

Annual Report for Period: 10/2006 - 09/2007

Submitted on: 05/14/2007

Principal Investigator: Guston, David H.

Award ID: 0531194

Organization: Arizona State University

Title:

NSEC: Center for Nanotechnology in Society at Arizona State University

Project Participants

Senior Personnel

Name: Guston, David

Worked for more than 160 Hours: Yes

Contribution to Project:

As PI and director, Guston is chair of the Executive Committee; he provides overall supervision for the Center and represents the Center publicly. In YR 2, in particular, he supervised post-doctoral fellows Conz, Fisher and Selin and several of the graduate and undergraduate. He participated in the creation and teaching of the Nanotechnology in Society Learning Community in SP 07. He served on the organizing committee of the NNCO's Workshop on the Ethical Aspect of Nanotechnologies and he represented CNS-ASU at the first Nano-in-Society Network PIs meeting in Washington, DC, in March 07.

Name: Miller, Clark

Worked for more than 160 Hours: Yes

Contribution to Project:

After moving from Wisconsin to ASU in August 2006, Miller has become the associate director for education and outreach at CNS-ASU, where he is principally responsible for overseeing and coordinating a variety of activities including engagement with NISE Net, local participation in the NCTF, etc. As a co-PI, Miller also serves on the Executive Committee, and in YR 2 he supervised post-doctoral fellow Barben.

Name: Carlson, Marilyn

Worked for more than 160 Hours: No

Contribution to Project:

In her role as co-PI, Carlson serves on the Executive Committee and, as director of the Center for Research on Education in Science, Mathematics, Engineering and Technology, provides supervision to the pre-college outreach program involving post-doctoral fellow Bennett and CNS-CRESMET graduate students D'Angelo and Garay.

Name: Sarewitz, Daniel

Worked for more than 160 Hours: Yes

Contribution to Project:

In his role as co-PI and associate director, Sarewitz has been a member of the Executive Committee. As co-leader of the RTTA 3 Deliberation and Participation activities, he has led the scenario development activity. He has also provided direct supervision for graduate student Panjwani for her project on mathematical models of privacy and security with nano-sensors.

Name: Poste, George

Worked for more than 160 Hours: No

Contribution to Project:

In his role of co-PI, Poste has been a member of the Executive Committee and has facilitated collaboration between CNS-ASU and The Biodesign Institute, which he directs. Following the 2005-6 NSF site visit team's recommendation that CNS-ASU obtain space in the Biodesign Institute for conferring with scientists working there, Poste assigned CNS-ASU a small space there.

Name: Allenby, Braden

Worked for more than 160 Hours: No

Contribution to Project:

Allenby is a member of the Executive Committee. He has participated in a number of collaborative activities, including as co-PI for the 'nanoethics shop' Ethics Education in Science and Engineering proposal (with PI McGregor and co-PIs Wetmore and Guston) and as a participant in the Trading Zones and the Human Cognitive Enhancement workshops.

Name: Shapira, Philip

Worked for more than 160 Hours: Yes

Contribution to Project:

Shapira is the PI on the GA Tech subcontract and leader of RTTA Research and Innovation System Analysis activity.

Name: Bozeman, Barry

Worked for more than 160 Hours: No

Contribution to Project:

Bozeman is leader of the RTTA 1 activity, Public Value Mapping. He participated in the Oct 06 PVM workshop.

Name: Van Horn, Carl

Worked for more than 160 Hours: No

Contribution to Project:

Van Horn is the PI on the Rutgers University subcontract and leader of the RTTA 1 activity, Workforce Assessment.

Name: Scheufele, Dietram

Worked for more than 160 Hours: Yes

Contribution to Project:

Scheufele is co-leader of RTTA 2, Public Opinion and Values (POV) and its public opinion survey activity, as well as PI for the Wisconsin sub-contract. Data collection and analysis of survey findings is underway with the collaboration of E Corley.

Name: Corley, Elizabeth

Worked for more than 160 Hours: Yes

Contribution to Project:

E Corley is co-leader of the RTTA 2 activity, public opinion survey, and co-leader of the RTTA 4 activity, reflexivity assessment. In the former capacity, she has been collaborating with Scheufele to field a survey of public knowledge of and attitudes toward nanotechnology. With Scheufele, she has also fielded a comparable survey of nanoscientists. In the latter activity, she has assisted E Hackett and K Corley (no relation) in mounting field work on the identity, knowledge, and practice of Biodesign scientists regarding nanotechnology in society.

Name: Dunwoody, Sharon

Worked for more than 160 Hours: No

Contribution to Project:

Dunwoody is the leader of the RTTA 2 activity, Media Influence. Data collection and content analysis are underway.

Name: Hamlett, Patrick

Worked for more than 160 Hours: No

Contribution to Project:

Hamlett is the PI on the North Carolina State University subcontract and is leader of the RTTA 3 activity National Citizens' Technology Forum. Although there are no funded activities in YR 1 or Yr 2 for NCTF, Hamlett has established an electronic workspace for the several institutional participants in the activity and will prepare an on-line training program for them in Su 07.

Name: Boradkar, Prasad

Worked for more than 160 Hours: Yes

Contribution to Project:

Boradkar leads the RTTA 3 activities InnovationSpace and CriticalCorps. In AY 06-07 debuted the undergraduate InnovationSpace course.

Name: Fischer, Heidi

Worked for more than 160 Hours: No

Contribution to Project:

Fischer is co-director of InnovationSpace.

Name: Corley, Kevin

Worked for more than 160 Hours: Yes

Contribution to Project:

K Corley is a leader of RTTA 4, Reflexivity Assessment and Evaluation, on the identity, knowledge, and practice of Biodesign researchers.

Name: Monahan, Torin

Worked for more than 160 Hours: No

Contribution to Project:

Monahan was the co-leader of TRC 1, Freedom, Privacy and Security, but he has withdrawn from the project and is no longer serving in that capacity. He oversaw the work of grad student Wall.

Name: Hogle, Linda

Worked for more than 160 Hours: No

Contribution to Project:

Hogle is the co-leader of Human Identity, Enhancement, and Biology Thematic Research Cluster. She has been collaborating in this research program with Robert. Hogle continues her own research on regenerative medicine and how techniques from nanoscale science, stem cell culture, tissue engineering, and synthetic biology are being combined in novel ways with older sets of knowledge, transforming understandings of wound healing and biocompatibility.

Name: Robert, Jason

Worked for more than 160 Hours: Yes

Contribution to Project:

Robert is the co-leader of the Human Identity, Enhancement, and Biology Thematic Research Cluster. He has been collaborating in this research program with Hogle.

Name: Pielke, Jr., Roger

Worked for more than 160 Hours: No

Contribution to Project:

Pielke is PI on the University of Colorado, Boulder subcontract and supervised Fisher's dissertation work.

Name: Mahajan, Roop

Worked for more than 160 Hours: No

Contribution to Project:

Mahajan supervised Fisher's participant-observation in his nano-materials laboratory in YR 1.

Name: Fujimura, Joan

Worked for more than 160 Hours: No

Contribution to Project:

Fujimura, working within the Human Identity, Enhancement, and Biology theme, is supervising Leung's dissertation field work on nano-scale science and engineering in China.

Name: Privateer, Paul

Worked for more than 160 Hours: No

Contribution to Project:

Privateer has recently completed a book on the social history of human intelligence and is now exploring issues of NBIC and transhumanism, including through a class he taught in Fa 06 entitled 'Studies in Transhumanism: Genetics, Robotics, Information Technology, Nanosciences, and the Human Future(s)' (FMS 494).

Name: Lindsay, Stuart

Worked for more than 160 Hours: No

Contribution to Project:

Lindsay, director of the Center for Single Molecule Biophysics at the Biodesign Institute at ASU, is learning how to build atom by atom at the nanoscale, manipulating and seeing results through a variety of new instrumentation. He offered the first Science Cafe in March 06 on 'Humankind's Future On the Head of a Pin: Nanotechnology - What is it? What can it do?' and in May 06 he presented, with CNS undergraduate intern Jackson, an historical review on the occasion of the 20th anniversary of scanning probe microscopy at ASU. Lindsay continues to supervise one of the CNS-Biodesign graduate student fellows and his lab hosts post-doc Fisher's project on public value mapping.

Name: Woodbury, Neal

Worked for more than 160 Hours: No

Contribution to Project:

Woodbury, director of the Center for BioOptical Nanotechnology at the Biodesign Institute at ASU, builds arrays of nano-scale sensors using techniques of molecular evolution. In addition to being a frequent collaborator on other nano-related grant applications (EASE, IGERT, etc.), Woodbury offered the May 06 Science Cafe speaking on the topic: 'Evolution on a Chip: Making Molecules Work for Us.' He also supervises one of the CNS-Biodesign graduate student fellows. In Sp 07 he co-taught the undergraduate Learning Community with Guston and Conz and he has initiated inquiries into deeper collaborations with CNS.

Name: Wetmore, Jameson

Worked for more than 160 Hours: Yes

Contribution to Project:

Wetmore (ASU), as a post-doctoral fellow funded by CSPO co-taught (with Bennett) 'Science, Technology, and Societal Outcomes' (BIO 598, POS 598, JUS 598) in Sp 06. In Fa 06, he joined the ASU faculty with an appointment in the School of Human Evolution and Social Change and an affiliation with CNS-ASU and CSPO. He organized, with post-doctoral fellows Selin and Fisher, the monthly seminar series and its related Yearbook, among other tasks. He has a strong interest in Equity and Responsibility and he will co-lead TRC 1 when it is reconfigured.

Name: He, Jiping

Worked for more than 160 Hours: No

Contribution to Project:

He, director of the Center for Neural Interface Design at the Biodesign Institute at ASU, is creating nano-neural implants for the brain that have the capacity to perform motor and/or cognitive functions while monitoring brain activity. In addition to other collaborative activities, especially working closely with Robert's research group on TRC 2, Human Identity, Enhancement, and Biology, He participated in the June 06 Science Cafe on 'Brain-Machine Interface: Science Fact or Science Fiction?' with Robert.

Name: Porter, Alan

Worked for more than 160 Hours: Yes

Contribution to Project:

Porter has worked extensively on RTTA 1/1 Research Program Mapping activities and provided guidance to several GA Tech graduate and undergraduate students assisting those activities.

Name: Devitt, Terry

Worked for more than 160 Hours: No

Contribution to Project:

Terry Devitt (Wisconsin) edits The Why Files.

Name: Farwell, Tricia

Worked for more than 160 Hours: No

Contribution to Project:

Tricia Farwell (ASU) investigates the impact of public relations materials on the reporting of science-based articles in the mass media.

Name: Ramakrishna, B

Worked for more than 160 Hours: Yes

Contribution to Project:

Ramakrishna (ASU) explores public understanding of NSE and is involved in NSE education at the secondary and college levels. He teaches the undergraduate course, 'Nanotechnology Perspectives and Entrepreneurial Opportunities.'

Name: Ingram, Helen

Worked for more than 160 Hours: No

Contribution to Project:

Ingram, a CNS-ASU consultant, studies the relationship between science and management and policy decisions and is working with RTTA 4, Reflexivity, Assessment and Evaluation, particularly with Schneider on comparing the functions of different boundary organizations in managing 'ways of knowing.'

Name: Reiter, Wellington

Worked for more than 160 Hours: No

Contribution to Project:

Name: Cobb, Michael

Worked for more than 160 Hours: No

Contribution to Project:

Cobb (NCSU) became active in YR 2 working with senior investigator Hamlett on the preparations for the National Citizens' Technology Forum (RTTA 3/4) in YR 3. He spoke as part of the Occasional Speakers presentations on the results of public opinion surveying.

Name: Cozzens, Susan

Worked for more than 160 Hours: No

Contribution to Project:

Cozzens (GA Tech) became active in YR 2 preparing to host a site of the National Citizens' Technology Forum in YR 3. She is proposed to be co-leader of the replacement TRC 1, Equity and Responsibility.

Name: Crone, Wendy

Worked for more than 160 Hours: No

Contribution to Project:

Crone (Wisconsin) oversees a highly regarded web site for K-12 and informal science education on NSE.

Name: Marchant, Gary

Worked for more than 160 Hours: No

Contribution to Project:

Marchant (ASU) has collaborated with CNS-ASU in organizing conferences, particularly 'Forbidding Science,' and in supervising students, particularly those in the Applied Research Seminar hosted by CNS and CSPO. Marchant, Abbott and Sylvester taught a new course entitled 'Nanotechnology Law and Policy' at ASU's Sandra Day O'Connor College of Law and Marchant's Center for Law, Science, and Technology has created a Nanotechnology Cluster for students and faculty.

Name: Youtie, Jan

Worked for more than 160 Hours: Yes

Contribution to Project:

Youtie has contributed to the RTTA 1/1 Research Program Mapping activity, co-authoring several of that group's publications and representing it at the first Nano-in-Society PI's Meeting in Mar 07 at NSF.

Name: Iacopetta, Maurizio

Worked for more than 160 Hours: Yes

Contribution to Project:

Iacopetta has contributed to the RTTA 1/1 Research Program Mapping activity, co-authoring several of its works.

Name: Fichtner, Aaron

Worked for more than 160 Hours: No

Contribution to Project:

Fichter is the research director at Rutgers' Heldrich Center for Workforce Development and a principal in the subcontract to Rutgers for the nano workforce assessment.

Name: Picreux, Tom

Worked for more than 160 Hours: No

Contribution to Project:

Picreux (DOE), formerly of ASU, is research director at the DOE's Center for Integrated Nanotechnology user facility and host of CNS-ASU's outreach effort to provide societal implications training to CINT staff and users with Fisher.

Name: Bernick, Phil

Worked for more than 160 Hours: No

Contribution to Project:

Bernick is the chief technical adviser to CNS-ASU and provides consultation on communications issues especially the use of new software and internet resources such as Google Docs and Spreadsheets, Del.icio.us, Creative Commons, and Second Life.

Name: Walsh, Charles

Worked for more than 160 Hours: Yes

Contribution to Project:

Walsh supported RTTA 2, in particular, the newspaper coverage of Nanotechnology from 1985 to present, under the direction of Dunwoody and Scheufele.

Name: Hackett, Ed

Worked for more than 160 Hours: No

Contribution to Project:

Hackett, who was co-director of RTTA 4, Reflexivity Assessment and Evaluation, has helped supervised the effort to study the identity, knowledge, and practice of Biodesign researchers regarding nanotechnology in society, conducted by K Corley and Conz. Hackett is currently on leave with NSF.

Name: Hejduk, Renata

Worked for more than 160 Hours: No

Contribution to Project:

Hejduk is participating in RTTA 3: DP/CriticalCorps. She will begin work with the Scenarios and the InnovationSpace products when they are ready for analysis.

Name: Zenhausern, Frederic

Worked for more than 160 Hours: No

Contribution to Project:

Zenhausern supervises one of the CNS-Biodesign graduate student fellows.

Post-doc

Name: Bennett, Ira

Worked for more than 160 Hours: Yes

Contribution to Project:

Bennett, a PhD nano-chemist from Woodbury's previous IGERT group, has worked extensively on the RTTA 3 activity, scenario development, and developed, with broad assistance from other NSE collaborators, a set of plausible nanotechnological scenarios. He also led the working group, under Carlson's supervision, that developed the nanotechnology-in-society course for pre-college teachers. With Wetmore he is leading a group of graduate students to D.C. for extended exposure to policy and policy makers.

Name: Conz, David

Worked for more than 160 Hours: Yes

Contribution to Project:

Conz, a recent doctoral awardee (Hackett, supervisor), is assisting K Corley in the RTTA 4 activity, reflexivity assessment, to study the identity, knowledge, and practice of Biodesign scientists in regard to nanotechnology in society. Conz has conducted some of the field work, much of the data preparation, and will contribute to the analysis. In SP 07 Conz became one of the 3 faculty in the nano-related Learning Community, and CNS-ASU provides 1/3 of his support.

