference, Chicago, IL.

294. **Rogers, Juan D.** December, 2010. "Publication Patterns and Collaborative Work at NSECs." Presentation. 2010 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA.

295. **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.

296. 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.

297. 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.

298. 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.

299. **Sarewitz, Daniel**. October, 2008. "Paths to Outcomes Based Innovation Policy." Presentation. National Institutes of Health Science of Science Management Meeting, Bethesda, MD.

300. **Sarewitz, Daniel**. September, 2008. "Science Policy and Innovation." Presentation. Presidential Council of Advisors on Science and Technology, Washington, DC.

301. **Sarewitz, Daniel**. November 26, 2007. "New Tools for Science Policy Making." Presentation. Harvard University, Science, Technology, and Society Circle, Cambridge, MA.

302. **Sarewitz, Daniel**. October, 2007. "Anticipatory Governance of Emerging Technologies: Competing Values, Irreducible Uncertainties, and Transformation Innovation." Presentation. University of Oviedo, Oviedo, Spain.

303. **Sarewitz, Daniel**. October, 2007. "Technology and Effectiveness in Contested Political Settings, Center for Research on Energy, Environment, and Transportation." Presentation. CIEMAT, Madrid, Spain.

304. **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.

305. **Sarewitz, Daniel**. March, 2007. "Connecting Research to Social Outcomes." Presentation. Presentation to the University of Nebraska Board of Regents, Lincoln, NE.

306. **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.

307. **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.

308. **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.

309. **Sarewitz, Daniel** and Roy Curtis. May 18, 2007. "Forbidding Science: Are There Things We Just Shouldnt Know." Talk. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

310. **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.

311. **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.

312. **Scheufele, Dietram A.** February, 2008. "Engaging Religious Audiences on Nanotechnology." Presentation. Annual Convention of the American Association for the Advancement of Science, Boston, MA.

313. **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.

314. **Scheufele, Dietram A.** March 16, 2007. "Public Perceptions and Understandings of Nanotechnology." Presentation. Nano and Giga Challenges in Electronics and Photonics conference, Tempe, AZ.

315. **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.

316. **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.

317. **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.

318. **Scheufele, Dietram A.** 2006. "Influences on Public Opinion About Nanotechnology." Presentation. Public Participation in Nanotechnology & Nanoscale Science workshop, National Nanotechnology Coordination Office, Washington, DC.

319. **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.

320. **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.

321. **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.

322. **Scheufele, Dietram A.** 2006. "Successful Public Communication About Nanotechnology." Talk. Integration of Societal Implications into Science workshop, U.S. Department of Energy, Washington, DC.

323. **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.

324. **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.

325. **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.

326. **Schuurbiers, Daan**. May 04, 2009. In and Out of the Lab." Lab Meeting. Center for Bioenergy and Photosynthesis, Arizona State University, Tempe, AZ.

327. **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.

328. **Schuurbiers, Daan**. January 17, 2009. "Can Shadows Shed Light." Presentation. STIR Workshop 1: Constructing Foundations, Tempe, AZ.

329. **Schuurbiers, Daan**. January 15, 2009. "Midstream Modulation as Part of a PhD on Social Responsibility in Science." Presentation. CNS All Hands Meeting, Tempe, AZ.

330. **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.

331. **Selin, Cynthia**. March 14, 2011. "Rethinking Urban Governance: Knitting together Foresight and Sustainability." Presentation. Resilience 2011, Arizona State University, Tempe, AZ.

332. **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.

333. **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.

334. **Selin, Cynthia**. December, 2010. "Plausibility Reasoning and Nanotechnology Futures." Presentation. Salt Lake City, UT.

335. **Selin, Cynthia**. November, 2010. "Foresight and Innovation." Presentation. Practices of Anticipatory Governance Workshop, Arizona State University, Tempe, AZ.

336. **Selin, Cynthia**. October, 2010. "Foresight and Scenarios." Presentation. Nanoscale Informal Science Education Network Annual Meeting, San Francisco, CA.

337. **Selin, Cynthia**. September, 2010. "Plausibilistic Reasoning in Nanotechnology Futures." Presentation. Society for the Study of Nanotechnology and Emerging Technologies, Darmstadt, Germany.

338. **Selin, Cynthia**. August, 2010. "Nanotechnology & Plausibility." Presentation. Society for the Social Studies of Science, Tokyo, Japan.

339. **Selin, Cynthia**. July, 2010. "The Future of Sustainable Phoenix." Presentation. Institute for the Future, Palo Alto, CA.

340. **Selin, Cynthia**. May, 2010. "The Future of Organizing." Presentation. Organization Design Forum Annual Meeting, Denver, CO.

341. **Selin, Cynthia**. April, 2010. "The Future of Nanotechnology" Nanotechnology Law and Policy Course. Arizona State University. Tempe, AZ.

342. **Selin, Cynthia**. March, 2010. "Anticipation and Foresight." International Study of the Long-term Impacts and Future Opportunities for Nanoscale Science and Engineering Workshop. Chicago.

343. **Selin, Cynthia**. March, 2010. "Envisioning Solar to Fuels." Workshop on Energy Futures, Policy and Society. Arizona State University. Tempe, AZ.

344. **Selin, Cynthia**. November, 2009. "Plausibility." ASU Plausibility Workshop. Tempe, AZ.

345. **Selin, Cynthia.** October, 2009. "Diagnosing Futures." Society for the Social Studies of Science. Washington, DC.

346. **Selin, Cynthia**. September, 2009. "Deliberation and Anticipation." Society for the Study of Nanoscience and Emerging Technologies. Seattle, WA.

347. **Selin, Cynthia.** June, 2009. "Anticipation and Deliberation on the Nano City." Risoe National Laboratory, Denmark.

348. **Selin, Cynthia**. April, 2009. "Using Scenarios and Foresight to Manage Turbulence." Presentation. Organizational Design Forum, Tacoma, WA.

349. **Selin, Cynthia**. May, 2008. "Managing the Uncertainty of Nanotechnologies." Panel. Challenges to Law, Ethics, and Policy Making Conference at University of Padua, Padua, Italy.

350. **Selin, Cynthia**. February, 2008. "Evidencing the Future and other Dilemmas Working in the Future Tense." Presentation. Anthropology Department, Rice University, Houston, TX.

351. **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.

352. **Selin, Cynthia**. October, 2007. "The Future Tense: The Ways and Means of Anticipation." Presentation. CSPO Enlightening Lunch, Tempe, AZ.

353. **Selin, Cynthia**. September, 2007. "The Future of Nano & Bio Technologies." Panel. CRN conference on Challenges & Opportunities, Tucson, AZ.

354. **Selin, Cynthia**. July, 2007. "Real Time Technology Assessment: Anticipation, Integration, & Engagement." Presentation. Program on Technology Scenarios, Risoe, National Laboratory, Roskilde, Denmark.

355. **Selin, Cynthia**. April, 2007. "Hope and Prudence: Experiments in Scenaric Learning." Presentation. Futures of Life: Acquiring and Creating Anticipatory Knowledge, Cornell University, Ithaca, NY.

356. **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.

357. **Selin, Cynthia**. September, 2006. "The Center for Nanotechnology in Society." Presentation. NanoTX Conference, Dallas, TX.

358. **Selin, Cynthia** and **Ira Bennett**. November 19, 2006. "Visions of Nanotechnology." Talk. CNS-ASU Science Cafe, Changing Hands Bookstore, Tempe, AZ.

359. **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.

360. **Selin, Cynthia** and Arnim Wiek. November, 2009. "Sustainability meets Anticipatory Governance in Phoenix." CSPO Enlightening Lunch, ASU.

361. **Selin, Cynthia**, Darlene Johnson, Santiago Manriquez, Terry Ryan and Lynda Zeise. November, 2008. "Democratizing Science: Should the Public Have a Voice in Science Research and Development." Presentation. CNS-ASU Science Cafe, Arizona Science Center, Phoenix, AZ.

362. 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.

363. 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.

364. 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.

365. **Shapira, Philip.** December, 2010. "Trajectories of Nanotechnology Research and Innovation." Presentation. 2010 NSF Nanoscale Science and Engineering Grantees Conference, Arlington, VA.

366. **Shapira, Philip.** October 01, 2010. "Innovation System Dynamics and the Globalization of Nanotechnology Innovation." Presentation. S.NET Conference 2010, Darmstadt, Germany.

367. **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.

368. **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.

369. **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.

370. **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.

371. **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.

372. **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.