Name: Fisher, Erik

Worked for more than 160 Hours: Yes

Contribution to Project:

Fisher completed in YR 1 his doctoral dissertation as an embedded humanist in the nano-materials laboratory of Mahajan at Colorado, testing ideas of 'midstream modulation' that are crucial to RTTA. He worked under the direction of Pielke. He also began an education/outreach project with Picreux at DOE's Center for Integrated Nanotechnology. In Fa 06, Fisher came to ASU to be a post-doctoral fellow with the Center, where he continues working with CINT, developing his ideas about RTTA, and co-organizing the monthly seminar series with Selin and Wetmore. He has also begun a public value mapping project in Lindsay's lab.

Name: Selin, Cynthia

Worked for more than 160 Hours: Yes

Contribution to Project:

Selin began a post-doctoral fellowship with CNS-ASU in Fa 06, working primarily with RTTA 3/1 Scenario Development, but also coordinating with Wetmore and Fisher the monthly seminar series and the Yearbook derived from it. She will conduct a

scenario workshop with NSF researchers in ASU's Biodesign Institute. She also taught 'Justice and the Future' (JUS 394) Sp 07.

Name: Barben, Daniel

Worked for more than 160 Hours: Yes

Contribution to Project:

Daniel Barben became a partially funded (1/4 support) post-doc in Yr 2. After the All Hands meeting in Apr 2006, Barben and co-PI Miller began planning an integrative study across the four RTTA areas on 'nanoneural implants.'

Name: Kim, Eun-sung

Worked for more than 160 Hours: Yes

Contribution to Project:

Kim, who recently completed a dissertation in Science and Technology Studies at RPI, works with co-leader Linda Hogle and other faculty at Wisconsin on the Human Identity, Enhancement, and Biology theme beginning in F06. He presented a poster on directed evolution at the CNS-ASU All Hands Meeting in Apr 2007.

Graduate Student

Name: Spadola, Quinn

Worked for more than 160 Hours: Yes

Contribution to Project:

Spadola, a PhD student in Lindsay's lab, is a CNS-Biodesign fellow who took the CNS-related course, 'Science, Technology, & Societal Outcomes' (POS/BIO/JUS 598) taught by Wetmore and Bennett and spear-headed the establishment of CNS's Science Cafe including speaker recruitment and logistics. She is writing her PhD+ on the societal aspects of the \$1000 genome.

Name: Lappe, Jason

Worked for more than 160 Hours: Yes

Contribution to Project:

Lappe, a graduate student in Woodbury's lab, is a CNS-Biodesign fellow took the CNS-related graduate course, 'Science, Technology, and Societal Outcomes' (POS/BIO/JUS 598) in Sp 06 and participated in the nano-science fiction writing workshop offered by collaborator

Berne. He is developing scenarios for potential technologies stemming from his research in directed evolution. Three different scenarios will be developed for each technology to give a wider perspective to each one.

Name: Panjwani, Azra

Worked for more than 160 Hours: Yes

Contribution to Project:

Azra is a mathematics major who received partial support in Sp and Su 06 and is receiving support from CNS-ASU for Sp 07 and Su 07.

Name: Tosi, Justin

Worked for more than 160 Hours: No

Contribution to Project:

Tosi (ASU) is a PhD student in political science researching privacy and rights considerations in the context of NBIC innovation in human physical and cognitive enhancement. He worked in Sp 06 under the direction of Guston and in collaboration with fellow graduate student Parsi. In Su 06 he contributed time to the project and in F 06 he worked on it under political science funding.

Name: Karinen, Risto

Worked for more than 160 Hours: Yes

Contribution to Project:

Karinen, a political science PhD student, has performed research on the governance of nanotechnology, and he served as a teaching assistant (on departmental funds) for PI Guston in POS 426 in Sp 06. Karinen is completing his dissertation abroad and attended 'Deliberating Future Technologies: Identify, Ethics, and Governance of Nanotechnology' at the University of Basel, Switzerland in early May, where he presented a paper, co-authored with Guston, to be included in a book following the conference. He was supported on CNS funds F 06.

Name: Hisamura, Nate

Worked for more than 160 Hours: Yes

Contribution to Project:

Hisamura, a PhD student in the mathematics department, was a CNS-CRESMET fellow working under the direction of Carlson and Bennett to assist in the creation of a nano-in-society course for pre-college educators. Hisamura's involvement ended in SU06.

Name: Leung, Ricky

Worked for more than 160 Hours: Yes

Contribution to Project:

Leung, a PhD student in sociology at University of Wisconsin, conducted fieldwork in China, interviewing NSE researchers and administrators, under the supervision of senior investigator Fujimura. He interviewed more than 60 scientists in China and the US (some on his earlier NSF support) and their post-docs, graduate and undergraduate students, and technicians. Leung expects to complete his dissertation based on these data by Su 07.

Name: DiNapoli, Shannon

Worked for more than 160 Hours: Yes

Contribution to Project:

DiNapoli (ASU) is currently a master's student working first under the supervision of TRC 2 leader Robert on issues in nano-ethics and then under the supervision of Guston. DiNapoli started her work with CNS in Sp 06 as an undergraduate intern and continued as a fully funded graduate assistant in AY 06-07 after enrolling in a master's program in the School of Life Sciences. She worked in the laboratory of senior investigator He and will be involved in coordination of the NCTF in Phoenix in Yr 3.

Name: Wheelock, Roxanne

Worked for more than 160 Hours: Yes

Contribution to Project:

Wheelock has been assessing the organizational development and communications function of CNS-ASU under CSPO funds and Guston's supervision. She has revamped communications for website, logo, newsletters, PowerPoint templates and coordinated the printing of posters and other material for the All-Hands Meeting in Apr 2007.

Name: Parsi, John

Worked for more than 160 Hours: Yes

Contribution to Project:

Parsi (ASU) is a doctoral student in political science and has been working, under the direction of Guston, on issues of privacy and other rights in the context of human nano-biotechnology. He worked on the project under political science department funding in Sp 06, CNS funding in Su 06, and department funding in F 06. He served as TA for the Learning Community Sp07 with department funding but also continued to work on various CNS-related projects.

Name: Hays, Sean

Worked for more than 160 Hours: Yes

Contribution to Project:

Hays (ASU) is a doctoral student in political science who was a fully funded graduate assistant with CNS-ASU in AY 06-07. Hays works in support of RTTA 1/2 Public Value Mapping and other activities making use of his methodological skills. He also attended the nano fiction writing workshop in Yr 1 and produced a story for it. In Yr 2 he spearheaded the development of wiki and blog sites for Privateer's Transhumanism class.

Name: Hillback, Elliott

Worked for more than 160 Hours: Yes

Contribution to Project:

Hillback (Wisconsin) has been working on both the content analysis and survey preparation for RTTA 2 under the supervision of Scheufele and Dunwoody in RTTA 2 studying the influence of the media on public opinion regarding nanotechnology.

Name: Wang, Jue

Worked for more than 160 Hours: Yes

Contribution to Project:

Wang (GA Tech) is a doctoral student in public policy and primarily engaged in RTTA 1/1 activities. She is researching a dissertation on 'Academic Researchers and the Development of New Nanotechnology Firms' under the direction of institutional leader and senior investigator Shapira.

Name: Bhaskarabhatla, Ajay

Worked for more than 160 Hours: Yes

Contribution to Project:

Bhaskarabhatla (GA Tech) is a master's student in public policy, engaged primarily in the RTTA 1/1 activity. In Sp 06 he completed a thesis on 'Spatial Analysis of Nanotechnology Enterprises in the US: Structure and Location.' Co-authored 'Connecting the Dots' for the Southern Growth Policies Board.

Name: Tang, Li

Worked for more than 160 Hours: Yes

Contribution to Project:

Tang (GA Tech) is a doctoral student in public policy, engaged primarily in the RTTA 1/1 agenda providing general research support for the project through YR 1. She attended the All-Hands Meeting in Apr 2007 and presented her research project. C

Name: Lamos, Erin

Worked for more than 160 Hours: Yes

Contribution to Project:

Lamos (GA Tech) is a master's student in public policy, engaged primarily in RTTA 1/1 activities.

Name: Malani, Uttam

Worked for more than 160 Hours: No

Contribution to Project:

Malani (GA Tech) -- not funded by CNS-ASU -- has been a collaborator on RTTA 1/1 related writing projects.

Name: Slanina, John

Worked for more than 160 Hours: No

Contribution to Project:

Slanina (GA Tech) is partially supported by CNS and involved primarily in the RTTA 1/1 activities.

Name: Stephens, Alexa

Worked for more than 160 Hours: No

Contribution to Project:

Stephens (GA Tech), not funded by CNS, is a collaborator on RTTA 1/1 related writing projects.

Name: Shanley, Lea

Worked for more than 160 Hours: Yes

Contribution to Project:

Shanley (Wisconsin) conducted research in the theme of Freedom, Privacy, and Security on animal tagging and tracing under the supervision of Suchman.

Name: Gallo, Jason

Worked for more than 160 Hours: Yes

Contribution to Project:

Gallo, a graduate student in the Media, Technology, and Society Program in School of Communication at Northwestern, was supported in YR 2 for work on his dissertation, which looks at the history of NSF's funding of NSE in the context of economic and security discourses.

Name: Shih, Tsung-Jen

Worked for more than 160 Hours: Yes

Contribution to Project:

Shih (Wisconsin), a graduate student in journalism, worked with Scheufele on RTTA 2/2 media influence.

Name: Libaers, Dirk

Worked for more than 160 Hours: No

Contribution to Project:

Libaers (GA Tech) had been working in support of the RTTA 1 activities under the supervision of Bozeman but not on CNS funds, until Bozeman left GA Tech. Libaers has since finished his dissertation under different supervision.

Name: Laurent, Brice

Worked for more than 160 Hours: Yes

Contribution to Project:

Laurent is a visiting doctoral student from France who is studying public participation in nanotechnology.

Name: Agrawal, Parul

Worked for more than 160 Hours: Yes

Contribution to Project:

Agrawal is a graduate student in Zenhausern's lab and a CNS-Biodesign Fellow. She joined CNS-ASU in January and has contributed support for the All Hands Meeting. She will be working with Miller to integrate RTTA 1 and HIEB.

Name: Patil, Jayesh

Worked for more than 160 Hours: Yes

Contribution to Project:

Patil (GA Tech) worked under the supervision of Porter on RTTA 1 activities, including developing and cleaning the nano publication and patent data base and the geocoding of records.

Name: Mehta, Pratik

Worked for more than 160 Hours: Yes

Contribution to Project:

Mehta (GA Tech), a master's student in quantitative finance, has worked under the supervision of Shapira on RTTA 1/1 activities, primarily developing and cleaning the patent and publication databases and developing programs and macros.

Name: van Merkerk, Rutger

Worked for more than 160 Hours: Yes

Contribution to Project:

Van Merkerk was a visiting doctoral student from the Netherlands who worked with Guston and Sarewitz on comparing RTTA to the Dutch constructive technology assessment.

Undergraduate Student

Name: Pirtle, Zachary

Worked for more than 160 Hours: Yes

Contribution to Project:

Pirtle (ASU) has been working in support of a number of research tasks, including the Human Identity, Enhancement, and Biology theme, and pursuing an undergraduate honors thesis on the evolution of ELSI funding in the US that resulted in the nano-in-society network. He completed his engineering degree and his honors thesis in Sp 07.

Name: Abdullah, Kalil

Worked for more than 160 Hours: Yes

Contribution to Project:

Abdullah (ASU) has worked in support of a variety of research activities, including background on the NNI and the source of attention to human and artificial intelligence in the 2003 Nanotechnology R&D Act. He completed his CNS-related work as of F 06.

Name: Young, Brian

Worked for more than 160 Hours: Yes

Contribution to Project:

Brian has provided support for the wiki-type site for the review of CNS-ASU scenarios and the governance project.

Name: Jackson, Taylor

Worked for more than 160 Hours: Yes

Contribution to Project:

Jackson (ASU), an undergraduate in biology and society, was supported in Sp and Su 06 to conduct research on the history of nanotechnology at ASU and assist other research projects. He has completed his work with CNS-ASU.

Name: Anderson, Derrick

Worked for more than 160 Hours: Yes

Contribution to Project:

Anderson has worked on cataloguing governing activities for the wiki.

Name: McCloud, Charles Luke

Worked for more than 160 Hours: Yes

Contribution to Project:

McCloud (GA Tech) is an undergraduate major in public policy, serving as a research assistant primarily with the RTTA 1/1 activity. He has worked for the project with institutional funding in Su 06 but was funded by the Center from F 06.

Name: Finney, Sharyn

Worked for more than 160 Hours: Yes

Contribution to Project:

Finney (GA Tech) is an undergraduate major in public policy and economics, assisting with the RTTA 1/1 activity.

Name: Bhalla, Nidhi

Worked for more than 160 Hours: No

Contribution to Project:

Bhalla (ASU) is a political science major who worked under the supervision of Robert in the TRC 2 HIEB activity in Sp 06.

Name: Weakley, Julia

Worked for more than 160 Hours: Yes

Contribution to Project:

Weakly has provided support for CNS-ASU communications GRA Wheelock, for the All Hands Meeting, and for RTTA 4 - Reflexivity and Assessment by editing transcripts of scientist interviews. She will be involved in activities designed to integrate the RTTAs and TRCs.

Name: Choi, Josh

Worked for more than 160 Hours: Yes

Contribution to Project:

Choi (Biomedical Engineering/Economics) has performed literature searches and reviews in service of the RTTA 3/1 scenario development activity, seeking mentions of nanotechnological futures relevant to the theme of freedom, privacy, and security from the literature broadly speaking. Choi completed his work with CNS-ASU in June 2006.

Name: Omer, Sidra

Worked for more than 160 Hours: No

Contribution to Project:

Omer (ASU) has prepared brief case studies in 'forbidding science' and worked in support of a number of CNS administrative and research activities. Omer completed work with the project in SU06.

Name: Cassellius, Brescia

Worked for more than 160 Hours: Yes

Contribution to Project:

Cassellius (Wisconsin) supported RTTA 2, in particular, the newspaper coverage of Nanotechnology from 1985 to present under the direction of Dunwoody and Scheufele.

Name: Davis, Rob

Worked for more than 160 Hours: Yes

Contribution to Project:

Davis, a student in HON/BIO 394 taught by senior investigator Ramakrishna, completed an undergraduate honors thesis on stakeholder analysis in relation to the NCTF in Sp 07.

Name: Hudson, Rebecca

Worked for more than 160 Hours: Yes

Contribution to Project:

Hudson joined CNS-ASU in Fa 07 and edited interview transcripts for K Corley's RTTA 4 activities. Following a semester abroad, she rejoins the staff in Su 07.

Name: Egnatios, Tara

Worked for more than 160 Hours: No

Contribution to Project:

Egnatios will work to enhance the outreach efforts of the International Network for Nanotechnology in Society. She will be responsible for accumulating data from the NanoFutures RTTA 3 open source scenario project and will perform literature reviews on virtual learning and novel uses of scenarios. Continuing in the fall, she will provide logistical support for the CNS Biodesign Scenario Conference.

Technician, Programmer

Other Participant

Name: Schneider, Anne

Worked for more than 160 Hours: No

Contribution to Project:

Scheider has been co-PI and co-leader of RTTA 4 Reflexivity Assessment and Evaluation and a member of the Executive Committee. She is stepping down from these positions but remaining affiliated with the Center. She is working w/ consultant Ingram to investigate the role of public participation and the role of boundary organizations like CNS in managing multiple 'ways of knowing.' With Ingram and other colleagues, she is planning a workshop to investigate these themes, which will also include a recently NSF-funded project at Harvard on boundary organizations and the international agricultural system.