373. **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.

374. **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.

375. **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.

376. **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.

377. **Shapira, Philip** and **Alan L. Porter**. September, 2005. "Mapping the Nanotechnology Enterprise." Presentation. American Political Science Association Annual Meeting, Washington, DC.

378. **Shapira, Philip**, **Alan L. Porter** and **Jan Youtie**. August, 2006. "Refining Search Terms for Nanotechnology." Presentation. Presented at the National Science Foundation, Arlington, VA.

379. **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.

380. **Shapira, Philip** and **David H. Guston**. March, 2007. "Societal Assessment of Nanotechnology US Experience." Presentation. Ministry of Research, Science and Technology, Wellington, New Zealand.

381. **Shapira, Philip** and **Jan Youtie.** March, 2010. "Transatlantic Workshop on Nanotechnology Innovation and Policy." Presentation. Transatlantic Workshop on Nanotechnology Innovation and Policy, Atlanta, GA.

382. **Shapira, Philip** and **Jan Youtie**. May, 2008. "Whats 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.

383. **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.

384. **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.

385. 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.

386. 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.

387. **Slade, Catherine.** December, 2009. "Public Values in Nanomedicine." *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, December 4.

388. **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." *Annual Meeting of the America Sociological Association*, San Francisco, California. August 7-11.

389. **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.

390. **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.

391. **Suchman, Mark C.** 2007. "The Implications of Nanotechnology for Social Science and Social Policy." Presentation. Cornell CNF Public Interest Talk Series, Ithaca, NY.

392. **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.

393. **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.

394. **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.

395. **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.

396. **Tang, Li**. February, 2008. "Nanotechnology Knowledge Networks in China." Presentation. PRIME Nanotechnology Winter School, Grenoble, France.

397. **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.

398. **Tang, Li**. October, 2007. "New Argonauts & Scientific Networks: Evidence from Chinas Nanotech Publication." Presentation. Atlanta Science and Technology Policy Conference, Atlanta, GA.

399. 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.

400. **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.

401. **Thorpe, Michael** and Ramsey 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.

402. Valdivia, Walter. August, 2008. "Technology, Growth, and Inequality." Poster presentation. Gordon Research Conference on Science and Technology Policy, Big Sky, MT.

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    i) January 6, 2011 – Nanowerk. http://www.nanowerk.com/news/newsid=19599.php
    j) January 6, 2011 – AzoNano. http://www.azonano.com/news.asp?NewsID=21122

57. Technische Universität Darmstadt. 2010. Second Annyal Conference of the Society for the Study of Nanoscience and Emerging Technologies. http://www.philosophie.tu-darmstadt.de/nanobuero/snet2010/welcome.de.jsp

58. **Wetmore, Jameson** April 20, 2010. ASU expert discusses 'why cars move men.' Arizona State University News. http://asunews.asu.edu/20100420_cars_wetmore

    a) April 19, 2010 – Men's Health. http://www.menshealth.com/best-life/men-and-cars

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60. **Wetmore, Jameson**, **Elizabeth A. Corley** and Neal Woodbury. October 15, 2010. Nano Focus. Phoenix Business Journal.

61. **Youtie, Jan** and **Phillip Shapira**. October 13, 2010. Beyond the Nobel Prize, what's next for graphene? Arizona State University News. http://asunews.asu.edu/20101012_cnsgraphenestudy

    a) October 12, 2010 – EurekAlert. http://www.eurekalert.org/pub_releases/2010-10/asu-btn101210.php
    b) October 12, 2010 – Softpedia. http://news.softpedia.com/news/Conducting-Graphene-Studies-Beyond-the-Nobel-160689.shtml
    c) October 13, 2010 – Scientific Computing. http://www.scientificcomputing.com/news-DS-Beyond-the-Nobel-Prize-Whats-Next-for-Graphene-101810.aspx#
    d) October 13, 2010 – Nanotechnology Now. http://www.nanotech-now.com/news.cgi?story_id=40392
    e) October 13, 2010 – Product Sourcing. http://www.jihsin.com/manufacturers/information-technology/beyond-the-nobel-prize-whats-next-for-graphene.html
    f) October 13, 2010 – Electronic Component News. http://www.ecnmag.com/News/2010/10/Beyond-the-Nobel-Prize,-what-s-next-for-graphene-/
    g) October 13, 2010 – ChemInsider. http://www.chem.info/News/Feeds/2010/10/topics-plant-operations-beyond-the-nobel-prize-whats-next-for-graphene-/
    h) October 13, 2010 – Bio-Medicine. http://www.bio-medicine.org/biology-technology-1/Beyond-the-Nobel-Prize--whats-next-for-graphene-3F-17600-1/
    i) October 13, 2010 – Physorg. http://www.physorg.com/news/2010-10-nobel-prize-big-graphene.html
    j) October 13, 2010 – Nanowerk. http://www.nanowerk.com/news/newsid=18468.php
    k) October 13, 2010 – R&D. http://www.rdmag.com/News/2010/10/Materials-Nanotechnology-Beyond-the-Nobel-Prize-whats-next-for-graphene/
    l) October 18, 2010 – Georgia Tech News. http://ww.gatech.edu/newsroom/release.html?nid=62364

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 are three new investigators working as team leaders on the renewal grant. They are:

a. Merlyna Lim, RTTA 3
b. Jose Lobo, RTTA 1
c. Deborah Strumsky, RTTA 1
d. Sander van der Leeuw, TRC 2

Their biosketches follow this page.

MERLYNA LIM
School of Social Transformation & Consortium for Science, Policy and Outcomes,
ARIZONA STATE UNIVERSITY TEMPE, AZ 85287-5603, (480) 727-8787,
MERLYNA.LIM@ASU.EDU

Education

University of Southern California	Annenberg Center for Communication Postdoc, 2006	
University of Twente (Netherlands)	Science & Technology Studies Ph.D., cum laude, 2005	
University of Parahyangan (Ind.)	Architecture	M.A., cum laude, 1999
Institute Technology Bandung	Architecture	B.Arch, 1997

APPOINTMENTS

Assistant Professor, Consortium for Science, Policy and Outcomes and School of Social Transformation (joint appointment), Arizona State University, 2006-present.
Networked Publics Fellow (postdoctoral research associate), Annenberg Center for Communication, University of Southern California, September 2005-August 2006
Henry Luce Southeast Asian Visiting Fellow, East West Center, Washington DC, September-December, 2004
NOW-funded Research Fellow, Technology and Sustainable Development in North-South Perspectives, University of Twente, April 2003-August 2005

RELATED PUBLICATIONS

Lim, M. (2011) Discontent Slippery Slope: Radical Islamism in Indonesia and Its Middle Eastern Connections, *The Middle East Review of International Affairs Journal.*
Lim, M. (2009) Global Muslim Blogosphere: Mosaics of Global-Local Discourses in McLelland & Goggin (eds) *Internationalizing Internet Studies: Beyond Anglophone Paradigms*, Routledge, 178-95
Lim, M. & Kann, M. (2008), 'Networked Politics: Deliberation, Mobilization and Networked Practices of Agitation' in Varnelis, K (ed.) *Networked Publics*, Cambridge: MIT Press, 77-107.
Lim, M. (2008), 'Transient Civic Spaces in Jakarta Indonesia' in Mike Douglass, KC Ho, Giok-Ling Ooi (eds.) *Globalization, the City and Civil Society in Pacific Asia -- The Social Production of Civic Spaces,* London: Routledge, p. 366-396 *(refereed by the editors).*
Lim, M. and Padawangi, R. (2008), 'Contesting Alun-Alun: Power Relations, Identities, and the Production of Urban Spaces in Bandung Indonesia' *International Development and Planning Review*, Vol. 30 (3), pp. 307-326.
Lim, M. (2006), 'Cyber-Urban Activism and Political Change in Indonesia' *Eastbound*, Vol. 1 (1), pp. 1-19.

COLLABORATORS AND OTHER AFFILIATIONS

Graduate and Postdoctoral Advisors
Nico S. Schulte Nordholt (dissertation chair, U Twente, *emeritus*), Patricia Spyer (dissertation committee, U Twente), Mizuki Ito (USC, postdoc supervisor).

Thesis Advisor and Postgraduate-Scholar Sponsor
Rebecca Robinson, Anthony Hayes, Sheruni Ratnabalasuriar, Joshua Augustine, Kishonna Gray, Robert Poe, Lisa Jaeger (Arizona State University)

BIOGRAPHICAL SKETCH
JOSÉ LOBO

Associate Research Professor, School of Human Evolution and Social Change
Associate Research Professor, W. P. Carey School of Business
Arizona State University, PO Box 872402, Tempe, AZ 85287-2402
Phone: (480) 965-62152; Fax: (480) 965-7671; E-mail: jose.lobo@asu.edu

PROFESSIONAL PREPARATION

Cornell University, Physics, B.S., 1984
Cornell University, City and Regional Planning, M.R.P., 1992
Cornell University, Regional Science, Ph.D, 1996

APPOINTMENTS

2007 – Present, Associate Research Professor, School of Human Evolution and Social Change and W. P. Carey School of Business, Arizona State University
2005 – 2007, Research Scientist, Global Institute of Sustainability, Arizona State University
2004, Visiting Researcher, Department of Social, Communication and Cognitive Sciences, University of Modena and Reggio Emilia (Italy)
2003, Visiting Researcher, Santa Fe Institute (Santa Fe, New Mexico)
2001 – 2002, Senior Scientists, BiosGroup, Santa Fe, New Mexico
1997 –2001, Assistant Professor, Department of City and Regional Planning, Cornell University (Ithaca, New York)
1995 – 1995, Instructor, Department of City and Regional Planning, Cornell University (Ithaca, New York)

RELATED PUBLICATIONS

Strumsky, Deborah, José Lobo and Sander van der Leeuw (2010) "Using Patent Technology Codes to Study Technological Change." Santa Fe Institute Working Paper 10-11-023. (Forthcoming in *Economics of Innovation and New Technology*.)

Bettencourt, Luis, José Lobo, Deborah Strumsky and Geoffrey West (2010) "Urban Scaling and Its Deviations: Revealing the Structure of Wealth, Innovation and Crime across Cities" PLoS ONE 5(11): e13541. doi:10.1371/journal.pone.0013541 (www.plos.org/press/pone-05-11-bettencourt.pdf)

Strumsky, Deborah, José Lobo and Joseph Tainter (2010) "Complexity and the Productivity of Science," *Systems Research and Behavioral Science*, 27: 496-509.

Lobo, José and Deborah Strumsky (2008) "Metropolitan patenting, inventor agglomeration and social networks: A tale of two effects," *Journal of Urban Economics*, 63, Pages 871-884.

Bettencourt, Luis, José Lobo and Geoffrey West (2007) "Why Are Large Cities Faster? Universal Scaling and Self-Similarity in Urban Organization and Dynamics," forthcoming in *European Journal of Physics B.*

Bettencourt, Luis, José Lobo, Dirk Helbing, Christian Kühnert and Geoffrey West (2007) "Growth, innovation, scaling and the pace of life in cities," *Proceedings of the National Academy of Sciences*, 104, 7301-7306.

Bettencourt, Luis, José Lobo and Deborah Strumsky (2007) "Invention in the city: increasing returns to patenting as a scaling function of metropolitan size," *Research Policy*, 36, 107-120.

OTHER SIGNIFICANT PUBLICATIONS

Pumain, Denise, Fabien Paulus, Céline Vacchiani-Marcuzzo and José Lobo (2006) "An Evolutionary theory for Interpretating Urban Scaling Laws" *CyberGeo: Revue Européenne de Géographie*, 343, 1-20.

Lobo, José, Matthew Drennan and Deborah Strumsky (2004) "An Application of the Unit Root Test to the Question of Income Convergence Across U.S. Metropolitan Areas," *Journal of Economic Geography*, 4, 583-595.

Drennan, M., S. Larsen, J. Lobo, D. Strumsky and W. Utomo (2002) "Sectoral Shares, Specialization and Metropolitan Wages in the United States, 1969-1996," *Urban Studies*, 39, 1129-1142.

Lobo, J. and D. Smole (2002) "Stratification and Spatial Segregation of Human Capital as Determinants of Metropolitan Productivity in the United States," *Urban Studies*, 39, 529-547.

Lobo, J. and N. Rantisi (1999) "Investment in Infrastructure as Determinant of Metropolitan Productivity," *Growth and Change: A Journal of Urban and Regional Policy*, 30, 106-127.

SYNERGISTIC ACTIVITIES

2008 – present	Faculty Steering Committee, Center for Social Dynamics and Complexity, Arizona State University.
2006 – present	Member, Urban and Social Scaling Working Group, Santa Fe Institute
2003 – 2006	Member, Information Society as a Complex System (ISCOM) Research Project (Funded by the science Commission of the European Union)
1999 – 2001	Faculty Steering Committee, Interdisciplinary Graduate Fellowships in Nonlinear Systems, Cornell University.

COLLABORATORS AND OTHER AFFILIATIONS

Collaborators and Co-Editors: Luis Bettencourt (Los Alamos National Laboratory), Lee Fleming (Harvard Business School), Walter Fontana (Harvard Medical School), Stuart Kauffman (Department of Bioinformatics, University of Calgary), Bennet Levitan (Johnson & Johnson Corporate Research and Development), Bill Macready (NASA Ames Research Laboratory), Karl Schell (Department of Economics, Cornell University), Richard Schuler (Department of Economics, Cornell University)

Graduate and Postdoctoral Advisors: Doctoral Committee Chair: Walter Isard (Department of Economics, Cornell University); Doctoral Committee Members: Sidney Saltzman (Department of City and Regional Planning, Cornell University), Richard Schuler (Department of Economics, Cornell University).

Thesis Advisor and Postgraduate-Scholar Supervised: Saurav Bhatta (Department of City and Regional Planning, University of Illinois-Chicago), Nahit Bingol (Ministry of Planning, Government of Turkey), Mark Kimura (MPSI Systems, Inc.), Shannon Larsen (Director, International Program, Santa Fe Institute), Yury Mansuri (Department of City and Regional Planning, Cornell University)
Norma Rantisi (Department of Urban Studies, McGill University), Deborah Strumsky (Department of Geography and earth Sciences, University of North Carolina-Charlotte), Wahyu Utomo (Ministry of Municipal Affairs, Government of Indonesia) **Total Advised: 8**

Deborah Strumsky
University of North Carolina-Charlotte **Telephone: (704) 687-5934**
Charlotte, NC 28223 **Email: dstrumsky@uncc.edu**

EDUCATION
University of Southern Maine, Economics, BS, 1996
Cornell University, Regional Science, MRP, 1998
Cornell University, Regional Science, PhD, 2002

PROFESSIONAL EXPERIENCE

August 2007 - Present	University of North Carolina – Charlotte, Charlotte, NC Assistant Professor, Department of Geography and Earth Science
June 2003 – July 2007	Harvard Business School, Cambridge, Massachusetts Statistician/Analyst, Department of Research and Faculty Development
April 2002 – June 2003	Energy Security Analysis, Inc., Wakefield, Massachusetts Energy Analyst, Electric Power Markets & Natural Gas Division
May 2001 – March 2002	BiosGroup Inc., Santa Fe, New Mexico Consulting Scientist

PUBLICATIONS most related to proposed project

Strumsky, D., Lobo, J., Tainter, J. "Productivity of Invention" Forthcoming in William S. Brainbridge Editor, Leadership in Science and Technology: A Reference Handbook, Sage Publishing

Bettencourt L., Lobo J., Strumsky, D. and West, G. (2010) "Urban Scaling and Its Deviations: Revealing the Structure of Wealth, Innovation and Crime across Cities". PLoS ONE 5(11): e13541. doi:10.1371/journal.pone.0013541

Strumsky, D., Tainter, J. and Lobo, J. (2010) "Diminishing Marginal Returns to Invention in U.S. Metropolitan Patenting" Systems Research and Behavioral Science, Volume 27, Issue 5, Sep/Oct 2010, 496–509.

Strumsky, D. and Lobo, J. (2008) "Metropolitan Patenting, Inventor Agglomeration and Social Networks" Journal of Urban Economics, Volume 63, Issue 3, May 2008, Pages 871-884

Strumsky, D., M. Marx and L. Fleming (2007) "Noncompetes and Inventor Mobility: Specialists, Stars, and the Michigan Experiment." Harvard Business School Working Paper No. 07-042 (forthcoming in *Management Science*.)

Bettencourt, L., D. Strumsky and J. Lobo (2007) "Invention in the City: Increasing Returns to Scale in Metropolitan Patenting." *Research Policy*, 36, 107–120.

SYNERGISTIC ACTIVITIES

2007 – 2009 Contributing Scientist, Entrepreneurship and Innovation Research Project, ASU/Kauffman Foundation Entrepreneurship Initiative

2004 – present Santa Fe Institute Working Group on Urban and Organizational Scaling.