Name: Wolbring, Gregor

Worked for more than 160 Hours: No

Contribution to Project:

Wolbring (Calgary) was commissioned to write a white paper on persons with disabilities and nanotechnological therapies and enhancements. He continues to interact with the HIEB theme.

Name: Smith, Rachel

Worked for more than 160 Hours: Yes

Contribution to Project:

Smith (ASU), a recent graduate in biology and society, worked under the supervision of post-doctoral fellow Bennett and PI Guston on a survey of the activities of US states in nanotechnology development and on the nano-and-religion project under the supervision of Wetmore. She completed her work with CNS in Su 06.

Name: Schoeneck, Dave

Worked for more than 160 Hours: Yes

Contribution to Project:

Schoeneck (GA Tech) is a recent physics graduate who has been working on RTTA 1/1 activities prior to applying to graduate school.

Name: Reynolds, Scott

Worked for more than 160 Hours: No

Contribution to Project:

Reynolds is a project director at Rutgers' Heldrich Center for Workforce Development and involved in the nano workforce assessment subcontract.

Name: Laird, Frank

Worked for more than 160 Hours: No

Contribution to Project:

Laird has collaborated with consultant Barben in writing a paper on 'Acceptance Politics' commissioned by CNS-ASU.

Name: Moore, Mary

Worked for more than 160 Hours: Yes

Contribution to Project:

Moore has mapped existing views on new life forms (self-assembly molecules, artificial cells, etc.) as articulated by a variety of religions. With Hogle, Moore has authored a paper that will be submitted to Nanoethics.

Research Experience for Undergraduates

Organizational Partners

Other Collaborators or Contacts

Appendix I: Partner Organizations

At Arizona State University

Consortium for Science, Policy and Outcomes

CNS-ASU and CSPO are tightly integrated but separate entities. CSPO contributes a significant share of the academic year time for CNS director Guston, associate director Sarewitz (who are, respectively, associate director and director of CSPO), associate director for education and outreach Miller and faculty member Wetmore. CSPO has co-funded post-doctoral fellow Bennett and graduate student Valdivia with CNS and provided the discretionary funds to Guston with which he hired graduate student Wheelock. CNS personnel, particularly undergraduate interns, have been co-located with CSPO personnel. CSPO also provided significant in-kind support and training for the start-up of CNS, including web development. The two centers collaborated on the YR 2 Public Value Mapping and Boundary Organizations workshops and exist together as a nearly seamless collegial group with joint co-curricular activities.

The Biodesign Institute

The Biodesign Institute at ASU is our major NSE partner, and Biodesign director Poste is a co-PI in CNS-ASU. This partnership is manifest in a number of formal and informal relationships, including:

- ò A co-funded staff person (15% CNS), Melissa Cornish, who is a senior analyst in the Biodesign Institute's department of strategy and research alliances and serves as CNS's liaison to Biodesign;
- ò Three co-funded (33%) graduate students (Spadola, Lappe, and Agrawal), designated CNS-Biodesign fellows, who take societal implications coursework, assist in outreach activities (especially the Science Caf ), provide technical advice to projects including RTTA 1/RISA and scenario development, etc.;
- ò Applications for other external funds, including a successful proposal to NSF from Lindsay's laboratory, leading to work by Fisher there;
- ò Concrete plans for more in-depth collaborations and the cost-sharing of CNS personnel to be 'embedded' in Biodesign, planned for Conz commencing Su 07; and
- ò Use of Biodesign space for the Learning Community, CNS-ASU seminars, and other activities.

CRESMET

The Center for Research on Education in Science, Mathematics, Engineering and Technology (CRESMET) is another major partner on campus, and its director Carlson is a co-PI in CNS-ASU. In addition to co-funding (50%) two CNS-CRESMET graduate student fellows (D'Angelo and Garay), CRESMET and CNS-ASU partnered through the work of post-doctoral fellow Bennett to develop a new course for in-service pre-college teachers in nanotechnology in society.

Hispanic Research Center

The Hispanic Research Center (HRC) co-funded (50%) with CNS-ASU a staff person, Raul Alcal , who served as a point of contact between our two organizations until his departure in Sp 07. CNS-ASU and HRC established two programs to improve ASU's ability to recruit graduate students from under-represented groups for nanotechnology and its societal implications. First, both CNS-ASU and HRC agreed to contribute supplementary fellowship funds to recruit graduate students from under-represented groups. In the current year, there were no opportunities to implement this agreement. Second, CNS-ASU and HRC collaborated in holding a student research conference for under-represented perspectives on nanotechnology and human enhancement. Other nodes of the nano-in-society network (CNS-UCSB, USC, and Harvard/UCLA) pledged resources to the meeting, but it was small enough that those commitments were not necessary to pursue.

InnovationSpace

Led by CNS senior investigator Boradkar, InnovationSpace (IS) is a trans-disciplinary educational collaboration among the ASU schools of design, business, and engineering. After a preparatory year of background research and curriculum development, IS added three cross-functional student groups in nanotechnology to its curriculum for AY 06-07. IS drew extensively from RTTA 3/Scenario Development activities and the expertise of post-doctoral fellows Bennett and Selin. Boradkar also led a NSF NUE proposal (submitted 5/06) on 'DESIN: Design for Environmentally and Socially Integrated Nanotechnologies' including CNS PI Guston and senior investigator Crittenden (Engineering) as co-PIs. This proposal went unfunded (receiving one E and two VGs), but a similar proposal to the National Collegiate

Inventors and Innovators Alliance was funded at \$30K and will finance the next year's IS nano activities. CNS-ASU anticipates a third year of collaboration in AY 08-09.

School of Human Evolution and Social Change

ASU's School of Human Evolution and Social Change (SHESC) shared with CNS-ASU the support of post-doctoral fellow Conz who, with CNS, led the Learning Community and supports RTTA 4 Reflexivity Assessment under the direction of senior investigator K Corley.

CNS-ASU and CSPO also share with SHESC assistant professor Wetmore, hired in F 06. Wetmore would co-lead the planned replacement TRC 1, Equity and Responsibility.

Sandra Day O'Connor School of Law

In YR 1, CNS-ASU and CSPO assisted the Program in Law, Science, and Technology at ASU's Sandra Day O'Connor School of Law in organizing a symposium on 'Forbidding Science,' which had a panel involving questions of nanotechnology û chaired by CNS co-PI Sarewitz and involving senior investigator Lindsay from ASU's Biodesign Institute and Patrick McCray from NSEC/CNS-UCSB û as well as panels on biosecurity, human cognitive enhancement, and rights to research. In conjunction with the meeting, primary organizer and CNS senior investigator Marchant has submitted a set of papers to Science and Engineering Ethics, including 'Science, Democracy, and the Right to Research' by Mark Brown (Cal State U., Sacramento) and CNS PI Guston. CNS and CSPO also served as a work site for three law students taking an Applied Research Seminar class. Two students wrote research papers on nano-related topics: 'The Asilomar Conference and its Application to Today's Technologies: Could an Asilomar Conference Help Manage Nanotechnology's Risks?' and 'Arizona State University's Potential Liability for Nanotechnology Research.' The third paper û 'Law and Research: Free Inquiry Absent a Recognized 'Right to Research" û is more broadly applicable but relevant to nanotechnology research. Marchant also helped prepare briefing papers for the EPA on Innovative Regulatory Approaches for nanotechnology and regulation of nanotechnology under the Clean Air Act. These were part of a series of seven briefing papers drafted by over 100 lawyers in the American Bar Association's Section on Environment, Energy and Resources. In YR 2, the Program in Law, Science, and Technology created a set of Law and Science Clusters, including a Nanotechnology Cluster, to bring together a variety of interested students and faculty from the Law School and beyond. The Nanotechnology Cluster is an anticipated distribution point for the scenarios, among other activities.

Center for the Study of Religion and Conflict

As part of its own agenda, CSRC has been investigating the phenomenon of transhumanism. CNS-ASU graduate assistant Hays will also be working with CSRC to create an on-line repository of discourse on human enhancement technologies and transhumanism.

Responsible Conduct of Research Program, School of Life Sciences

Karin Ellison, director of RCRP, provided a training session in the responsible conduct of research to CNS-ASU graduate and undergraduate researchers.

Decision Center for a Desert City

This NSF-funded center at ASU collaborated on the Nov 06 Boundary Organizations workshop.

Science Policy Assessment and Research on Climate (SPARC)

This NSF-funded center at ASU and University of Colorado collaborated on the Nov 06 Boundary Organizations workshop.

Other Than at ASU

National Nanotechnology Coordinating Office

In collaboration with the NNCO, CNS-ASU helped organize and support a workshop in Tempe in Jan 07 on Ethical Issues in Nanotechnology. Director Guston served on the organizing committee along with Kate Alexander, Celia Merzbacher (OSTP), Nigel Cameron (IIT), and Rosalyn Berne (UVA). A report of the workshop is in production.

Sandia National Laboratory

In YR 1, CNS-ASU, CSPO, and the Advanced Concepts Group at SNL partnered to run a workshop on 'Policy Implications of Technologies for Cognitive Enhancement' at ASU in May 06. CNS co-PIs Guston and Sarewitz and senior investigators Allenby, Marchant, Privateer, and Robert attended, among two dozen other attendees. A report, co-authored by Sarewitz, is available at <http://www.osti.gov/bridge/purl.cover.jsp?purl=/901973-W3T1e9/>.

US DOE/Center for Integrated Nanotechnology (CINT)

Primarily through post-doctoral fellow Fisher, CNS-ASU has developed a program to inform CINT staff and users about the societal implications of nanotechnology. Our goal is to create a training program in societal implications that can be integrated into CINT's own training, that is portable back to the users' own institutions, and which can be replicated at DOE's other nano user facilities.

Nanoscale Informal Science Education Network (NISE Net)

In YR 1, CNS-ASU began a number of contact activities with NISE Net, including: a plenary talk by PI Guston at the NISE Net launch in San Francisco in Nov 05 (also attended by senior investigator Ramakrishna); a networking lunch among nano-in-society, NISE Net, and other interested parties during the AAAS annual meeting in Feb 06 in St. Louis; and discussions with Anna Waldron of the Cornell Nanobiotechnology STC for a nano-in-society experiment in one of the large NISE museum exhibits. In YR 2, CNS-ASU expanded its contacts with NISE Net, including additional attendance at meetings (Miller at Nov 06 annual meeting; Guston, Bennett, Garay and D'Angelo at meeting in Mar 07; NISE Net principals Bell, Duckworth, and Koch at All-Hands in Apr 07) but also deeper collaborations around the use of CNS-ASU scenarios and the production by CNS-ASU for NISE Net of 'Ten Big Ideas for Nanotechnology in Society,' which is nearing completion.

Arizona Science Center and Changing Hands Bookstore

In YR 2, the AZ Science Center and Changing Hands have been partners in hosting the monthly Science CafÚs.

Arizona Nanotechnology Cluster

AZ Nano Cluster has assisted RTTA 1/3 workforce assessment in contacting regional nano-industries and distributing its survey.

Arizona Bioindustry Organization

AzBO has assisted RTTA 1/3 workforce assessment in contacting regional nano-industries and distributing its survey.

Arizona Technology Council

AZ Tech Council has assisted RTTA 1/3 workforce assessment in contacting regional nano-industries and distributing its survey.

Bioindustry Organization of Southern Arizona

BOSA has assisted RTTA 1/3 workforce assessment in contacting regional nano-industries and distributing its survey.

The Center for International Development, Harvard University

Under an NSF grant to William C. Clark (Harvard U.), CNS director Guston collaborated in the Nov 06 Boundary Organizations workshop.

The Foresight Institute

The Foresight Institute will be a collaborating distributor of the scenarios wiki.

International Nanotechnology in Society Network (INSN)

In YR 1, INSN held its third meeting in Mar 06 in conjunction with the World Forum on Science and Civilization, hosted by the Martin Institute at Oxford University, England and with support from CNS-ASU and CSPO. INSN (www.nanoandsociety.org), with membership in more than a dozen countries, has created a governance structure, charted shared goals and projects, and conducted further sub-group meetings at conferences of the European Association for the Study of Science and Technology (Lausanne, Aug 06) and the Society for the Social Studies of Science (Vancouver, Oct 06). INSN has facilitated international travel and connections for CNS-ASU graduate students and post-doctoral fellows, include Fisher's research trip in Su 06 and several OISE-funded trips in Su 07. INSN will also help facilitate the management of the planned wiki on governance of nanotechnology.

NSEC/CNS-University of California, Santa Barbara (UCSB)

In addition to ongoing and regular conversations, CNS-ASU successfully negotiated with CNS-UCSB to be the sixth site of the National Citizens' Technology Forum. CNS-UCSB co-director Barbara Harthorn attended the CNS-ASU launch, and CNS-ASU faculty member Wetmore attended the CNS-UCSB launch. CNS-UCSB co-director Patrick McCray participated in both the 'Forbidding Science' workshop hosted by the ASU O'Connor College of Law and the Trading Zones workshop organized by UVA's Michael Gorman û both of which CNS-ASU helped to organize and sponsor. CNS-ASU co-PIs Guston and Sarewitz have also traveled to Santa Barbara to visit with their CNS-UCSB colleagues, and GA Tech PI and RTTA 1 leader Shapira has met with his CNS-UCSB counterpart, Chris Newfield twice to discuss and coordinate their respective NSE research and innovation assessment activities.

Nanotechnology in Society PIs Group

CNS-ASU director Guston participates, along with CNS-UCSB co-director Barbara Harthorn and NSF-funded nano-in-society PIs Davis Baird and Richard Freeman, in a monthly teleconference to discuss common issues and activities. There have been a variety of networking outcomes, including an anticipated collaboration among the group in CNS-ASU's research conference for underrepresented students.

Illinois Institute of Technology

CNS director Guston and IIT's Vivian Weil co-organized a symposium proposed for the October 2006 annual meeting of the Society for Social Studies of Science on 'New Ethnographies of Nanotechnology.' In Jun 07, Guston will be a visiting fellow at the Center for Nanotechnology and Society at IIT's Kent School of Law.

UCLA/Harvard/NBER: Collaborative Research; Personnel Exchanges

CNS-ASU subcontractors at GA Tech are mostly faculty in the School of Public Policy there. They have developed collaborative relationships with several of their GA Tech colleagues -- mostly in the School of Management -- who are part of the NSF-funded NIRT and nano-in-society network project at UCLA/Harvard/NBER that includes GA Tech. Collaborators include management faculty member Graham.

James Martin Institute for Science and Civilization, Oxford University

The Martin Institute, and its director Steve Rayner, have been generous collaborators and hosts of an INSN meeting and several OISE-funded graduate and post-doctoral researchers. CNS-ASU is also exploring the Martin Institute's use of the scenarios developed under RTTA 3/1.

OISE International Travel

The following individuals and/or institutions have or will have hosted OISE-sponsored travel by CNS-ASU graduate students and post-doctoral fellows in YR 2:

- ò Science Policy Research Unit (SPRU), University of Sussex, UK;
- ò Institute for Technology Assessment and Systems Analysis, Germany;
- ò Rathenau Institute, The Netherlands;
- ò Centre of Science, Technology and Ethics, Belgium;
- ò Pierre Wack Library, Oxford University, UK;
- ò European Environmental Agency, Denmark;
- ò Risoe National Laboratory, Denmark;
- ò Barend van der Meulen, University of Twente, The Netherlands;
- ò Ruud Smits, University of Utrecht, The Netherlands;
- ò Research Center on Technology, Energy, and the Environment, University of Antwerp, Belgium;
- ò Marina Merz, University of Luzern, Switzerland;
- ò Alain Kaufmann and Dietmar Braun, University of Lausanne, Switzerland;
- ò John Adams, University College London, UK.
- ò Researching Inequality through Science and Technology (ResIST) at Oxford University.

All-Hands Meeting

The following scholars without CNS-ASU affiliations attended the All-Hands Meeting: Chris Bosso (Northeastern), Nigel Cameron (IIT), Steve Fuller (Warwick/EU), Paul Rabinow (Berkeley), Fern Wickson (Bergen), Gregor Wolbring (Calgary), Josephine Johnston (Hastings), Larry Bell (NISE Net), Kate Duckworth (NISE Net), Sue Koch (NISE Net), John Besley (South Carolina), Susanna Priest (South Carolina), John Trumpbour (UCLA), and Guillermo Foladori (Zacatecas-Mexico).

Jennings Strouss

The law firm of Jennings Strouss is hosting two faculty (Wetmore and Woodbury), a post-doc and approximately a dozen science and engineering graduate students in Washington DC during the two-week 'Science Outside the Lab: A Policy 'Dis'-Orientation.'

Activities and Findings

Research and Education Activities: (See PDF version submitted by PI at the end of the report)

Findings: (See PDF version submitted by PI at the end of the report)

Training and Development:

Training and Development

Post-Doctoral Training

CNS-ASU maintains an active post-doctoral fellowship program that includes both research and teaching responsibilities for post-doctoral fellows.

In YR 1 (corresponding roughly to AY 05-06 and the subsequent summer, the Center co-funded two post-doctoral fellows, Bennett and Conz. See the annual report for YR 1 for their responsibilities in that year.

In YR 2, CNS-ASU fully supported two post-doctoral fellows, Selin and Fisher, and partially supported three, Bennett, Conz, and Barben. This support of post-doctoral fellows is in significant excess of the original budget for YR 2, and it is largely supported through the carrying over of unexpended personnel costs from YR 1.

Selin, a recent PhD from the Copenhagen Business School, conducted her dissertation research on scenario development and other future-oriented techniques for nanotechnology. She contributed substantially to RTTA 3/1 scenario development activities. She also taught a

course in Sp 07, 'Justice and the Future,' on future-oriented techniques with a focus on nanotechnology, listed with the School of Justice and Social Inquiry. She collaborated with Fisher and Wetmore to run the monthly seminar series and edit the resulting papers into the first volume of the Yearbook of Nanotechnology in Society (New York: Springer, forthcoming 2008). She also collaborated with Guston, Barber and Fisher on a chapter on anticipatory governance of nanotechnology contributed to the Handbook of Science and Technology Studies. Selin participated in a Science Caf  and will be traveling on OISE funds to the UK and Denmark in Su 07. She has begun publishing on scenarios and other nano-future projects and she made four research presentations during the year. Selin is currently in consideration for a faculty position between CSPO and an academic unit to be determined.

Fisher, a recent PhD from the University of Colorado-Boulder whose graduate work as an 'embedded humanist' in a nano-materials laboratory CNS-ASU supported in YR 1, continued his research on 'mid-stream modulation' and its implications for RTTA as a spur for anticipatory governance. He has initiated a research activity in Lindsay's Laboratory for Single Molecule Biophysics, co-funded by the lab, that will focus on a set of questions related to Public Value Mapping, pursued through participant observation and workshops. He has led the outreach activities with DOE's Center for Integrated Nanotechnology and, like Selin, collaborated in the organization of the seminar series and editing of the Yearbook as well as the drafting of the Handbook chapter. He has interacted with a number of students about their research plans and has agreed to serve on the doctoral committee of CNS-CRESMET fellow Garay and will be collaborating on a conference paper with CNS-ASU-sponsored international graduate student Laurent. With OISE support, he will travel to Norway, Germany, Belgium, the Netherlands, and the UK this summer. CNS-ASU will retain Fisher in a post-doctoral position in YR 3 with funding from CNS and, potentially, elsewhere.

Bennett continued much of his YR 1 activities and expanded them. He again co-taught the graduate course Science, Technology, & Societal Outcomes with Wetmore. Bennett also continued his work with the team from CRESMET developing a course in nanotechnology-in-society which he debuted in Sp 07. He also worked closely with IS to support its work in creating nanotechnological product designs. He participated in two Science Caf s and developed the International Perspectives on Nanotechnology and Society (IPNS) program, which is in collaboration with Woodbury's IGERT and trained about a dozen NSE graduate students in nano-and-society issues in the UK and the Netherlands in Su 06. In Su 07 he will lead, along with Wetmore, the DC Summer Session training for NSE graduate students. Bennett also continues to work, under Sarewitz's leadership, in the RTTA 3/1 scenario development activities, particularly focusing on the pursuit of technical validations. CNS-ASU will likely continue a sharing of Bennett in a post-doctoral position in YR 3.

Conz also continued much of his YR 1 activities and expanded them. He continued to contribute fieldwork and data analysis to RTTA 4/1 Reflexivity Assessment, under the leadership of K Corley, and he is leading the preparation of a network analysis of CNS-ASU, supervising the undergraduate student Weakley in the process. Conz also led the Learning Community on 'Nanotechnology in Society' offered in Sp 07. He also participated in a Science Caf . The current but not yet secured plan for retaining Conz in YR 3 involves a jointly funded position as an assistant research scientist with the Biodesign Institute.

Barben's work in YR 2 as a post-doctoral fellow included the collaboration with Selin, Fisher, and Guston on the Handbook chapter. He and Miller have outlined a book (working title, Our Nanotechnological Future: Science and Democracy at a Crossroads), which they intend to draft Sp 08. Barben contributed two sections for the project 'Ten Big Ideas on Nanotechnology in Society,' which is part of the growing collaboration with NISE Net. The CNS authors of this outline plan to elaborate a concise version of these ideas for Nature Nanotechnology.

In YR 2, Wisconsin hired Kim, who has a recent PhD in Science and Technology Studies from RPI, where he completed a dissertation on the stem cell controversy, as a post-doctoral fellow to work with TRC 2 co-leader Hogle on HIEB activities. Kim's research has focused on directed evolution as an aspect of nanobiotechnology.

Graduate Training

CNS-ASU provides research training to supported graduate students in the Center's RTTA and Thematic Research Cluster programs. At ASU, the Center funds three types of graduate students: First, CNS fully funds four graduate students in the social sciences and humanities who provide research support to CNS programs. Second, the Center provides 1/3 funding for each of three Biodesign-affiliated NSE graduate students, designated CNS-Biodesign fellows, who supplement their NSE training with a variety of nano-in-society training. Third, the Center provides 1/2 funding for each of two graduate students (from any background) who are shared with the Center for Research on Education in Science, Mathematics, Engineering, and Technology (CRESMET) and CNS-CRESMET fellows who support educational outreach activities while learning about nano-in-society.

Graduate students receive supervision in at least two ways: first, through the faculty member with whom they are doing their research, e.g., the faculty leader of a particular RTTA or TRC activity; and second, through every other week meetings among all graduate students with CNS director Guston and CNS administrative staff. In Oct 06 in a joint meeting of CNS-ASU graduate and undergraduate researchers and Dr. Karin Ellison, director of Director, Responsible Conduct of Research Program for School of Life Sciences provided students with training in the

responsible conduct of research.

In Jan 07, CNS-ASU renewed the status of CNS-Biodesign fellows Quinn Spadola (Physics) and Jason Lappe (Biochemistry). The third CNS-Biodesign fellow, Brelsford, chose not to continue in her graduate program, and CNS-ASU then hired Parul Agrawal (Material Sciences Engineering). Both Spadola and Lappe are making strong progress in their work toward their PhD+. Spadola is investigating the societal consequences of the \$1000 genome sequencing technology that is one of the goals of her research. Lappe is developing three different kinds of anticipatory explorations — analytical essay, product scenario, and science fiction — for each of three technologies related to his work — lab-on-a-chip, designer enzymes, and directed evolution process as product. Spadola has also been leading the organization of the Science Cafés.

CNS-ASU also provides training programs for NSE graduate students beyond the scope of the CNS-Biodesign fellows program. In Su 06 (after YR 1 annual report), in collaboration with the Woodbury IGERT, CNS helped support the International Perspectives on Nanotechnology and Society (IPNS) program, which exposed ten graduate students to science policy and nano-in-society topics over a three-week stay in the UK and the Netherlands. The meetings were hosted by Steve Rayner of the James Martin Institute on Science and Civilization at Oxford University and Arie Rip of the NanoNed project at the University of Twente.

In Jun 07, CNS will offer a DC Summer Session for NSE graduate students to 'dis-orient' them to topics in science policy and nanotechnology in society in Washington, DC. Currently, eleven students are enrolled in the two-week long session, 'Science Outside the Lab: A Policy Dis'-Orientation.' Students will leave their labs behind to explore and reflect on the relationships among science, policy, and societal outcomes. They will meet with government officials, lobbyists, staffers, regulators, journalists, academics, museum curators, and others who will educate them in the many ways that people in Washington, D.C. impact, direct, and learn from science. Students will participate in a mock hearing that will help them to understand how Congress obtains and uses scientific advice, talk with museum curators to see how science is presented to the public, and participate in a science fiction writing workshop to get experience thinking about the complex relationships among people, science, and technology. The students are drawn mainly from the Biodesign Institute, but also from the Department of Chemistry and the Fulton School of Engineering.

In YR 2, CNS-ASU renewed the status of CNS-CRESMET fellow Manuel Garay (Educational Leadership and Policy Studies) and hired Cynthia D'Angelo (Physics and Science Education). Both have been instrumental in the organization and the (upcoming) evaluation of the course in nanotechnology in society for in-service high school teachers. Garay also hosted the first Spanish-language Science Café in Oct 06, and will be assisting in translating the scenarios into Spanish.

In the full-time CNS-ASU graduate assistant positions in YR 2, CNS-ASU hired the following students:

ò Risto Karinen (Political Science), who worked with Guston on the 'Toward Anticipatory Governance' paper for the conference, 'Deliberating Future Technologies: Identify, Ethics, and Governance of Nanotechnology' in Basel, Switzerland, and who led the production of the governance wiki (assisted by undergraduate intern Anderson), worked with CNS-ASU in F 06 before returning, after completing his requirements for candidacy, to his native Finland for his field work.

ò Azra Panjwani (Mathematics), who served as a graduate assistant in YR 1, completed the Sp 07 slot (held by Karinen in F 06). Panjwani continues to develop her mathematical modeling of potential nano-surveillance systems (under supervision from Greenwood and Sarewitz) and expects to have a manuscript for submission by the time she finishes her master's thesis in Su 07.

ò A'ya Garc'ya-Mont (Educational Leadership and Policy), who continued her work on the identity, knowledge, and practice of Hispanic and Latino/a NSE researchers, is receiving her master's degree in Su 07, and CNS-ASU will retain her over the summer to complete her project. She also contributed to organizing the 'Hispanic Leaders on Nanotechnology' conference, co-sponsored with the Hispanic Research Center and the Biodesign Institute, to organizing the Spanish-language Science Café held in Oct 06, and to translating the scenarios into Spanish.

ò Sean Hays (Political Science), who has been involved in a number of projects, including data cleaning and sample selection for RTTA 2/3 Scientists' Survey and RTTA 1/1 Trends in the Professional Literature (both using VantagePoint software). After taking Privateer's course on transhumanism, Hays led the creation of a blog on the topic, and will continue to work with TRC 2 leader Robert on HIEB issues. He plans to write a dissertation in political science on the intersection of human enhancement technologies and the emergence of global governance. He will present a paper in Su 07 on the semiotics of transhumanism at a conference on the Prague School of Structuralism. Hays is also working with the Center for the Study of Religion and Conflict to create an on-line repository of discourse and information about human enhancement technologies and transhumanism. His work is also relevant to RTTA 3/3 CriticalCorps.

ò Shannon DiNapoli (Biology and Society), working as an undergraduate and then as a post-bacc during YR1, compiled a survey of the nano-ethics literature to be used in conjunction with work by John Parsi (under the supervision on Guston) to produce a paper with Guston and Robert on the novelty of ethical issues in nanotechnology. She continues to analyze the data from her collaboration with a neuroprosthetics lab during F 06. In Sp 07 DiNapoli joined the NCTF project as the graduate assistant for the ASU site. DiNapoli continues to work on her theoretical understanding of public participation models and deliberative democracy exercises.

CNS-ASU also hired Walter Valdivia (Public Affairs) as a graduate assistant, splitting his time with CSPO. Valdivia worked on RTTA 1/2

PVM activities and on RTTA 1/1 Trends in Professional Literature activities. He is planning to do his dissertation on related topics (potentially including nanotechnology and equity issues in conjunction with the planned new TRC 1) and will be a full-time CNS graduate assistant in AY 07-08.

Although he is no longer supported by CNS-ASU, Parsi (Political Science) has continued to work on a variety of projects, including serving as a teaching assistant for the Learning Community, exploring a potential project with CNS-ASU consultant Wolbring on able-ism and transhumanism, consulting with Hamlett about issues of deliberative democracy regarding the NCTF, and working with Guston, Robert, DiNapoli and Pirtle on what is new about nano-ethics. Parsi has entered candidacy for his doctoral degree with a proposal to study the political and legal implications of biological and technological challenges to sex dimorphism. Starting Su 07, he will also begin pursuing a JD at the University of Michigan.

As of this writing, CNS-ASU has staffed its graduate positions at ASU almost completely for AY 07-08. Spadola and Lappe will complete their second calendar year (Sp 07 to F 07) as CNS-Biodesign Fellows, with possible renewal in Sp 08. Agrawal will continue through the calendar year with possible renewal as well. Garay and D'Angelo will continue as CNS-CRESMET fellows through the calendar year with possible renewal. Hays and DiNapoli will continue their assistantships; Garcia-Mont and Panjwani will have graduated. CNS-ASU will hire Valdivia as a full-time assistant. It is unclear now whether the Center will hire a fourth graduate assistant or apply those funds toward maintaining some of the additional post-doctoral fellows.

Outside of ASU in the CNS network, Wisconsin supported several doctoral students performing significant research:

- ò Gallo (Communication) came from Northwestern to collaborate with CNS personnel on his dissertation work on the rhetorical foundations of the National Nanotechnology Initiative. He used his time at Wisconsin very productively for talks and conference presentations and also to complete his dissertation work, largely linked to CNS.
- ò Shanley (Sociology) performed research under the supervision of Suchman on RFID animal tagging and tracking, with implications for nano-tracking devices.
- ò Moore (Medical History and Bioethics) has investigated the role of religious institutions in understanding the boundaries of new forms of life, including self-assembly and nanotechnology.
- ò Leung (Sociology) continued his dissertation work on nanotech in China under CNS sponsorship. Under the supervision of senior investigator Fujimura, Leung interviewed NSE researchers and those from related areas from several universities (including Peking, Tsinghua, and Shanghai) and from several institutes of the Chinese Academy of Sciences in Beijing and Shanghai. He has interviewed more than 60 scientists in China and the US (some on his earlier NSF support) and additional numbers of their post-docs, graduate and undergraduate students, and technicians. Leung expects to complete his dissertation based on these data by Su 07.
- ò Hillback (Communication), who has been working under the supervision of Scheufele and Dunwoody in RTTA 2/2 studying the influence of the media on public opinion regarding nanotechnology.