1999 – 2001 Interdisciplinary Graduate Fellowships in Nonlinear Systems, Cornell University.

Coauthors and Collaborators

Jose Lobo (Arizona State University)
Luis Bettencourt (Los Alamos National Laboratory)
Lee Fleming (Harvard Business School)
Matthew Marx (Harvard Business School)
Matthew Drennan (Department of City and Regional Planning, UCLA)
Joseph Tainter (Department of Environment & Society, Utah State University)

Graduate and Postdoctoral Advisor:

Takahashi, Yoshiko (Public Policy PhD Candidate, University of North Carolina-Charlotte)
Stivender, Carol (Public Policy PhD Candidate, University of North Carolina-Charlotte)
Wodarski, Stephanie (Geography and Earth Science, University of North Carolina-Charlotte)
Porter, Petra (Public Policy, University of North Carolina-Charlotte)
Lapitan, Aileen (Public Policy, University of North Carolina-Charlotte)
Gong, Zhaoya (Geography and Earth Science, University of North Carolina-Charlotte)
Farrow-Chestnut,Tonya (Geography and Earth Science, University of North Carolina-Charlotte)
Doudareva, Alexandra (Public Policy, University of North Carolina-Charlotte)

BIOGRAPHICAL SKETCH

SANDER E. VAN DER LEEUW
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PROFESSIONAL PREPARATION

University of Amsterdam, History, B.A. (equiv.), 1968
University of Amsterdam, Medieval History/Prehistory, M.A. (equiv.), 1972
University of Amsterdam, Archaeology, Ph.D., 1976
University of Michigan, Fulbright Post-Doctoral Fellow, 1976-1977

APPOINTMENTS

2010-present	Dean, School of Sustainability, Arizona State University
2004-present	Professor and Director, School of Human Evolution and Social Change, Arizona State University-Tempe
2000-present	External Professor, Santa Fe Institute; 2002-2007, Chair of Archaeology, Institut Universitaire de France
2002-2004	Deputy Scientific Director, Institut National des Sciences de l'Univers
2002-2004	Deputy Scientific Director, Department of Social Sciences and Humanities, Centre National de la Recherche Scientifique, Paris
1995-2004	Professor, Archaeology and History of Techniques, Université de Paris I
1988-1995	Lecturer, Cambridge University; 1976-1985, Assistant Lecturer and Lecturer, University of Amsterdam.

RELATED PUBLICATIONS

Lane, D., D. Pumain, S.E. van der Leeuw, G. West (eds.) 2009 *Complexity Perspectives on Innovation and Social Change* Berlin: Springer (Methodos series).

T. Kohler, S.E. van der Leeuw, (eds.) 2007. *The Model-Based Archaeology of Socio-Natural Systems.* School of Advanced Research, Santa Fe, NM.

van der Leeuw, S. E., J. McGlade, (eds.) 1997. *Archaeology: Time, Process and Structural Transformations.* Routledge, London. 484 pp.

van der Leeuw, S. E., J. McGlade. 1993. Information, Cohérence et dynamique urbaines. Pp. 195-245 *in* B. Lepetit & D. Pumain, eds., *Temporalités Urbaines*. Anthropos/Economica, Paris.

van der Leeuw, S. E., R. Torrence, (eds.) 1989. *What's New? A Closer Look at the Process of Innovation.* Unwin Hyman, London.

OTHER SIGNIFICANT PUBLICATIONS

van der Leeuw, S.E., 2008. "Agency, Networks, Past And Future", in: *Material and Nonhuman Agency* (C. Knappett & L. Malafouris, eds.), pp. 217-247, New York: Springer

Read, D.W., S.E. van der Leeuw, 2008, "Biology Is Only Part Of The Story …", *Philosophical Transactions of the Royal Society, Series B* 363, 1959-68

van der Leeuw, S.E., F. Favory, J.-L. Fiches. (eds.) 2003. *Archéologie et systèmes socio-environnementaux: études multiscalaires sur la vallée du Rhône dans le programme ARCHAEOMEDES* Valbonne : CNRS (Monographies du CRA).van der Leeuw, S.E and the ARCHAEOMEDES Teams, 1998, *The Archaeomedes Project - Understanding the natural and anthropogenic causes of land degradation and desertification in the Mediterranean.* Luxemburg: Office for Official Publications of the European Union

van der Leeuw, S. E. 1994. Cognitive aspects of technique. Pp. 135-142 *in* Colin Renfrew and Ezra B. W. Zubrow, eds., *The Ancient Mind: Elements of Cognitive Archaeology.* Cambridge University Press, Cambridge.

van der Leeuw, S. E., D. A. Papousek, and A. Coudart. 1991. Technical traditions and unquestioned assumptions: The case of pottery in Michoacan. *Techniques et Culture* 17-18:145-173.

SYNERGISTIC ACTIVITIES

Member of the Editorial Board of *Ecology & Society*, 2004-present; Treasurer and Member of the Scientific Council, International Human Dimensions of Global Change Program, 2004-present; Member, Editorial Board of *Global Environmental Change*, 2004-present; Member, National Advisory Board, NSF Long Term Ecological Research Program, 2005-present; Secretary General, National Coordination Council for the Social Sciences and Humanities, France, 2001-2003; Coordinator (with C. Lévèque) of the Program "A European network on long-term socio-environmental research," DG Research of the European Union, 2002–2004.

COLLABORATORS AND OTHER AFFILIATIONS

Collaborators and Co-Editors: Wolfgang Cramer, Free University of Berlin, Germany; François Favory, Univeristé de Franche-Comté, France; Ann Kinzig, Arizona State University, USA; David Lane, U of Modena, Italy; Tim Kohler, Washington State University, USA, S. Oberg, U of Uppsala, Sweden; Charles L. Redman, ASU, USA; Lord Colin A. C. Renfrew, U of Cambridge, UK; John Thornes, Kings College London, UK; B. J. de Vries, U of Utrecht, Holland; Geoffrey B. West, Los Alamos National Laboratory, USA; Douglas White, U of C Irvine, USA; Henry T. Wright, University of Michigan, USA.

Graduate and Postdoctoral Advisors: Professor H. H. van Regteren Altena, University of Amsterdam.

Thesis and Postdoctoral Scholars Supervised: More than 150 supervised. None within the last five years.

17. Honors and Awards

Wiek, Arnim and Cynthia Selin. Received the 2011 ASU President's Award for Sustainability for their project, "The Future of Phoenix – Crafting Sustainable Development Strategies." An inter-and transdisciplinary research team of ASU faculty and students in collaboration with the City of Phoenix's Planning Department engaged in analyzing the current state of Phoenix, crafting future visions and scenarios, and developing transformative sustainability strategies, which were incorporated into the new General Plan Hearing Draft. This activity engaged more than one hundred (100) citizens, businesses, non-profit organizations, and other stakeholder groups. March 2011.

Corley, Elizabeth. Received ASU School of Public Affairs Distinguished Research Award. May 2010.

Cozzens, Susan. Invited to present "Knowledge to Policy: Contributing to the Measurement of Social, Health, and Environmental Benefits" by Office of Science and Technology Policy at the National Press Club. December 2010.

Fisher, Erik. Featured for his Socio-Technical Integration Research (STIR) project at two National Science Foundation (NSF) SciSIP workshops, involving participants from federal science agencies. One workshop was co-sponsored by the American Association for the Advancement of Science (AAAS), and the other workshop on the Science of Science Measurement identified a joint Science of Science Policy research agenda for Federal Science and Technology agencies and the research community. December 2010.

Ho, Shirley S., Dietram Scheufele, and Elizabeth Corley. Awarded Top Three Faculty Paper in Mass Communication Division for "Integrating Models of Mass-Interpersonal Communication: Testing Moderation and Mediation Effects of Elaborative Processing and Interpersonal Discussion on Scientific Knowledge and Public Attitudes Towards Nanotechnology." International Communication Association Conference, Singapore. June 2010.

Lindsay, Stuart. Honored by President Barack Obama and Vice President Joe Biden at a White House reception for his innovative efforts to bring low-cost DNS sequencing to the masses. August 2010.

Schnell-Vivas, Dusana. Received Fulbright grant for work in the Comexus Binational Business Development Program in Mexico to study international business practices. June 2010.