Graduate training at GA Tech included the activities of the following students:

- ò Mehta (Quantitative Finance) is a master's student working under Shapira's supervision on the nano publication and patent databases, developing programs and macros for database cleaning and datamining, and analysis of US nano publication and patent patterns, including geographical assignment of records to metropolitan areas.
- ò Patil (Computing) is a master's student working under Porter's supervision on nano publication and patent database development and cleaning and development of programs and macros for database cleaning and datamining.
- ò Wang (Public Policy) is a doctoral researching a dissertation on 'Academic Researchers and the Development of New Nanotechnology Firms' under the direction of Shapira.
- ò Tang (Public Policy) is a doctoral student who has provided general research support on the nano publication and patent databases and on Chinese nanotechnology research trajectories.
- ò GA Tech public policy doctoral student Libaers is researching his dissertation on 'The role of foreign-born researchers in the US Nanoscience and technology research enterprise,' under the supervision of senior investigator Bozeman.

Undergraduate Training

CNS-ASU undergraduate interns contribute a great deal to the Center substantively and socially. Most of these students come from backgrounds in the sciences and are seeking information and experience about the social, ethical, and political side of their interests. In F 06, Hudson, who had been a student in Guston's POS 426, joined CNS-ASU. In Sp 07, Weakley and Egnatios (who had been a student in Selin's JUS 394) joined the Center. Hudson is returning to CNS-ASU in Su 07 after a semester abroad.

Abdullah (Molecular Biotechnology) performed web-based research on the nano-in-society activities of the other NSECs (finding that little has apparently been done, or at least made available on the web) and has written a background paper on the origins of the computer and human intelligence amendment, offered by Representative Sherman (D-CA), to the National Nanotechnology R&D Act of 2003. Abdullah also led the

founding of ASU's chapter of the Triple Helix: The International Journal of Science, Society and Law. Abdullah completed his work with CNS-ASU in Su 06.

Anderson (Political Science) performed research on the governance activities of academic, industry, government, and third-sector organizations with respect to nanotechnology with Karinen, including the initial design of a wiki site. He is currently leading ASU's chapter of the Triple Helix this year including preparation of the second edition, due out Su 07.

Choi (Biomedical Engineering/Economics) performed literature searches and reviews in service of the RTTA 3/1 scenario development activity, seeking mentions of nanotechnological futures relevant to the theme of freedom, privacy, and security from the literature broadly speaking. Choi completed his work with CNS-ASY in Su 06.

Hudson (Economics) worked with CNS-ASU in Fa 06 before studying abroad in Sp 07. Her work centered on the scenario development project. She began compiling a list of nanoscientists and worked with Selin on the wiki interface.

Jackson (Biology) researched the history of nanotechnology as ASU, particularly through instrumentation such as the scanning probe microscope built by Lindsay in 1986. He completed his work with CNS-ASU in Su 06.

Pirtle (Mechanical Engineering) performed research on the history of ethical, legal and social implications in US R&D policy under the supervision of Guston and is also working with Robert's HIEB lab group. He completed his honors thesis and graduated in Sp 07.

Saludo (Design) assisted CNS-ASU in attempting to create logos and other visual signatures of its activities.

Young (Biology/Biology and Society) was instrumental in the technical development of the wiki site for hosting of the scenarios and was responsible for administration and collection of data for analysis. He graduated in Sp 07.

Weakley (Global Studies) joined CNS-ASU in March and participated in planning and logistics for the All Hands Meeting. She edited interview transcripts for K Corley's RTTA 4 activities and worked with Conz on the social networking project. She is also exploring usage of Del.icio.us, Creative Commons, and Second Life with Selin for scenario development purposes.

Egnatios (Justice Studies/ Barrett Honors) will work to enhance the outreach efforts of the International Network for Nanotechnology in Society. She will be responsible for accumulating data from the NanoFutures RTTA 3 open source scenario project and will perform literature reviews on virtual learning and novel uses of scenarios. Continuing in the fall, she will provide logistical support for the CNS Biodesign Scenario Conference.

At Georgia Tech, supported undergraduates included McCloud (Aeronautical Engineering and Public Policy) and Finney (Public Policy and Economics). These students have been engaged in bibliometric database development for nanotechnology, including data cleaning, data analysis, and geocoding of records for RTTA 1/1 research program assessment.

At Wisconsin, supported undergraduates included Cassellius (Law and Society Honors Program) and Warsh (Undergraduate Scholars Research Program), both of whom assisted with the content analysis of newspaper coverage of nanotechnology for RTTA 2/2 media influence.

Appendix VI: Diversity

Technological Enhancement Conference. Continuing its commitment to the education and training of under-represented populations, CNS-ASU together with the Hispanic Research Center, CNS-UCSB, NBER, Nano Science & Technology Studies at the USC NanoCenter, MGE@MSA and WAESO co-sponsored a research conference entitled 'Technological Enhancement of Humans? Perspectives of Researchers From Underrepresented Populations.' The conference was held on 24 Apr 2007 in Tempe. The conference committee (Guston and Sarewitz from CNS-ASU and Garcia and Sullivan from HRC) received 43 abstracts in application to the conference. The committee selected six students to present papers and posters at the conference. Students were also encouraged to submit their papers to Minus 9, an undergraduate research journal for nanotechnology, which had expressed interest in dedicating a special volume to selected papers from the meeting.

Diversity of Trainees

Below is a table describing the diversity of the post-docs, graduate students, post-baccalaureate students, and undergraduates employed by CNS-ASU (names suppressed). We report fully funded as well as partially funded trainees. 'Title' refers to rank status at time of reporting.

'YR' refers to the academic year of employment, although personnel will have been employed for neither the entire academic year in question nor for comparable periods of time. We report current year (06-07) for post-docs and graduate students, post-baccalaureate or undergraduate students. Under 'Ethnicity,' 'W' refers to White/Caucasian, 'H/L' refers to Hispanic/Latino/a, 'NA' refers to Native American and 'A/PI' refers to Asian/Pacific Islander. We report all institutions together and the list may not be comprehensive for shared or new personnel.

Title Yr Sex Ethnicity

POST-DOCS 06-07

- M W
- M W
- M W
- F W
- M W
- M A/PI

GRADUATE 06-07

- M W
- F NA
- M H/L
- M A/PI
- F W
- F H/L
- M W
- M W
- F A/PI
- M W
- F W
- F A/PI

UNDERGRADUATE 06-07

- M W
- M W
- M W
- M W
- F W
- F W
- F W
- M A/PI

Georgia Tech

- | Title/Status | Yr | Sex | Ethnicity | Disability |
|--------------------|-----------|--------|-----------|------------|
| Li Tang, GRA | 2006-2007 | female | A/PI | none |
| Jue Wang, GRA | 2006-2007 | female | A/PI | none |
| Pratik Mehta, GRA | 2006-2007 | male | A/PI | none |
| Jayesh Patil, GRA | 2006-2007 | male | A/PI | none |
| Sharyn Finney, URA | 2006-2007 | female | AF/A | none |
| Luke McCloud, URA | 2006-2007 | male | AF/A | none |

Diversity of Students

Below is a table describing the diversity of the students in the courses specifically developed by CNS-ASU. 'AF/A' refers to African-American, 'H/L' refers to Hispanic/Latino/a, and 'A/PI' refers to Asian/Pacific Islander. 'NA' refers to Native American. 'DIS' refers to disabled, in this case, mobility.

Course	Sem	N	M	F	W	AF/A	H/L	A/PI	NA	DIS
Learning Community-Guston	Sp 07	9	6	3	7	0	0	1	1	0

Justice and the Future-Selin Sp 07 37 20 17 30 1 5 0 1 0
 Bioethics and the Brain-Robert Sp 07
 Nanotechnology Law and Policy-Marchant Sp 07 25 14 11 20 0 4 0 1 0
 Regenerative Medicine, Ethics and Society-Hogle Sp 07 8 1 7 5 1 0 2 0 0
 Science, Technology & Societal Outcomes - Wetmore Sp 07 10 8 2 10 0 0 0 0 1
 InnovationSpace-Boradkar Sp07/
 Fa 06 14 10 4 0 0 1 2 0 0
 Perspectives in Nanotechnology-N/Av Fa 06
 Studies in the Transhuman-N/Av Fa 06

Activity Sem N M F W AF/A H/L A/PI NA DIS
 International Perspectives on Nano in Society Su 06 10 5 5 9 1 0
 Technological Enhancement of Humans? Conference Sp 07 43 -- -- 3 22 16 1 2 --
 Nano-in-Society for In-service Teachers Sp 07 10 2 8 10 0
 Science Outside the Lab: A Policy 'Dis' Orientation Su 07 11 7 1

Diversity of Speakers

Below is a table describing the diversity of the speakers hosted by CNS-ASU at ASU only (names suppressed). Under 'Ethnicity,' 'W' refers to White/Caucasian, 'AF/A' refers to African-American. We also report 'Other' including disability and origin from a non-US institution.

M/F AF/A H/L A/PI NA DIS
 18/4 1 4 1 0 0

Diversity of Audiences

ò 15 September 2006. Christine Peterson. Audience: 59 people. 35 men, 24 women; 51 White, 1 AF/A, 5 A/PI, 2 H/L, 1 NA.
 ò 6 Oct 2006. Rosalyn Berne. Audience: 18 men, 13 women; 26 White, 1 Native American, 2 Hispanic, 2 Asian.
 ò 17 Nov, 2006. Griffith Kundahl. Audience: 14 men, 10 women; 19 White, 1 Native American, 1 Asian, 3 Hispanic.
 ò 15 Dec 15, 2006. Meyya Meyyappan. Audience: 16 women, 24 men; 24 White, 1 Native American, 15 Asian.
 ò 19 January 2007. Ulrich Fiedeler. Audience: 25-30. 1 Native American,
 ò 23 February 2007. Arie Rip. Audience: 34 men, 20 women; 40 white, 1 Native American, 11 Asian, 2 Hispanic.
 ò 30 March, 2007: Ahmad Soueid. Audience: 33 people. Male: 19, Female: 14; Asian: 3, Hispanic: 2, White: 27, Native: 1.
 ò 16 Oct 2006. Ben Bova. Audience: 10 people. 8 male; 2 female. 8 White; 1 Hispanic, 1 Native American
 ò 17 Oct 2006. Brian Rappert. Audience: 11 people. Six men, 5 women. All white.
 ò 27 Oct 2006. Lieve Goorden et al. Audience: 3 females, 4 males; 5 White, 1 Native American, 1 Hispanic.
 ò 1 Dec 2006. Michael Cobb. Audience: 12 people. 4 women, 8 men; 11 White, 1 Hispanic.
 ò 9 March 2007. Andrew Jamison. Audience: 7 people. 4 women, 3 men. 2 Asian, 2 Hispanic, 3 white.
 ò 2 March, 12 April. Lee Gutkind. Audience: 19 people; 9 women, 10 men; 1 African American, 1 Asian, 1 Native American, 16 white
 ò 21 March 2007. Anthony Garcia, et al. Audience: 55 people. No demographic breakout but significant Hispanic presence.
 ò 29 March 2007. Kristen Kulinowski. Audience: 10-12 people. 8 White; 2 Asian.
 ò 13 April 2007. Mark Bunger. Audience: N/Av.
 ò 26 April 2007. David Berube. Audience: 15 people. Male: 10, Female: 5; White: 12, Indian: 1, Hispanic: 2

Pre-College Training and Development

The Center for Research on Education in Science, Mathematics, Engineering, and Technology (CRESMET) is coordinating CNS-ASU activities with the ongoing work of Project Pathways, a five-year education research project funded by NSF through the Math & Science Partnership program (MSP). In Project Pathways, ASU researchers collaborate with high school mathematics and science teachers in five Phoenix metropolitan school districts, aiming to develop a new model to support teachers' continuing education in their disciplines and professional development as instructors. In the original research design, this new model included four graduate courses for teachers coupled with ongoing professional learning communities. CRESMET's participation in CNS-ASU enabled us to develop a fifth course, 'Nanoscience & Society: How Will We Guide and Be Guided by the New Science of Very Small Things?' This fifth module of the MSP project integrates the natural science that underlies nanotechnology with an inquiring look at how nanotechnology products might affect people, the environment, and social systems. The centerpiece of the module is a pair of three-week experiences in which teachers will follow a nanoscale phenomenon from an idea in the lab to a product marketed to the public. In the process, they will pursue questions ranging from research mechanics (should

we publish or patent?) to engineering (does this work and work safely?) to marketing (what price point will attract the most buyers?). At every stage, the course instructors prompt the teachers with questions that encourage them to discuss the social consequences of their products and who is responsible for anticipating and controlling them. The teachers will return to their classrooms with lesson planning for delivering an adapted version of the course to their high school students. Bennett led the initial teaching of this course in Sp 07. The team that developed the fifth course includes professor Horan (College of Education), assistant professor Nelson (College of Education), research scientist McKelvy (Center for Solid State Science), and CNS-CRESMET fellows D'Angelo (Physics) and Garay (Education). To our knowledge, this is the only nano-in-society course for in-service teachers in the nation.

Outreach Activities:

Outreach Activities

Science Caf 

In YR 1, CNS-ASU introduced to the Tempe area the 'Science Caf '   a casual event in an informal setting at which a scientist speaks for 15-20 minutes on a topic and the audience has the opportunity to ask questions and interact with the scientist. In YR 2, CNS-ASU organized Science Cafes at Changing Hands Bookstore in Tempe in Fa 06 and at the Arizona Science Center in Sp 07. We also offered our first Spanish-language Science Cafe in Fa 06. Spadola, a CNS-Biodesign fellow from Lindsay's lab, coordinates the cafes, which have attracted a growing number of attendees. Science Cafes are free and open to all interested community members.

  24 September 2006. 'Predicting Your Medical Future.' Dr. Stephen Johnston, Director of the Center for Innovations in Medicine at the Biodesign Institute, and Dr. Joan McGregor, Director of the Bioethics Policy and Law Program at Arizona State University. Changing Hands Bookstore. ..\Science Cafe\Science Cafes-Sep 24.pdf. Questions included:

- Why not focus on preventive healthcare, so that illness does not even have to become something picked up by Doc-in-a-Box? For example, obesity.
- I see Doc-in-a-Box as something that would be marketed to people who are financially secure. For people who use the Emergency Room as their primary care, would it really make a difference on a macro scale?
- Does Doc-in-a-Box have any implications for the mental health field?
- Will we reach the point where we won't have tolerance for variation, perceived 'flaws'?
- Will people who take a 'sick day' be looked at differently? How will we regard the 'imperfect'?
- Will society put pressure on you or look at you differently if you want to have a non-genetically-selected child? How will the rest of society regard that child? How will that parent be regarded?

  27 September 2006. Caf  Ciencia. 'Renewable Energy through Photosynthesis: The Problem of Climate Change and Possible Solutions.' Dr. Ana Moore, Biodesign Institute in the Department of Chemistry and Biochemistry. Friendly House. Though the turnout was small due to staff illness at Friendly House, it was a productive conversation. [HYPERLINK](#)

  29 Oct 2007. 'Alternative Fuels: What We Can Do (and Can't Do) to Make Our Skies Blue Again.' Dr. Daniel C. Brune, a Senior Research Specialist in the Protein Chemistry Lab at ASU, and Dr. David Konz. ..\Science Cafe\Oct06 flyer-13x19.pdf. Changing Hands Bookstore. Among the attendees were a large number of car and conservation enthusiasts, whose lively interaction gave this Caf  the most audience-initiated discussion to date. Issues included wondering about the efficiency of fuel alternatives from switchgrass to butanol, and audience members traded many personal stories concerning their own experimentation. This group was clearly interested in the U.S. freeing itself from petrochemical dependence.

  19 Nov 2007. 'Visions of Nanotechnology.' Dr. Cynthia Selin and Dr. Ira Bennett. ..\Science Cafe\Flyers\Oct06 poster-13x19.pdf Regarding nano-scale applications in healthcare, audience questions included:

- What if you are blacklisted for having a disease?
- What if you are diagnosed early for something with no cure? How does that affect the quality of your life?
- How do you get this stuff out of your body?
- What if sooner or later [the nano material] is going through everyone's blood, people who didn't want it?
- Who is going to control all those medicines?
- How will broad patents be issued? Who should own which kinds of nanotechnology?
- How can you prove that someone is infringing on your patent, given the size of the materials, and what if they become building blocks for other things?

  19 January 2007: 'Adaptive Technologies for the Central Nervous System: Are We Changing What It Means to be Human?' Bioengineer Dr. Ranu Jung and bioethicist Dr. Jason Robert. <http://cns.asu.edu/cafe/jan07cafe.html>. Audience questions included the following:

- Who funds the research?
- If DOD funds some of the research, some people are concerned with the directions that DOD might take it, e.g., to enhance abilities of soldiers. Do you ever worry about this?
- At the end of the day, it doesn't matter who funds the research, because any research can be used for malfeasant ends. It always comes back to, who's watching the social decisions about the technology?

- Who is going to have access to this technology?
- What metrics do you have for success?
- Do you see a problem with being funded by pharmaceuticals that, as certain technologies emerge, the pharmaceutical will have a monopoly on the ends of the technology?
- If the government intervenes, won't you lose your autonomy?
- What would count as success?
- What is your vision for the radical distribution of this technology through society?
- Do people in your labs have this kind of conversation?
- What about animal research? We always hear that it will be conducted humanely, but how do we really know?
- CSPO studies current ethical dilemmas, but might that be a problem in that you don't address current issues that are very popular or well funded, or that have a lot of political momentum behind, etc.?
- Do you take a critical perspective on market driven technologies? We started out with glasses and crutches. But the attraction is to the far-out. But my vision would be that what if everyone who needed crutches and glasses had access to it? Do scientists ever engage with this kind of consideration?
- But what are our values re. paying attention to the low tech versus the high tech?

ò 16 Feb 2007: 'Why Things (Still) Don't Fit: Human Variation and Ergonomics in the 21st Century.' Dr. Claire Gordon and Dr. Ira Bennett. <http://cns.asu.edu/cafe/feb07cafe.html>. Audience questions included:

- Why don't things fit civilians? What are your ideas about how companies can make things that fit better and still be economically competitive?
- What other things might be dangerous if they won't fit well?
- What facilities exist for soldiers to make these different protection requests?
- The cost of basic equipment, like clothing, versus the cost of training a new soldier in an all-volunteer force. It would seem that that ratio would suggest that you would be able to spend more to have customized clothing. On the other hand, like a jet, it would seem that you have to change seat sizes, etc., to fit all people. What really is the monetary tradeoff to go to a more flexible system so that soldiers would be able to get what they really need? And for things other than clothing, how much variance does the army build in, for things like airplane seats, etc. What things don't they do?
- What happens if you fall outside of the 90th percentile?
- My question has to do with the feedback loop that you get from soldiers. Obviously, they can't send you an email while they're in combat. I have a son who actually tripped a wire. He's been in one of those offices for 2-3 weeks. He says they can't fight in the gas mask, and it got to where they looked for any excuse to not wear them. My question is, is there any system for getting this feedback to you?
- So we know there is a concern, and that you guys are beginning to address it. But that doesn't lead to where the manufacturing of protective gear is any different yet. There seems to be a big leap, there.
- A lot of what you're talking about is passive. What are you doing that is active, like cell phones, iPods, etc.
- Are you finding that the obesity rates are changing body types?
- You hear a lot in the news about the US working to train and equip people in other countries, particularly the security forces in Iraq. Do you worry about US ability to understand the size distributions in these other countries?
- How do other militaries around the world compare to US efforts in this field?
- How far along are you at making a cool vest, for places like Arizona?

ò 23 Mar 2007: 'Western Technology to Developing Countries: Good Intentions, Unexpected Outcomes.' Technology transfer to developing countries was discussed by Dr. Bert Jacobs, whose research includes programs in Africa related to HIV, and Dr. Jamey Wetmore. <http://cns.asu.edu/cafe/mar07cafe.html>. Audience questions included:

- This presents a moral dilemma. Do you give people in 3rd world countries the drugs, or do you give them the capacity to make the drugs themselves. But if you give them the capacity, then do you give them the education and infrastructure so they can do it themselves. If you simply give them the drugs, then who benefits? So, the question is, how do you decide which path to go down, assuming you have a moral imperative to help a 3rd world country.
- Are there any implications to growing vaccines into the food supply?
- Around the world there are very strong cultural associations with food. Is there a danger that these vaccine-carrying foods might affect those associations?
- You mentioned that there are some countries that are smart consumers of imported technologies. Who are some of them?
- Why aren't there a lot of other scientists who take the time like you to (travel to the country and try to get to know the people they are trying to help)?
- Do you have any examples of how you are involved with communities?
- Earlier you were talking about the winners and losers û who are going to gain û it seems like some governments today are very suspicious and may impede the process.
- Did Dr. Jacobs come back changed from his experience in Tanzania?

ò 20 Apr 2007: 'Reductionism and Emergence in Science: New vs. Old Views of Nature and the Universe.' Michael Thorpe, Director of the

Center for Biological Physics in the Biodesign Institute, and Manfred Laubichler, Assistant Professor, Theoretical Biology at ASU. <http://cns.asu.edu/cafe/apr07cafe.html>. Audience questions included:

- I'm referring back to your earlier example about the physics of a baseball in flight, and the fact that there are a complex variety of factors in addition to the spin and velocity of the ball, such as the wind and the air pressure, etc., and I'm thinking that there are also a lot of factors associated with the fact of the baseball game itself, such as what went into the scheduling of that game with those particular players in that particular location on that particular date.
- This reminds me of [Erwin] Schrödinger's 1943 book, *What is Life?* which I read and never understood. Can you explain it?
- What do you think about neural Darwinism? Can information about the world be built into genetic material?
- How do you understand and explain human history? What separates non-social from social phenomena?
- Why is emergence an area of science now? Why not before?
- Could you explain the implications of your work from an astronomical point of view? What are the implications for the development of life elsewhere?

ò 18 May 2007: 'Forbidding Science: Are There Things We Just Shouldn't Know?' CNS Director Guston (for Sarewitz) and Dr. Roy Curtiss, Director of the Center for Infectious Diseases and Vaccinology at ASU's Biodesign Institute. <http://cns.asu.edu/cafe/may07cafe.html>.

One potential outcome from the Science Caf  has been reported to CNS-ASU. AZNanotech News announced the University of Arizona's First 'got Science? Caf ,' which opened 2 April 2007. CNS-ASU has been sending Tucson AZNanotech the Science Caf  announcements and has been told that the Tucson sector has been inspired by them. While CNS-ASU by no means originated the Science Caf  idea, it appears we have been instrumental in the Tucson Nanotech Cluster's pursuit of a similar link with the University of Arizona.

Speakers

Speaker Series. The 2006-07 CNS-ASU Speaker Series is entitled 'Studying the Future of Nanotechnology: Establishing Empirical and Conceptual Foundations.' The papers resulting from the Series will be published in a Yearbook of Nanotechnology in Society, to be published by Springer in 2008. The presentations are generally available on the website in MP3 format along with PowerPoint presentations (<http://cns.asu.edu/new-at-cns/seminararchive.htm>). YR3's Speaker Series will focus on the TRC 2 issues in Human Identity, Enhancement and Biology, and will be led by Robert. Future Yearbooks will include the newly planned TRC 1 in Equity and Responsibility (Wetmore) and Nanotechnology and Democracy (Barben and Miller).

ò 15 Sep 2006. Christine Peterson. 'Thinking Longer Term about Technology.' Peterson is a founder of Foresight Nanotech Institute, the leading nanotech public interest group in the US. She writes, lectures and briefs the media on coming powerful technologies, especially nanotechnology. She is Vice President of Public Policy at Foresight, whose mission is to ensure the beneficial implementation of nanotechnology. Foresight educates the public, technical community and policymakers on nanotechnology and its long-term effects. <http://cns.asu.edu/new-at-cns/2006Sep-CNSASU-Peterson.ppt>. <http://cns.asu.edu/new-at-cns/seminararchive.htm>.

ò 6 Oct 2006. Rosalyn Berne. 'Nano-Ethics through the Writing of Science Fiction.' There is moral significance in imagined possibilities, in beliefs and visions, and especially in the mythical searches for meaning reflected in conceptualizations of nanotechnology. As such, narrative is an indispensable device for the collection of moral and social observations about nanotechnology, especially those dealing with the categories of ethics, meaning and belief. Narrative provides access to the important but often unarticulated hopes, fears, expectations, and assumptions regarding our relationships to our bodies, to one another, and to the physical world we inhabit. It also brings to light essential, yet otherwise tacit, elements of the human psyche as those pertain to technological development. In science fictional narratives, in particular, everything that is, all the givens, are open to modification. In its essence, science fiction projects into contexts that are at variance with what is now taken to be basic, and depicts the consequences of counter suppositions. Dr. Berne believes that the use of science fiction writing is potentially a powerful and illuminating pedagogical tool for engaging the multiple dimensions of nanotechnology ethics. In this talk she explained the theoretical basis for that assertion and described the Nano-Science Fiction Writing Project she now directs, to engage global participation in the creative formulation and exploration of nanotechnology ethics.

ò 17 Nov 2006. Griffith Kundahl. 'New Communication Strategies to Guide the Future of Nanotechnology.' The great promise of nanotechnology comes with many uncertainties regarding the science's impact on areas from international competitiveness to health and safety to regulatory reform. A new playing field characterized by social uncertainties, paradoxes and unintended consequences has emerged for corporate, government, nonprofit and academic stakeholders. To further their respective missions, these stakeholders must learn to communicate in new ways, utilizing new methodologies, and through adaptive and perhaps unorthodox channels. Kundahl reviewed how some nanotechnology stakeholders are already adopting new communications strategies. He also looked at how others might proactively anticipate and engage future issues, and how planning techniques and strategies can be customized and mobilized for the novel challenges nanotechnology will present in the future. Kundahl works for Feinstein Kean Healthcare.

ò 15 Dec 2006. Meyya Meyyappan. 'Designing the Future on the Nano-Frontier.' Nanotechnology deals with creation of useful materials, devices and systems of any practical size by manipulating matter at the nanoscale and by taking advantage of novel and interesting properties that arise solely because of the nanoscale. This tiny technology is a broad, enabling technology with expected impact on every aspect of the economic spectrum: materials and manufacturing, electronics and computing, health and medicine, energy, environment, transportation, national security etc. There is a tremendous excitement across the world about this technology of the 21st century. Meyyapan's talk provided an

overview of nanotechnology, what we can expect in the near, medium and long term, and what it means for society. Meyyappan is Chief Scientist for Exploration at the Center for Nanotechnology, NASA Ames Research Center in Moffett Field, CA. Until Jun 2006, he served as the Director of the Center for Nanotechnology as well as Senior Scientist. He is a founding member of the Interagency Working Group on Nanotechnology (IWGN) established by the Office of Science and Technology Policy (OSTP). The IWGN is responsible for putting together the National Nanotechnology Initiative.

ò 19 Jan 2007. Ulrich Fiedeler. Fiedeler is a member of the Institute for Technology Assessment and Systems Analysis (ITAS). He has studied the development of nanotechnology from a variety of prospective approaches including Vision Assessment and Roadmapping as a tool for Technology Assessment. Areas of focus include the role of Nanotechnology in Chemical Substitution, Social Issues of Neuronal Implants, and Naturalness and Neuronal Implants.

ò 23 Feb 2007. Arie Rip. Rip coordinates a program on TA and societal aspects of nanoscience and technologies in the research consortium NanoNed. Originally a chemist, he moved into chemistry & society, and science, technology and social studies more generally, at Leiden University. He was a professor of science dynamics at the University of Amsterdam before joining the University of Twente in 1987 as a professor of science & technology. Rip developed the approach of constructive technology assessment and also studies science policies and changes in knowledge production.

ò 30 Mar 2007. Ahmad Soueid. Soueid is Principal/SVP of HDR Architecture, Inc. and focuses exclusively on the design & construction of advanced technology facilities. He is an internationally known leader in the design of nanotechnology facilities, such as the NIST Advanced Measurement Laboratory, Birck Nanotechnology Center at Purdue, and the Center for Functional Nanomaterials at Brookhaven National Lab. Soueid also served as nanotechnology facilities advisor to Centro Nacional de Metrologia in Mexico and National Physical Lab (UK), and was co-chair of the Buildings for Advanced Technology Workshop I & II sponsored by ASU in Jan 2003 and 2004.

ò 12 Apr 2007. Mark Bunger. 'Forecasting the Impact of Science-Based Innovation.' San Francisco Lux Research is an independent industry research firm that looks at emerging, natural science based technologies. Nanotechnology has been foremost among their research, in that it has entered the commercial sphere arguably more rapidly than any analogous domain of science. Lux also studies areas such as regenerative medicine, 'cleantech' and post-CMOS electronics. Their research culminates in data and ideas regarding the commercial impact of emerging technologies. Bunger described Lux's methods for conducting such research, including quantitative, qualitative, and conceptual approaches.

Occasional Speakers. In addition to the monthly speaker series, CNS-ASU occasionally hosts visitors on other topics in nanotechnology in society. The presentations are typically also available on the website in MP3 format along with PowerPoint presentations.

ò 17 Oct 2006. Brian Rappert. 'Engaging with Scientists about Responsible Research: A Proposed Method.' In recent years, the continuing high public profile of ethical, social, and political issues associated with scientific research has renewed attention to long-standing questions about its place in society. Post 9-11, the relationship between national security and research has received considerable attention, as questions are being raised regarding whether the knowledge and techniques generated through fundamental and applied life science research might facilitate the production of bioweapons and therefore whether controls should be placed on what gets done, how, and whether information is widely circulated. In response to this emerging discussion, this presentation elaborated a pragmatic empirical research agenda for engaging with practicing scientists regarding the governance of their work. In discussing the preparation for, planning and conducting of these workshops, it proposed a strategy of engagement and learning relevant for other areas of emerging controversy. Various dilemmas and difficulties with social and life science research were recounted, with a view to reflecting on the unavoidable choices made in efforts to promote responsive research.

ò 27 Oct 2006. Lieve Goorden and Michiel van Oudheusden (Research Center on Technology, Energy and Environment, University of Antwerp) and Johan Evers (Centre of Science, Technology and Ethics, Katholieke Universiteit Leuven), along with Marian Deblonde (Antwerp) and Johan De Tavernier (Leuven). 'Widening the Circle of Nano Research: A Case for Reflective Action Research in Flemish Society.' Drawing on the hard lessons learned from the public controversy over genetically modified crops in Flanders/Europe, policy makers as well as scientists and technologists have begun to recognize the need to engage wider audiences in technology innovation. While this upstreaming of public involvement is by no means a new idea, it is increasingly being called for in social democracies seeking to address the societal implications of nanotechnologies. One case in point is the highly industrialized region of Flanders, Belgium. Its government is funding a research project entitled 'Nanotechnologies For Tomorrow's Society' (NanoSoc), which the authors coordinate. The endeavor brings together scientists, stakeholders, and interested citizens in an effort to collectively construct sustainable nanotechnology trajectories. As this entails more than merely assessing possible technology impacts, an open, experimental model of social science research with respect for the undetermined nature of nanotechnology is set forth. Its key aim is to discover and reflect on the motivations and considerations of nano-researchers, as well as to openly debate the economic and social driving forces that shape the technology in the Flemish region. Identifying and systematically calling into question these underlying incentives with all participants is the central feature of the research method. It is, the authors argue, crucial to move the debate upstream, as not only does it reveal which nanotechnology trajectories are in the making, but also suggests how they could effectively be adjusted or altered to better fit society's needs. The talk outlined the technology assessment framework that underlies the authors' reflective action research approach and motivates its application in co-shaping nanotechnology developments in Flanders.