Shapira, Philip, and Jan Youtie. Awarded Nanotechnology Infrastructure Network, Social and Ethical Issues (NNIN SEI) Seed Grant Competition funding for "Nanotechnology's Transition from Discovery the Commercialization in Small and Medium-Sized Enterprises: An Exploration of Evidence from Novel Unstructured Sources." August 2010.

Consortium for Science, Policy, and Outcomes (CSPO), CNS-ASU's parent center named the 9th Top Science and Technology Think Tank internationally by the Think Tanks and Civil Society Program at the Foreign Policy Research Institute at the University of Pennsylvania. March 2011.

20. Leverage

The Center for Nanotechnology in Society at Arizona State University (CNS-ASU) receives support from the Consortium for Science, Policy, and Outcomes (CSPO). Support includes desktop computers for all CNS-ASU faculty, staff, and students, and access to printers, copiers, scanners, projectors, fax machine, and conference room with videoconferencing equipment.

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 between September 14, 2010 and September 14, 2011.

CNS-ASU has relationships with one hundred forty-one (141) academic partnering institutions and ninety-five (95) non-academic partnering institutions, both domestic and international. This information in included in Table 5 below.

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									
		Barrett, The Honors College									x	
		Biodesign Institute	x	x								
		CRESMET									x	
		Center for the Study of Religion and Conflict									x	
		Center for Law, Science and Technology	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	
		Global Institute of Sustainability									x	
		Graduate College	x									
		Health Services									x	
		Herberger Institute for Design and the Arts	x									
		Hispanic Research Center			x							
		Ira A. Fulton School of Engineering	x	x								
		LightWorks	x									
		Mary Lou Fulton School of Education	x									
		Office of Knowledge and Enterprise Development (OKED)		x								
		Office of Knowledge Enterprise Development	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 Sustainability	x									
		Science Policy Assessment and Research on Climate (SPARC)									x	
		Stardust Center	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												
		Antwerp University								x		
		Austrian Academy of Science								x		
		Beijing Institute of Technology, China	x							x		
		Carnegie Mellon University								x		
		Case Western Reserve University									x	
		Center for Nanotechnolgy in Society, UCSB		x								
		Colorado School of Mines	x									
		Columbia University									x	
		Copenhagen Business School, Denmark	x							x		
		Cornell University									x	
		Dalian University of Technology, China	x							x		
		Delft Technical University, the Netherlands	x							x		
		Dublin City University								x		
		Durham University, United Kingdom	x							x		
		Ecoles des Mines, France	x							x		
		ETH Zurich								x		
		European Commission	x							x		
		Ewha Women's University								x		
		Federal University of Parana, Brazil	x							x		
		Flemish Institute of Science & Technology								x		
		Florida International University									x	
		George Washington University									x	
		Georgetown University									x	
		Georgia Institute of Technology	x									
		Grenoble Institute of Technology	x							x		
		Harvard University									x	
		Illinois Institute of Technology									x	
		Indiana University	x									
		Institute of International Sociology of Gorizia	x							x		
		Institut d'Estudes Politiques de Grenoble, France	x							x		
		James Martin Institute for Science and Civilization, Oxford, UK								x		
		Lancaster University								x		
		Leeds University Business School, UK	x							x		
		Mesa Biotech Academy									x	
		Mesa High School									x	
		Michigan State University									x	
		MIT SENSEable City Lab									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		
		Portland State University									x	
		Purdue University	x									
		Queens University								x		
		Radboud University								x		
		Rensselaer Polytechnic Institute	x									
		Rice University									x	
		Rice University/ICON		x								
		Rutgers, The State University of New Jersey	x									
		Said Business School, Oxford								x		
		Technical University of Denmark								x		
		Texas State University, San Marcos	x									
		The Center for International Development, Harvard University									x	
		Tokyo University	x							x		
		UCLA/Harvard/NBER: Collaborative Research; Personnel Exchanges									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 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, Santa Barbara									x	
		University of Colorado, Boulder	x									
		University of Colorado, Denver	x									
		University of Denver									x	
		University of Edinburgh	x							x		
		University of Georgia	x									
		University of Gothenburg, Sweden								x		
		University of Groningen, the Netherlands								x		
		University of Illinois, Chicago									x	
		University of Iowa									x	
		University of Leeds	x							x		
		University of Liege, Belgium	x							x		
		University of Manchester	x									
		Univesity of Massachusetts, Amherst									x	
		University of Michigan									x	
		University of Minnesota									x	
		University of New Hampshire	x									
		University of New York, Albany	x								x	
		University of North Carolina, Charlotte									x	
		Univesity of Nottingham	x							x		
		University of Seville, Spain	x							x		
		University of South Carolina									x	
		University of South Florida									x	
		University of Tennessee, Knoxville									x	
		University of Texas									x	
		University of Twente, the Netherlands	x							x		
		University of Victoria	x							x		
		University of Virginia									x	
		University of Washington									x	
		University of Wisconsin, Madison	x									
		Vanderbilt University									x	
		Virginia Tech University									x	
		Yale University									x	
	Total Number Academic Partners											
		143										
II. Non-academic Partnering Institutions												
		Agilent Technologies	x									
		ALD Nano Solutions						x				
		American Association for the Advancement of Science (AAAS)		x							x	
		American Bar Foundation									x	
		Arizona Nanotechnology Cluster						x				
		Arizona BioIndustry Organization						x				
		Arizona Science Center							x			
		Arizona Technology Council						x				
		Arizona Research Institute for Solar Energy									x	
		Axon Technologies	x									
		Bassetti Foundation								x	x	
		Bergeson & Campbell	x									
		BioIndustry Organization of Southern Arizona						x				
		Buckeye Express									x	
		Cambridge Public Health Department	x									
		Carnegie Mellon									x	
		Cell Publishing		x						x		
		Center for Business Models in Health Care									x	
		Center for Responsible Nanotechnology									x	

		City of Phoenix									x	
		Complex Global Risks									x	
		Danish Board of Technology								x		
		Decker Yeadon LLC									x	
		Department of Energy (DOE)					x					
		Ecological Society of America									x	
		EKLATEK Engineering									x	
		Environmental Protection Agency (EPA)					x					
		Exploratorium, San Francisco							x			
		European Commission								x		
		Food and Drug Administration (FDA)					x					
		Genome British Columbia								x	x	
		German Parliament								x		
		Global Business Network						x				
		Gordon Research Conferences (GRC)		x								
		Greenwall Foundation		x								
		HDR Architecture										
		Iconic Architecture									x	
		Institute for the Future	x									
		Institute of Technical Assessment & Systems Analysis									x	
		Intelligent Information Group Services						x				
		International Nanotechnology in Society Network (INSN)								x		
		Jennings, Strouss and Salmon PLC		x								
		Lawrence Livermore Lab					x					
		Loka Institute									x	
		Luxe Ventures						x				
		Mayo Clinic-Scottsdale						x				
		Meridian Institute	x									
		Microchip						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 Business Museum							x			
		National Geographic Society									x	
		National Nanotechnology Coordinating Office									x	
		National Nanotechnology Infrastructure Network									x	
		National Research Council									x	
		National Science Foundation					x					
		Nature Publishing Group		x						x		
		North Carolina State University										
		Norweigian Institute					x			x		
		Nuclear Waste Review Board					x					
		Office of Naval Research					x					
		Oregon Museum of Science & Industry							x		x	
		Penman PR	x									
		Pennsylvania Bio Nano Systems	x									
		Planetary ONE	x								x	
		Practical Action									x	
		Physician Services Group									x	
		Rathenau Institute								x		
		Research Council of Norway	x							x	x	
		Rhode Island School of Design	x								x	
		Rockefeller Foundation		x								
		Ryley Carlock & Applewhite	x									
		Sandia National Laboratory					x					
		Savage Film									x	
		Science & Technology Policy Institute	x									
		Sciencecener, New York						x				
		Science Museum of Minnesota						x			x	
		Semi-Conductor Research Corporation	x									
		Spirit of the Senses Salon									x	
		Springer Publishing		x								
		SRI Institute	x									
		Stardust Center for Affordable Homes and the Family	x									
		Sundt Construction, Inc.									x	
		Targeted Genetics Corporation (TGen)									x	
		Teach America									x	
		Tempe Festival of the Arts									x	
		Televerde									x	
		The Eluminati, LLC									x	
		The Foresight Institute									x	
		The Rockefeller Foundation	x									
		The Royal Society									x	
		The Washington Post									x	
		U.S. DOE/Center for Integrated Nanotechnology (CINT)					x					
		Will Bruder & Partners Ltd.									x	
		Woodrow Wilson International Center for Scholars									x	
	Total Number Non-academic Partners:											
		97										

21. Current and Pending Support

Current and Pending Support Page 1 of 2

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Ira Bennett | Other agencies (including NSF) to which this proposal has been/will be submitted

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **NSEC: Center for Nanotechnology in Society at Arizona State University (CNS-ASU)**

Source of Support: **National Science Foundation**

Total Award Amount: **$6,308,000** Total Award Period Covered: **10/1/05 – 9/30/11**

Location of Project: **Arizona State University**

Person-Months Per Year Committed to the Project. Cal: Acad: 0 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

EESE: Ethics in Engineering and Science Education Grant for "Integrating Microethics and Macroethics in Graduate Science and Engineering Education: Development and Assessment of Instructional Models"

Source of Support: **National Science Foundation**

Total Award Amount: **$300,000** Total Award Period Covered: **10/1/08 – 9/30/11**

Location of Project: **Arizona State University**

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

NSEC: Center for Nanotechnology in Society at Arizona State University (CNS-ASU) Renewal

Source of Support: **National Science Foundation**

Total Award Amount: **$6,500,000** Total Award Period Covered: **10/1/10 – 9/30/15**

Location of Project: **Arizona State University**

Person-Months Per Year Committed to the Project. Cal: Acad: 4.5 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Interaction of Engineered Nanomaterials with Artificial Cell Membranes

Source of Support: **National Science Foundation**

Total Award Amount: **$313,015** Total Award Period Covered: **9/1/2009 - 8/31/2012**

Location of Project: **Arizona State University**

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Collaborative Research: **Rationale Design of Enhanced Catalytic Nanomotors**

Source of Support: **National Science Foundation (CBET)**

Total Award Amount: **$600,000** Total Award Period Covered: **6/1/2009 – 5/31/2012**

Location of Project: **Arizona State University**

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: International Collaboration in Chemistry: Predicting Nanoparticle Interactions with Biological Interfaces and Bioaccumulation

Source of Support: National Science Foundation

Total Award Amount: $522,865 Total Award Period Covered: 7/1/2011 – 6/30/2014

Location of Project: Arizona State University

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Prasad Boradkar | Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Improving the Quality of Healing Environments

Source of Support: Herman Miller, Inc.
Total Award Amount: $150,000 Total Award Period Covered: August 2005-May 2011
Location of Project: Tempe
Person-Months Per Year Committed to the Project. 2 Cal: Acad: 2 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Finding New Material Applications for Healthcare

Source of Support: Dow Corning Corporation
Total Award Amount: $60,000 Total Award Period Covered: August 2009-May 2011
Location of Project: Tempe
Person-Months Per Year Committed to the Project. 2 Cal: Acad: 2 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Assisting Individuals Facing the Challenges of Autism

Source of Support: Pathways to Entrepreneurship Grant
Total Award Amount: $34,000 Total Award Period Covered: August 2009-May 2010
Location of Project: Tempe
Person-Months Per Year Committed to the Project. 2 Cal: Acad: 2 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Networks of Innovation

Source of Support: Entrepreneurship at ASU/Kaufman Foundation
Total Award Amount: $241,000 Total Award Period Covered: August 2007-May 2012
Location of Project: Tempe
Person-Months Per Year Committed to the Project. 2 Cal: Acad: 2 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Medical Device Development for Flexible Displays (Graduate Student Support)

Source of Support: Flexible Display Center, ASU
Total Award Amount: $18,000 Total Award Period Covered: August 2009-May 2010
Location of Project: Tempe
Person-Months Per Year Committed to the Project. 1 Cal: Acad: 1 Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support
(See GPG Section II.D.8 for guidance on information to include on this form.)
The following information should be provided for each investigator and other senior per-

Investigator: Elizabeth A. Corley	Other agencies (including NSF) to which this proposal has been/will be submitted. National Science Foundation

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Governing Nanotechnology Risks And Benefits In The Transition To Regulation: Innovative Public And Private Approaches (Role: Co-Principal Investigator)
Source of Support: U.S. Department of Energy
Total Award Amount: $245,271 Total Award Period Covered: October 2010 – September 2012
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
An Exploration of the Ethical Implications of Human Exposure to Nano-Materials in University Research Laboratories (Role: Principal Investigator)
Source of Support: Lincoln Center of Applied Ethics
Total Award Amount: $20,000 Total Award Period Covered: May 2010 to December 2011
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Center for Nanotechnology in Society – ASU (Role: Co-Principal Investigator)

Source of Support: National Science Foundation
Total Award Amount: $12,700,000 Total Award Period Covered: October 2005 – September 2015
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: NSEC: Center for Nanotechnology in Society at Arizona State University

Source of Support: National Science Foundation
Total Award Amount: $6,500,000 Total Award Period Covered: September 2010 – August 2015
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Susan Cozzens

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

NSEC: Center for Nanotechnology in Society at Arizona State University.

Georgia Tech subcontract; PI: Jan Youtie

Source of Support: National Science Foundation

Total Award Amount: $6,500,000 Total Award Period Covered: 09/15/10-09/14/15

Location of Project: Arizona State University with subcontract at Georgia Tech

Person-Months Per Year Committed to the Project. Cal: 5.0 Acad: Sumr:

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Worldwide Views on Global Warming.

Georgia Tech subaward with Pomona College; PI: Richard Worthington

Source of Support: National Science Foundation

Total Award Amount: $59,604 Total Award Period Covered: 07/01/09-06/30/11

Location of Project: Pomona College with subcontract at Georgia Tech

Person-Months Per Year Committed to the Project. Cal: .50 Acad: Sumr:

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

MOD: Models of International Research Collaboration.

Source of Support: National Science Foundation

Total Award Amount: $399,348 Total Award Period Covered: 01/01/08-12/31/10

Location of Project: Georgia Tech

Person-Months Per Year Committed to the Project. Cal: 1.0 Acad: Sumr:

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Distributional Assessment of Emerging Technologies: Case Studies in the Americas.

Source of Support: National Science Foundation

Total Award Amount: $390,547 Total Award Period Covered: 10/01/07-09/30/10

Location of Project: Georgia Tech

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

World Water: Case Studies in Research Policy as a Redistributive Force in the Knowledge Society

Source of Support: National Science Foundation

Total Award Amount: $215,068 Total Award Period Covered: 06/15-06-05/31/09

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.	
Investigator: Sarah Davies	Other agencies (including NSF) to which this proposal has NA

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Center for Nanotechnology in Society

Source of Support: National Science Foundation

Total Award Amount: $6,200,000 Total Award Period Covered: 10/1/05 – 9/30/10

Location of Project: Arizona State University

Person-Months / Year Committed to the 12 Cal: Acad: Sumr:

NSF Form 1239 (10/99) **USE ADDITIONAL SHEETS AS NECESSARY**

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: David Guston

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

ERC for Quantum Energy and Sustainable Solar Technologies

Source of Support: National Science Foundation

Total Award Amount: $18.5 million Total Award Period Covered: March 1, 2011 – February 29, 2016

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. 0.00 Cal: 0.00 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

To think, to write, to publish: Forging a working bond between next generation science communicators and next Generation of science and technology policy leaders

Source of Support: National Science Foundation

Total Award Amount: $49,362 Total Award Period Covered: January 2010 – December 2010

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. 0.00 Cal: 0.00 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Workshop for The Next Generation of Science and Technology Policy Leaders

Source of Support: National Science Foundation

Total Award Amount: $28,200 Total Award Period Covered: September 2009 – August 2011

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. 0.00 Cal: 0.00 Acad: 0.00 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

NSEC: Center for Nanotechnology in Society at ASU Renewal

Source of Support: National Science Foundation

Total Award Amount: $6.5 million Total Award Period Covered: October 1, 2010 – September 30, 2015

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. 0.00 Cal: 0.00 Acad: 1.25 Sumr: 0.00

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Socio-Technical Integration Research (STIR)

Source of Support: National Science Foundation

Total Award Amount: $540,000 Total Award Period Covered: April 1, 2009 – March 30, 2015

Location of Project:

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

EESE: Integrating Microethics and Macroethics in Graduate Science and Engineering Education

Source of Support: National Science Foundation

Total Award Amount: $299,915 Total Award Period Covered: October 1, 2008 – September 30, 2011

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. 1.00 Cal: 0.00 Acad: 0.00 Sumr: 0.00