ò 1 Dec 2006. Michael Cobb, North Carolina State University. 'What Happens When Americans Learn More About Nanotechnology? (The Good, The Bad, The Ugly).' The public profile of ethical, social, and political issues associated with scientific research has renewed attention to questions about its place in society. Post 9-11, the relationship between national security and research has received considerable attention. Questions raised include whether the knowledge generated through life science research and in related fields such as nanotechnology and engineering, might facilitate the production of bioweapons and whether controls should be placed on what gets done, how, and whether

information is widely circulated. Cobb's presentation elaborated a pragmatic empirical research agenda for engaging with practicing scientists regarding the governance of their work. It proposed a strategy of engagement and learning relevant for other areas of emerging controversy. Various dilemmas with social and life science research were recounted with a view to reflecting on the unavoidable choices made in efforts to promote responsive research.

ò 9 Mar 2007. Andrew Jamison (Aalborg University, Denmark). 'Turning Nano Green: The Hybrid Imagination in Action.' Jamison discussed the enormous task of bringing nanotechnology and green knowledge into a more intimate and mutually beneficial relationship with each other. Jamison also visited the Nanotechnology in Society Learning Community and met with Miller, Fisher, and Shiv Visvanathan, visiting scholar in CSPO.

ò 21 Mar 2007: Panel discussion. 'Government, Academia, and Industry: Hispanic Leaders on Nanotechnology.' Three widely respected Hispanic representatives from government, academia and industry will discuss nanotechnology in their respective fields at a panel sponsored by More Graduate Education @ Mountain States Alliance, the Western Alliance to Expand Student Opportunities, and CNS-ASU. Moderated by Dr. Anthony Garcia, Professor of Bioengineering in the Ira A. Fulton School of Engineering at ASU, the panel featured Dr. Manuel Marquez-Sanchez, Senior Scientist and Director of the Nanotek Consortium at Kraft Foods, Dr. Carlos A. González, Director of the NIST Center for Theoretical and Computational Nanosciences at the National Institute of Standards and Technology (NIST), and Dr. Vladimiro Mujica, Deputy Director of the NIST Center for Theoretical and Computational Nanosciences. Audience: 55 people of whom 23 were grad or PhD students from ASU.

ò 16 Oct 2006. Ben Bova. The Piper Center for Creative Writing Scholar made a brief presentation followed by interaction with students, postdocs and staff on his work as a science fiction author.

ò 2 Mar 2007; 12 April 2007. Lee Gutkind. Piper Center for Creative Writing Scholar and creative non-fiction writer presented to the Learning Community and reviewed class papers; presented to the CNS-ASU Student Researcher meeting. Gutkind also worked with GRA Roxanne Wheelock on creative non-fiction writing.

ò 29 Mar 2007. Kristen Kulinowski. 'Environmental, Safety and Health Aspects of Nanomaterials: Overcoming Barriers to International Cooperation.' Dr. Kulinowski serves as the Director of the International Council on Nanotechnology (ICON), a multi-stakeholder organization whose mission is to develop and communicate information regarding potential environmental and health risks of nanotechnology, thereby fostering risk reduction while maximizing societal benefit. She has experience as a chemical researcher, educator, curriculum developer, administrator, outreach coordinator and policy fellow. Since 2004 Dr. Kulinowski has been actively engaged in developing and promoting the International Council on Nanotechnology (ICON), which provides a neutral forum in which experts from academia, governments, industry and nonprofit organizations can explore questions of nanotechnology's environmental health and safety (EHS). She has directed an effort that resulted in the web publication of the first publicly available database of citations to peer-reviewed papers on nano EHS. Other activities of ICON include a survey of best practices for nanomaterial handling in the workplace, and a public portal of information on nanotechnology EHS. Dr. Kulinowski has extensive experience in science education, particularly in developing innovative curricula at the undergraduate level, and developed Rice's first introductory undergraduate course on nanotechnology. From 2002-2004, Dr. Kulinowski served as CBEN Executive Director for Education, developing and managing an educational outreach portfolio of programs for audiences that range from middle school children to adults. During this time the center established itself as a national leader in nanotechnology educational outreach.

ò 26 Apr 2007. David Berube. 'Intuitive Toxicology: The Public Perception of Nanoscience.' If the public as citizens and consumers are to react favorably to the introduction of nanotechnology into the market, their perceptions of the risks associated with applied nanoscience is important. While protecting the health and safety of workers who make products involving nanoparticles is incredibly important, the citizen consumer has been poorly addressed. It is important for standard risk assessments to continue, but it is equally important that parallel to these efforts we engage public risk perception and design communication strategies appropriate to the task at hand. The problem for experts, regulators, business and industry, and policy makers is that the public uses a non-rational calculus based on a matrix of attitudes and beliefs (hereafter referred to as values) to decide risk issues, whereas current risk assessment algorithms used by risk management professionals who do not include these non-rational variables. Dr. Berube is the author of *Nano-Hype: The Truth Behind the Nanotechnology Buzz* (2006), a thoroughly researched, accessible overview of nanotechnology in contemporary culture. In it Berube evaluates the claims and counterclaims about nanotechnology by a broad range of vested interest groups, including government officials and bureaucrats, industry leaders and entrepreneurs, scientists, journalists and other media representatives. He appraises programs and grand initiatives and examines the environmental concerns raised by opponents, as well as the government and private responses to these concerns.

Other Outreach

Post-doctoral fellow Fisher runs the Interactive Program on the Societal Dimensions of Nanotechnology, which is a partnership between the CNS-ASU and the Center for Integrated Nanotechnologies (CINT) that combines cycles of outreach and education activities with opportunities for two-way learning and exchange. Programs cycles are expected to run approximately four to six months each and are comprised of three levels of engagement: Briefings followed by discussion sessions, roundtable dialogues, and informal interviews. The first cycle of the program series is currently underway. In December 2006, CNS-ASU and CINT signed a memorandum of understanding to implement the program. Longer term goals include establishing a training component in the societal dimensions of nanotechnology for all CINT users, to be replicated at other Department of Energy (DOE) Nanoscale Science Research Centers (NSRC).

Dietram Scheufele was interviewed by WILL AM 580 (Illinois Public Radio) in a live one-hour broadcast for the morning show, 'Focus 580 with David Inge.' 30 April 2007.

Michael Moffitt, CNS-ASU Board of Visitors and Nano Industry Liaison Committee, taught a Professional Development Course at the Semiconductor Environmental, Safety, and Health Association's (SESHA) 29th Annual International High Tech Symposium and Exposition, Apr 2007, Santa Clara, CA., in affiliation with Stanford University's Nanofabrication Facility. The course was attended by 30 facility and corporate EH&S managers, approximately 75% of whom were male; most were white with 3 Hispanic and 3 Asian participants.

Information Channels

CNS-ASU uses email and listservs as two important channels of communication. Below are details about the type of information distributed via three listservs developed by CNS-ASU.

CNSASU (Interested individuals and organizations located anywhere with no formal affiliation to CNS-ASU; N=988 as of 5-11-07). Designed to reach members of the general public, elected officials, government employees, regulatory bodies, etc., this distribution list receives our monthly newsletter and announcements about CNS activities and employment opportunities and conferences.

CNSINT (Colleagues at ASU interested in nano issues; N=185 as of 5-11-07). Designed to reach ASU personnel who have expressed an interest in CNS-ASU or nanotechnology, this distribution list carries information about local CNS-ASU activities and opportunities.

CNSLTD (CNS-ASU project colleagues; N=90 as of 5-11-07). Designed to reach CNS-ASU project collaborators, the list carries information of general interest and administrative importance.

Journal Publications

D. H. Guston., "A Still Small Voice", Journal of Nanoparticle Research, p. 149, vol. 8, (2006). Published,

E. Fisher and R. Mahajan, "Nanotechnology Legislation: Contradictory intent? US federal legislation on integrating societal concerns into nanotechnology research and development", Science and Public Policy, p. 5, vol. 33(1), (2006). Published,

D. A. Scheufele, "Five lessons in nano outreach", Materials Today, p. 64, vol. 9, (2006). Published,

G. Wolbring, "Medicine, Disabled People, and the Concept of Health: A New Challenge for HTA, Health Research, and Health Policy.", Health Technology Assessment (HTA) Initiative #23, p. 1, vol. Dec, (2005). Published,

T. Monahan and T. Wall, "Somatic Surveillance: Bodies, Networks, and Social Control", Surveillance and Society, p. , vol. , (). Submitted,

E. Fisher, R. Mahajan, and C. Mitcham, "Midstream Modulation of Technology: Governance from Within", Bulletin of Science, Technology and Society, p. , vol. , (). Submitted,

I. Bennett and D. Sarewitz, "Too Little, Too Late?: Research Policies on the Societal Implications of Nanotechnology in the United States.", Science as Culture, p. 309, vol. 15, (2006). Published,

E. fisher, R. Mahajan and C. Mitcham, "Midstream Modulation of technology: governance from within.", Bulletin of Science, Technology and Society, p. 486, vol. 26, (2006). Published,

J. Gallo, "The Rhetorical and Operational Foundations of the National Nanotechnology Initiative in the History of the National Science Foundation", Perspectives on Science, p. , vol. , (). Submitted,

L.F. Hogle, "Enhancement technologies and the body", Annual review of Anthropology, p. 695, vol. 34, (2006). Published,

C. Lee and D.A. Scheufele, "The influence of knowledge and deference toward scientific authority: A media effects model for public attitudes toward nanotechnology", Journalism and mass Communications, p. 819, vol. 83, (2006). Published,

T. Monahan and T. Wall, "Somatic Surveillance: Corporeal Control through Information Networks", Surveillance and Society, p. , vol. 4, (2007). Accepted,

Z. Pirtle, "Nanotechnology: Constructing a Proactive science policy towards democracy", *The Triple Helix: The International Journal of Science, Society and Law*, p. 48, vol. 3, (2006). Published,

D.A. Scheufele, "Five lessons in nano outreach", *Materials Today*, p. 64, vol. 9, (2006). Published,

C. tahan, R. Leung, G.M. Zenner, K.D. Ellison, W.C. Crone, C.A. Miller, "Nanotechnology and society: A discussion-based undergraduate course", *American Journal of Physics*, p. 443, vol. 74, (2006). Published,

J. Wetmore, "Book review. Nanotalk: conversations with scientists and engineers about ethics, meaning, and belief in the development of nanotechnology.", *Science and Engineering Ethics*, p. 583, vol. 12, (2006). Published,

J. Youtie and P. Shapira, "Mapping the Nanotechnology Enterprise: A Multi-indicator Analysis of Emerging Nanodistricts in the US South", *J. Technology Transfer*, p. , vol. , (). Submitted,

J. Youtie, M. Iacopetta, S. Graham,, "Assessing the nature of nanotechnology: can we uncover an emerging general purpose technology?", *J. Technology Transfer*, p. , vol. , (2007). Accepted,

A. Porter, J. Youtie, and P. Shapira, "Refining Search Terms for Nanotechnology?", *Journal of Nanoparticle Research*, p. , vol. Apr, (2007). Submitted,

Books or Other One-time Publications

J. Tosi, J. Parsi, and D. H. Guston., "Anticipating the Political and Ethical Challenges of Human Nanotechnologies", (). Book, Accepted
Editor(s): P. Lin and F. Allhoff, eds.

Collection: Nanoethics

Bibliography: New York: Wiley.

J. Wetmore, E. Fisher, C. Selin, eds., "Studying the Future of Nanotechnology: Establishing Conceptual and Empirical Foundations", ().
Book, Under contract

Editor(s): D. H. Guston, series editor.

Collection: Yearbook of Nanotechnology in Society I:

Bibliography: Dordrecht: Springer.

Southern Growth Policies Board and the Georgia Tech Program in Science, Technology and Innovation Policy; co-authors: Philip Shapira, Jan Youtie, Ajay Bhaskarabhatla, Erin Lamos, Uttam Malani, John Slanina, Alexa Stephens and Li Tang, "Connecting the Dots: Creating a Southern Nanotechnology Network", (2006). Report, Published

Bibliography: Southern Growth Policies Board, Research Triangle Park, NC

G. Wolbring

, "The Unenhanced Underclass", (2006). book chapter, Published

Editor(s): Paul Miller, James Wilsdon

Collection: Building Everyday Democracy

Bibliography: London: Demos

D. Barben , E. Fisher, C. Selin and D. Guston, "Anticipatory governance of nanotechnology: Foresight, engagement and integration", ().
Book, Accepted

Editor(s): E.J. Hackett, O. Amsterdamska, M.E. Lynch and J. Wajcman

Collection: New Handbook of Science and Technology Studies

Bibliography: Cambridge, MA: MIT Press

W. Valdivia and D. Guston, "Public Value Mapping Workshop", (2006). Report of Workshop, Published

Bibliography: Online: <http://cns.asu.edu/cns-library/documents/PVMfinal.pdf>

G. Marchant., "Nanotechnology Regulation: The United States Approach", (2007). Book, Accepted
 Editor(s): Hodge, GA, DM Bowman and K Ludlow
 Collection: New Global Frontiers in Regulation: The Age of Nanotechnology
 Bibliography: Cheltenham: Edward Elgar.

L.F. Hogle, "Sentinel Beings: the biopolitics of human biosensors.", (2007). Book, Published
 Editor(s): M. Cooper and C. Waldby
 Collection: Biopower, Biotechnology and Globalization;
 Bibliography: BioSocieties

C. Miller, "Boundary Organizations: Strategies for Linking Knowledge to Action", (2006). Report of Workshop, Online
 Bibliography: Online: <http://cns.asu.edu/cns-library/documents/BoundaryOrgWorkshopReport.pdf>

G. Wolbring, "The Unenhanced Underclass", (2006). Book, Published
 Editor(s): P. Miller and J. Wilsdon
 Collection: Building Everyday Democracy
 Bibliography: London: Demos

C.A. Miller and S.K. Pfatfeicher, "Nanotechnology in Society Education: Teaching the Mental Habits of Social Engineers and Critical Citizens", (2007). Book, Published
 Editor(s): Aldrin Sweeney
 Collection: Nanoscale Science and Engineering Education: Issues, Trends, and Future Directions
 Bibliography: American Scientific Publishers

J. Parsi, J. Tosi, and D. H. Guston, "Anticipating the Political and Ethical Challenges of Human Nanotechnologies", (). Book, In preparation
 Editor(s): P. Lin and F. Allhoff
 Collection: Nanoethics
 Bibliography: New York: Wiley

A. Porter, J. Youtie, and P. Shapira, "Refining Search Terms for Nanotechnology", (2006). Briefing paper, Online
 Bibliography: Online: <http://cns.asu.edu/cns-library/documents/Porter-Shapira%20Nano%20Search%20Briefing%20Paper.pdf>

J.S. Robert, "Controversial science, controversial scientists, and prospects for progress in a pluralistic society", (2008). Book, Accepted
 Editor(s): F. Allhoff and P. Lin
 Collection: Nanoethics: Emerging Debates
 Bibliography: Springer

D. Sarewitz and D. Guston, "The Scientific Responsibility for Public Engagement", (). Book, In preparation
 Editor(s): T. Rogers-Hayden, A. Mohr, D. H. Guston, N. Pidgeon, and B. Wynne
 Collection: Engaging with Nanotechnologies: Engaging Differently?
 Bibliography: New York: Wiley

Hogle, L.F., "Emerging Medical Technologies.", (). Book, Accepted
 Editor(s): Amsterdamska, O., Lynch, M., & Hackett, E.
 Collection: Handbook of Science, Technology and Society.
 Bibliography: Cambridge, MA: MIT Press.