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Matthew Harsh

Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: The Role of Philanthropic Foundations in the Governance of Agricultural Science and Computer Science in Kenya, Uganda, and Ghana (this proposal)

Source of Support: National Science Foundation

Total Award Amount: $309,005 Total Award Period Covered: 07/01/2011 – 06/30/2013

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: Acad: 4 Sumr: 2.45

Support: ☒ Current Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: NSEC: Center for Nanotechnology in Society at ASU (Renewal)

Source of Support: National Science Foundation

Total Award Amount: $6,500,000 Total Award Period Covered: 10/01/10-09/30/15

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: NSEC: Center for Nanotechnology in Society at ASU

Source of Support: National Science Foundation

Total Award Amount: $6,328,000 Total Award Period Covered: 10/01/05-09/30/11

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: 4S Travel Grant

Source of Support: National Science Foundation

Total Award Amount: $100,000 Total Award Period Covered: 08/01/2011 – 07/31/2016

Location of Project: Louisiana State University

Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Erik Fisher

Other agencies (including NSF) to which this proposal has been/will be

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
NSEC:Center for Nanotechnology in Society at ASU (renewal)

Source of Support: National Science Foundation
Total Award Amount: $6,500,000 Total Award Period Covered: 10/1/2010 – 9/30/2015
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: 3.6 Sumr: 1.0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Socio-Technical Integration Research Project and the City (this proposal)

Source of Support: National Science Foundation
Total Award Amount: $503,985 Total Award Period Covered: 07/01/11-06/30/14
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Socio-Technical Integration Research (STIR)

Source of Support: National Science Foundation
Total Award Amount: $543,030 Total Award Period Covered: 4/01/09 to 3/31/12
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 1.00

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/98) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

Investigator: Merlyna Lim	
Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ Transfer of Support	
Project/Proposal Title: NSEC: Center for Nanotechnology in Society at Arizona State Nanotechnology in Society at Arizona State	
Source of Support: NSF	
Total Award Amount: $6,500,000 Total Award Period Covered: 10/01/10 - 09/30/15	
Location of Project: Arizona State University	
Person-Months Per Year Committed to Cal: Acad: Sumr:	
Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ Transfer of Support	
Project/Proposal Title: Public Media Interest in Indonesia	
Source of Support: Ford Foundation	
Total Award Amount: $ 200,000 Total Award Period Covered: 10/01/09 - 09/30/11	
Location of Project: Arizona State University	
Person-Months Per Year Committed to Cal: Acad: Sumr: 2.0	
Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ Transfer of Support	
Project/Proposal Title: Blogtrackers: Analyzing Social Media For Cultural Modeling	
Source of Support: DoD-Navy-Onr	
Total Award Amount: $334,791 Total Award Period Covered: 01/01/10 - 12/31/12	
Location of Project: Arizona State University	
Person-Months Per Year Committed to Cal: Acad: Sumr: 0.7	
Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ Transfer of Support	
Project/Proposal Title: Finding Her Master's Voice: The Power of Collective Action on Female Blogosphere	
Source of Support: NSF	
Total Award Amount: $339,853 Total Award Period Covered: 08/01/2011 – 07/31/2013	
Location of Project: Arizona State University & University of Arkansas Little Rock	
Person-Months Per Year Committed to Cal: Acad: Sumr: 2.0	
Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ Transfer of Support	
Project/Proposal Title:	
Source of Support:	
Total Award Amount: Total Award Period Covered:	
Location of Project:	
Person-Months Per Year Committed to Cal: Acad: Sumr:	

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jose Lobo

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
NSEC: Center for Nanotechnology in Society at Arizona State University

Source of Support: National Science Foundation
Total Award Amount: $6,500,000 Total Award Period Covered: September 2010-August 2015
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 1.0

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Urban and Organizational Scaling, submitted by the Santa Fe Institute

Source of Support: Templeton Foundation
Total Award Amount: $ Total Award Period Covered:
Location of Project: Santa Fe Institute
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 2.0

Support: X Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
The Origins of Biological and Technological Novelty, submitted by ASU

Source of Support: James MacDonnel Foundation
Total Award Amount: $ Total Award Period Covered:
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: 2.0 Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Clark Miller
Investigator:

Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: NSEC: Center for Nanotechnology in Society at Arizona State University (renewal) – this proposal

Source of Support: National Science Foundation
Total Award Amount: $9,101,371 Total Award Period Covered: October 1, 2010 – September 30, 2015
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: .25

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Studies of Science, Technology and Sustainability: Building a Research Agenda

Source of Support: National Science Foundation
Total Award Amount: $65,000 Total Award Period Covered: 09/01/08 – 08/31/09
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: 1.0 Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: Energy Frontier Research Center for Bio-Inspired Solar Fuel Production

Source of Support: Department of Energy
Total Award Amount: $25,000,000 Total Award Period Covered: 9/1/09-8/31/14
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: 1.0 Sumr: 1.0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
IRES: Conservation Science and Environmental Issues in Cross Cultural Perspective with Research Laboratories in France.
Source of Support: National Science Foundation
Total Award Amount: $147,570 Total Award Period Covered: 09/01/06 – 08/31/09
Location of Project: University of Wisconsin – Madison
Person-Months Per Year Committed to the Project. Cal: Acad: .25 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
NSEC: Center for Templated Synthesis and Self-Assembly

Source of Support: National Science Foundation
Total Award Amount: $13,365,000 Total Award Period Covered: 10/01/04 – 09/30/09
Location of Project: University of Wisconsin – Madison
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Clark Miller
Investigator:

Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
NSEC: Center for Nanotechnology in Society

Source of Support: National Science Foundation
Total Award Amount: $6,220,000 Total Award Period Covered: 10/01/05 – 09/30/10
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: 1.0 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
IGERT: Vulnerability in Coupled Human-Natural Systems

Source of Support: National Science Foundation
Total Award Amount: $3,089,699 Total Award Period Covered: 06/01/06 – 05/31/11
Location of Project: University of Wisconsin – Madison
Person-Months Per Year Committed to the Project. Cal: Acad: .25 Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: Socio-Technical Integration Research (STIR)

Source of Support: National Science Foundation
Total Award Amount: 540,000 Total Award Period Covered: 1/15/09 to 1/14/12
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Dietram Scheufele

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: x Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: NSEC: Center for Nanotechnology in Society at Arizona State University
The University of Wisconsin, Madison has a subcontract with CNS-ASU

Source of Support: NSF
Total Award Amount: $6.5 million Total Award Period Covered: 09/15/10-09-14/15
Location of Project: ASU with UW-Madison subcontract
Person-Months Per Year Committed to the Project. Cal: 1 Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:

Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: **Cynthia Selin**	Other agencies (including NSF) to which this proposal has NA

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: A Climate of Uncertainty

Source of Support: National Science Foundation (subaward under Science Museum of Minnesota)

Total Award Amount: $249,822 Total Award Period Covered: 7/1/11 – 6/30/14

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. Cal: Acad: 3 yr 1 Sumr: 2 yr 1
2.5 yr 2
1.5 yr 3

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Center for Nanotechnology in Society

Source of Support: National Science Foundation

Total Award Amount: $6,328,000 Total Award Period Covered: 10/1/05 – 9/30/11

Location of Project: Arizona State University

Person-Months / Year Committed to the Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: NSEC: Center for Nanotechnology in Society at Arizona State University (renewal)

Source of Support: National Science Foundation

Total Award Amount: 6,500,000 Total Award Period Covered: 10/1/10 – 9/30/15

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) **USE ADDITIONAL SHEETS AS NECESSARY**

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Philip Shapira | Other agencies (including NSF) to which this proposal has been/will be submit-

Support: X Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:NSEC/Center for Nanotechnology in Society at Arizona State University (renewal)

Source of Support: National Science Foundation
Total Award Amount: $6,500,000 Total Award Period Covered: October 1, 2010 – September 30, 2015
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: MOD Measurement and Analysis of Highly Creative Research in the US and EUR

Source of Support: NSF
Total Award Amount: $339,636 Total Award Period Covered: January 1, 2008 – December 31, 2010
Location of Project: Georgia Tech, Atlanta
Person-Months Per Year Committed to the Project. Cal: 1 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: NSEC: Center for Nanotechnology in Society

Source of Support: National Science Foundation via Arizona State University
Total Award Amount: $768,138 Total Award Period Covered: October 1, 2005 – September 30, 2010
Location of Project: Georgia Tech, Atlanta
Person-Months Per Year Committed to the Project. Cal: 1 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: ERAWATCH: US and China

Source of Support: European Union
Total Award Amount: $91,926 Total Award Period Covered: June 02, 2007 – April 30, 2009
Location of Project: Georgia Tech, Atlanta
Person-Months Per Year Committed to the Project. Cal: .25 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: INNOPOLICYWATCH: Future Trends in European Innovation Policy

Source of Support: European Union
Total Award Amount: $457,788 Total Award Period Covered: February 17, 2007 – February 16, 2010
Location of Project: Georgia Tech (Atlanta) and MIoIR (Manchester)
Person-Months Per Year Committed to the Project. Cal: 2 Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Deborah Strumsky

Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Collaborative Research: RAPID: Developing Real Time Metrics on the Effect on the Effects of ARRA Investments on Technological Invention
Source of Support: National Science Foundation
Total Award Amount: $115,816 Total Award Period Covered: 9/1/2009-8/31/2010
Location of Project: University of North Carolina-Charlotte
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 1

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Source of Support:
Total Award Amount: $ Total Award Period Covered:
Location of Project:
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

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Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Sander E. van der Leeuw

Other agencies (including NSF) to which this proposal has been/will be submit-

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Urbanization and Global Environmental Changes (UGEC) Project

Source of Support: NSF
Total Award Amount: $585,000 Total Award Period Covered: 10/01/2009-9/30/2012
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: 0.2 Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
NSEC/Center for Nanotechnology at ASU

Source of Support: NSF
Total Award Amount: $9,082,819 Total Award Period Covered: 10/01/2010-09/30/2015
Location of Project:
Person-Months Per Year Committed to the Project. Cal: 0.2 Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
Environmental Synthesis Center Preliminary proposal:
The International Center for Environmental Synthesis
Source of Support: NSF
Total Award Amount: $0 Total Award Period Covered: 08/31/2011-09/01/2016
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
University as Entrepreneur

Source of Support: Ewing Marion Kauffman Foundation
Total Award Amount: $5,000,000 Total Award Period Covered: 1/24/2007-6/30/2012
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: 2 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title:
International Project Office for Urbanization: A Partnership with the IHDP
Source of Support: NSF-BCS
Total Award Amount: $522,606 Total Award Period Covered: 09/01/2006-08/31/2011
Location of Project: Arizona State University
Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Jameson M. Wetmore	Other agencies (including NSF) to which this proposal has NA

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: The Role of Philanthropic Foundations in Governance of Agricultural Science and Computer

Source of Support: National Science Foundation

Total Award Amount: $285,000 Total Award Period Covered: 7/1/2011 – 6/30/2013

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: Acad: Sumr: yr 1 - .25, yr 2 - .5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Developing and Assessing Macroethics Modules for the Collaborative Institutional Training Initiative Responsible Conduct of Research Courses

Source of Support: National Science Foundation

Total Award Amount: $295,909 Total Award Period Covered: 10/1/10 – 9/30/12

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: Acad: Sumr: .25

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Center for Nanotechnology in Society

Source of Support: National Science Foundation

Total Award Amount: $6,308,000 Total Award Period Covered: 10/1/05 – 9/30/11

Location of Project: Arizona State University

Person-Months / Year Committed to the Cal: Acad: Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Integrating Microethics and Macroethics in Graduate Science and Engineering Education

Source of Support: National Science Foundation

Total Award Amount: $300,000 Total Award Period Covered: 10/1/08 – 9/30/11

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: Acad: Sumr: 0.5

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Interaction of Engineered Nanomaterials with Artificial Cell Membranes

Source of Support: National Science Foundation

Total Award Amount: $ $313,015 Total Award Period Covered: 9/1/2009 - 8/31/2012

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: Acad: Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: Collaborative Research: Rationale Design of Enhanced Catalytic Nanomotors

Source of Support: National Science Foundation (CBET)

Total Award Amount: $200,000 Total Award Period Covered: 10/1/2009 – 9/31/2012

Location of Project: Arizona State University

Person-Months / Year Committed to the Project. Cal: Acad: Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: NSEC: Center for Nanotechnology in Society at Arizona State University
Source of Support: National Science Foundation
Total Award Amount: 6,500,000 Total Award Period Covered: 10/1/10 – 9/30/15
Location of Project: Arizona State University
Person-Months / Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: Science Master's Program: Solar Energy Engineering & Commercialization
Source of Support: National Science Foundation
Total Award Amount: $700,000 Total Award Period Covered: 7/1/2010-6/30/2013
Location of Project: Arizona State University
Person-Months / Year Committed to the Project. Cal: 0 Acad: 0 Sumr: 0

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support
Project/Proposal Title: International Collaboration in Chemistry: Predicting Nanoparticle Interactions with Biological Interfaces and Bioaccumulation
Source of Support: National Science Foundation
Total Award Amount: $522,865 Total Award Period Covered: 7/1/2011 – 6/30/2014
Location of Project: Arizona State University
Person-Months / Year Committed to the Project. Cal: Acad: Sumr:

*If this project has previously been funded by another agency, please list and furnish information for immediately preceding funding period.

NSF Form 1239 (10/99) **USE ADDITIONAL SHEETS AS NECESSARY**

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: Arnim Wiek

Other agencies (including NSF) to which this proposal has been/will be submitted.

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Congruence and Gaps between Theory and Empirical Research in Sustainability Science**

Source of Support: National Science Foundation

Total Award Amount: $325,315 Total Award Period Covered: August 1, 2009 – July 31, 2011

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr: 1

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title: **Measuring the societal effects of problem-oriented participatory sustainability research**

Source of Support: Social Science and Humanities Council Canada

Total Award Amount: $25,000 Total Award Period Covered: July, 1 2008 – June 30, 2009

Location of Project: University of British Columbia (Canada)

Person-Months Per Year Committed to the Project. No salary commitment Cal: Acad: 1 Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project: Arizona State University

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. No salary commitment Cal: Ac Sumr:

Support: ☐ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Source of Support:

Total Award Amount: Total Award Period Covered:

Location of Project:

Person-Months Per Year Committed to the Project. No salary commitment Cal: Acad: Sumr:

NSF Form 1239 (10/99) USE ADDITIONAL SHEETS AS NECESSARY

Current and Pending Support

(See GPG Section II.D.8 for guidance on information to include on this form.)

The following information should be provided for each investigator and other senior personnel. Failure to provide this information may delay consideration of this proposal.

Investigator: **Jan Youtie**	Other agencies (including NSF) to which this proposal has been/will be submitted. **NSF**

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title**: Center for Nanotechnology in Society – Arizona State University**

Source of Support: **Arizona State University and National Science Foundation**

Total Award Amount: **$800,000** Total Award Period Covered: **10/1/10-9/30/14**

Location of Project: Georgia Tech

Person-Months Per Year Committed to the Project. Cal: 1 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Research Collaboration and Credit Sharing: Social and Ethical Implications

Source of Support: **National Science Foundation**

Total Award Amount: **$352,242** Total Award Period Covered: **10/1/2010 - 9/30/2012**

Location of Project: **University of Georgia and Georgia Tech**

Person-Months Per Year Committed to the Project. Cal: 2 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ Transfer of Support

Project/Proposal Title: **Assessment of Nanoscale Science and Engineering Centers (NSECs) Outcomes and Impacts: Their contribution to NNI Objectives and Goals**

Source of Support: **National Science Foundation**

Total Award Amount: **$198,380** Total Award Period Covered: **10/1/2009-3/31/2011**

Location of Project: **Georgia Tech**

Person-Months Per Year Committed to the Project. Cal: 2 Acad: Sumr:

Support: ☒ Current ☐ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Nanotechnology's Transition from Discovery To Commercialization in Small and Medium-Sized Enterprises

Source of Support: **National Nanotechnology Infrastructure Network's (NNIN) Social & Ethical Issues Seed Grant**

Total Award Amount: **$19,712** Total Award Period Covered: 5**/01/10-4/30/11**

Location of Project: **Georgia Tech**

Person-Months Per Year Committed to the Project. Cal: Acad: Sumr:

Support: ☐ Current ☒ Pending ☐ Submission Planned in Near Future ☐ *Transfer of Support

Project/Proposal Title:

Evaluating Student Gains Through Research Assistantships: Student Publishing as a Measure of Learning

Source of Support: **National Science Foundation**

Total Award Amount: **$250,000** Total Award Period Covered: **9/1/2011-8/31/2013**

Location of Project: **Georgia Tech**

Person-Months Per Year Committed to the Project. Cal: 1.45 Acad: Sumr:

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*If this project has previously been funded by another agency, please list and furnish information for immediately