J. Gallo., "Archival Research: Using Federal Resources.", (). Book, Accepted
 Editor(s): Eszter Hargittai
 Collection: Research Methods from the Trenches
 Bibliography: University of Michigan Press

Web/Internet Site

URL(s):
cns.asu.edu

Description:
Comprehensive site covering activities, papers, conferences, links to relevant sites, events, speakers, organizational partners, etc.

Other Specific Products

Product Type:
website

Product Description:
<http://www.cherry.gatech.edu/>

Sharing Information:
online

Product Type:
web site

Product Description:
<http://sciencepolicy.colorado.edu/nanotechnologyinsociety/>

Sharing Information:
web site

Product Type:
URL

Product Description:
Website: <http://studiesinthetranshuman.blogspot.com/>.

Sharing Information:
Privateer's Transhumanism class' blog website. Privateer and members of the class still visit and update the site.

Contributions

Contributions within Discipline:
CNS-ASU is inherently and even aggressively trans-disciplinary, and there is no discipline as such that it primarily addresses by its work. Intellectual contributions will be reported in 'Contributions to other disciplines.'

Contributions to Other Disciplines:
Contributions
Academic Contributions

Many social science disciplines — particularly political science, sociology, and anthropology — as well as professional fields such as public policy, journalism, and design, established subfields such as science communication, regional economics, and bioethics, and emergent fields including surveillance studies, will find contributions from the Center's activities. The Center's central contributions, however, will be in the closely related interdisciplinary fields of science and technology policy (STP) and science and technology studies (STS). Indeed, an important intellectual motivation of the Center is to achieve something of a practical unity between these two fields which, while not alienated from each other, have not been as interactive as one might hope given their ostensibly common interests. The Center furthermore expects to contribute to potentially emerging fields of social studies of nanotechnology, e.g., nanoethics (as an analogue to bioethics). The Center's contract with Springer to publish a Yearbook of Nanotechnology in Society is an effort to channel just this emergence.

The Center's research programs may loosely be understood as a set of use-inspired Real-Time Technology Assessment (RTTA) activities cross-cut with a more fundamental set of thematic research clusters (TRCs). As described in 'Research Activities' above, there are four major RTTA activities and two TRCS:

ò RTTA 1 Research and Innovation Systems Analysis (RISA)

- ò RTTA 2 Public Opinion and Values (POV)
- ò RTTA 3 Deliberation and Participation (DP)
- ò RTTA 4 Reflexivity Assessment and Evaluation (RAE)

- ò TRC 1 PROPOSED TRANSITION from Freedom, Privacy and Security to Equity and Responsibility
- ò TRC 2 Human Identity, Enhancement, and Biology (HIEB)

Each of these RTTA and TRC areas has a lower-order set of activities whose contributions to a variety of fields, as well as to other aspects of the CNS-ASU program, will be discussed below. Especially since this discussion is at least in part prospective, it is intended to be illustrative and not comprehensive. This section also mentions some contributions that one research area makes to others within CNS-ASU.

RTTA 1: RISA

Activity 1: Research Program Assessment (RPA)

A key activity in RPA has been creating, through a broad process including consultation with NSE researchers and an international set of colleagues, an operational definition of nanotechnology with which to query bibliographic and patent databases. Analysis of the results has led to preliminary maps of the research dynamics of NSE, including the identification of global and US/regional nano-districts that are the focus of publishing and patenting activities. RPA is thus contributing to STP and STS understandings of how new technical fields emerge and evolve, and to regional economics understandings of the geography of NSE activities. A key finding of RPA is that NSE appears to be following a pattern of intellectual property akin to general purpose technologies (GPTs) like information technology, rather than more focused technologies like pharmaceuticals. Such a finding contributes to the legitimacy of the perspective of RTTA by suggesting that one can begin to grapple with emerging technologies before they are fully established, as GPTs have patterns of adoption, distribution, and societal interactions distinct from other technologies.

RPA will also contribute these understandings of the NSE dynamics to a variety of other CNS activities, including empirical understandings of the pace and direction of areas of NSE development to the scenario development workshops (RTTA 3/1 below), of the geography of NSE research to the workforce assessments (RTTA 1/3 below), and of the emerging sub-fields to the NSE researchers themselves.

Activity 2: Public Value Mapping (PVM)

PVM has been engaged in conceptual development to extend the evaluation of publicly funded research from traditional output measures of publications through the research ecology of an area to the societal outcomes that are promised in the original justification of the research. Developing PVM will add a more robust and comprehensive model to the analytical kit for STP that will contribute to the ability to assess research for its broadest contributions to wide societal outcomes. This development is particularly important in the context of increasing interest from sponsors of research in a 'science of science policy' that accounts for the return on the public investment in research.

A PVM framework is also contributing to the work that post-doc Fisher is doing in collaboration with Lindsay's Center for Single Molecule Biophysics.

Activity 3: Workforce Assessment (WA)

WA is contributing a concrete understanding of developing labor markets for NSE activities. A use-inspired application of a pre-existing methodology, this research contributes to the understanding of how such novel, high-tech labor markets develop but, more importantly, to the understanding of policy makers in public, academic, and industrial sectors in the studied regions (Phoenix, Madison, Atlanta) of that NSE labor market, and to the understanding of the National Citizens' Technology Forum (RTTA 3/4 below) about what reasonable expectations for local job growth might be from NSE R&D.

RPA findings that the Phoenix region is not within the top 20 regions in the US for either NSE publications or patents correspond with preliminary WA findings that industrial perspectives on NSE employment within the region are not well-developed.

RTTA 2: POV

Activity 1: Public Opinion Polling (POP)

The public opinion survey will make significant contributions to the academic understanding of the public's knowledge of and attitudes toward nanotechnology, in large part because this survey will be the first to take advantage of opportunities to compare changes over time (with questions from previous NSF-sponsored surveys) and differences across nations (with questions from Eurobarometer). Preliminary findings that public awareness has not progressed much if at all since 2004 suggests that public education, understanding and engagement activities have a long road ahead to meet their goals.

POP will also contribute important information about public expectations û perhaps for both good and ill û regarding nanotechnology for use in discussions with NSE researchers (in RTTA 4/1 Reflexivity Assessment below) and in discussions with lay citizens who participate in the National Citizens' Technology Forum (RTTA 3/4 below) and other participatory activities.

Activity 2: The Why Files

Currently beginning the analysis of media coverage, The Why Files will contribute to our understanding in science communication of how journalism can shape public understanding of and attitudes toward new technical developments like NSE.

When coupled with RTTA 2/1 POP, it will provide a powerful approach to detailing the dynamic relations of changing representations of NSE and changing public perspectives, and it will help us understand how to better tailor information to various sub-publics and improve public outreach.

Activity 3: Scientists' Values

The survey of scientists' values regarding NSE, an area of very little research, complements the survey of the public's values and provides parallel measures of some attitudes and opinions. It will contribute to the understanding within STS of the relationship between scientists' values and their work.

When coupled with POP and Reflexivity Assessment (RTTA 4/1 below), it will provide a comprehensive and comparative assessment of how various publics anticipate nanotechnologies.

RTTA 3 DP

Activity 1: Scenario Development

The primary contribution of scenario development will be to projects within CNS-ASU itself, including to the National Citizens' Technology Forum and to the InnovationSpace (RTTA 3/2 below). The 'open source' method for developing the scenarios, through a wiki site, may contribute to a greater capacity to create such useful probes of plausible technological futures for NSE and other emergent, knowledge-based technologies. Already we have had offers from a variety of other groups — the Woodrow Wilson International Center, the James Martin Institute at Oxford University, Norway's NanoMat program, and a network of nanotechnology researchers in Latin America coordinated by Guillermo Foladori — to make use of the scenarios. See below for an example of an illustrated scenario.

Activity 2: InnovationSpace

The particular intellectual contribution of InnovationSpace is the engagement of the field of design — which as a professional and academic activity is about the mediation of objects (technologies) and human and social needs -- with STS and STP. To date, the academic disciplines of design have not seriously addressed NSE. Designers have not contemplated new products and scenarios that NSE will make possible, nor have design studies scholars addressed how people's everyday lives and the discipline itself could change because of nano-scale technologies. The critical examination of these issues and the generation of new NSE-based products and scenarios will be the major contributions of this project. As InnovationSpace is a multi-disciplinary program, this project will also help graphic design, industrial design, business and engineering students participate in the process of new product development centered around nanotechnology. They will have a better comprehension of the role their individual disciplines will play in bringing nanotechnology into everyday life. See below for illustrations of the products imagined.

The 'Current' kiosk:

The 'Electricitree' fuel cell:

The 'Dialogue' user interface and reader:

Activity 3: CriticalCorps

By subjecting the scenarios and other products of the Center to critical scrutiny, CriticalCorps will open up a dialogue at a cultural level about nanotechnology and contribute to the cultural assessment of nanotechnological futures. Faculty and graduate students involved with CriticalCorps will publish this information in cultural studies and design studies journals and therefore contribute the awareness in these fields of the importance of NSE and its societal and cultural issues. This project also offers a new area of scholarly exploration for graduate students in design.

Activity 4: National Citizens' Technology Forum

The NCTF will be the first attempt at expanding the small-scale citizens' technology forum, or consensus conference, to a national-wide enterprise. This pilot will test whether such large-scale deliberative activities are feasible and whether they can contribute to public dialogue. It will also serve a major integrating role for many activities of the Center more broadly.

RTTA 4: RAE

Activity 1: Reflexivity Assessment

The interviews with NSE researchers that are the focus of RA will contribute to the general understanding of how researchers' identity, knowledge, and practice interact in a more or less self-conscious way, and to the practical understanding of how particular kinds of interventions may help may researchers more reflexive about their role in producing societal outcomes from their research. In particular, the study of Hispanic and Latino/a NSE researchers will contribute to our understanding not only of the narrow question of ethnic identity among scientists but also to more policy-relevant issues of recruitment and retention of under-represented researchers and how the values of such researchers influence their work and its outcomes.

Activity 2: Evaluation

In addition to providing an opportunity to evaluate the overall performance of the Center, evaluation activities will contribute to an understanding of boundary organizations and their ability to mediate between research and societal outcomes.

TRC 1: FPS (ER)

CNS-ASU proposes to terminate the Freedom, Privacy and Security TRC due to personnel changes and replace it with Equity and Responsibility.

TRC 2: HIEB

Preliminary work makes clear the contribution that findings will have for bioethics and the ethics of emerging technologies like nanotechnology, but also for closely related fields, such as regenerative medicine. Particularly in the area of neurological innovations, concepts of human biology and human identity are being challenged in similar ways, no matter what the technological intervention. Activities in regulatory standards and ethical guidelines appear to moving in some parallel ways; this research will identify whether this is a general

movement or specific to nanotechnology as compared to other emerging technologies. Organizational studies will also gain from this work, as the research is uncovering evidence of the way that accountability for ethical and social concerns shifts institutional structures and practices.

Contributions to Human Resource Development:

Contributions to Education and Human Resources

CNS-ASU is already making significant contributions to education and human resource development in nanotechnology in society.

First, we are educating and training a relatively large number of diverse undergraduate and graduate students in the social studies of nanotechnology through both formal coursework and research experiences. In this area, we have designed courses that reach out to undergraduates and introduce them to NSE and its societal issues, and we have designed courses that allow graduate students to explore, in an interdisciplinary setting, more rigorous approaches to policy and social studies perspectives on NSE. The undergraduate courses were particularly fertile ground for attracting interns and honors thesis writers to CNS, and the graduate course was particularly useful in reinforcing social and intellectual connections among the students with diverse academic backgrounds. The Learning Community and InnovationSpace courses, in particular, demonstrate the kind of inter- and trans-disciplinary work for which CNS has found fertile ground at ASU.

Second, we are educating and training a smaller set of NSE graduate students in taking a more reflexive approach to their own research. The graduate course contributes to this goal, as do activities including regular student research meetings, the Science Fiction Workshop, the IPNS and DCSS workshops, and the provision of opportunities for NSE graduate students to take ownership of a societal implications activity, e.g., the way CNS-Biodesign fellow Spadola has taken ownership of the Science Cafes and the way we hope new CNS-Biodesign fellow Agrawal will take ownership of a portion of the connectivity between TRC 2 and RTTA activities. We believe such activities bode well for the implementation of the planned PhD+, in which students like Spadola, Lappe, and Agrawal will take on a social scientist to their thesis committee and write a chapter of their dissertation on a societal issue regarding their work. Indeed, Spadola and Lappe have already presented their posters on their PhD+ for the All-Hands Meeting, and other students û e.g., Troy Benn, who does research on nanoparticles and water quality û have sought us out for PhD+ opportunities.

Third, we have managed to reconstitute a significant post-doctoral training component by reprogramming funds from YR 1 residuals, re-establishing (at least for YR 2) a portion of a major activity we had to cancel due to the budget reduction in the award. ASU hosted two full-time (Selin, Fisher) and three shared (Conz, Barben, Bennett) post-doctoral fellows in AY 06-07, and Wisconsin hosted one full-time post-doc. In YR 3, we plan to retain Fisher full-time and Bennett part-time. Barben will continue at ASU as an associate research professor with some duties toward CNS, and the Center is currently negotiating with Biodesign and Bachelor of Interdisciplinary Studies program for a package that would allow Conz to continue as an instructor and assistant research professor with duties toward CNS. Selin is currently under consideration for a faculty position.

Fourth, with CRESMET we launched in Sp 07 the course on nanotechnology-in-society for in-service high school teachers. In its first year, the course trained 10 teachers who will reach hundreds of high school students each subsequent year. To our knowledge, this course is only course in the nation to train pre-college teachers to deliver nano-in-society content.

Based on the data presented in other sections of the report, we feel that CNS-ASU has already made a very good start in assuring the participation of individuals from under-represented groups in its activities, particularly in graduate education. In an important effort to expand our ability to recruit students from traditionally under-represented groups, we collaborated with the Hispanic Research Center on a student research conference held 24 April 07. The conference hosted six students, selected from nearly 45 applicants. CNS-ASU and HRC are already making concrete plans for improving and expanding the conference next year.

Contributions to Resources for Research and Education:

Contributions to Resources for Research and Education

Through its Monthly Speaker Series and its Occasional Speaker Series, CNS-ASU has already generated a significant electronic library of scholarship and perspectives on nanotechnology in society. Most of these talks are available in MP3 format, along with PPT slides, on our web site archive at <http://cns.asu.edu/new-at-cns/seminararchive.htm>.

Through its RTTA 3/1 activity, CNS-ASU has developed a set of scenarios for the plausible future development of nanotechnologies. See Research Activities above for details, and see below for a fully illustrated version of one scenario. We have created a wiki-like site to host them. The Beta-test version is at <https://???> But we are also awaiting further discussions with potential collaborators at the Exploratorium in San Francisco about upgrading the user interface. On the site, we will conduct a quasi-experiment in which we will invite different groups to interact with the scenarios. Already we have had requests from NISE Net and others for their use.

We are also in the process of creating an additional public resource in a similar format for cataloguing the emerging governance activities around nanotechnologies. Graduate student Karinen and undergraduate Anderson have completed a structure and catalogue for domestic and some international (UK, EU, Japan) nano governing activities. Rather than using CSN personnel to conduct surveys, scan the literature and the web, etc., we have created a wiki-like site in which the participants in nano-governance themselves can contribute to updating the site. The site can become a meeting place for expanded interaction and governance activities. This possibility has been greeted warmly when discussed in public, including at the All-Hands Meeting, and we are currently in the process of finalizing the wiki site and recruiting regional secretaries to administer it.

The Beta-test version is at http://cns.asu.edu/nanogovernance/wiki/index.php/Main_Page.

In conjunction with senior investigator Privateer's class on transhumanism, CNS graduate student Hays and others established a blog, <http://studiesinthetranshuman.blogspot.com/> and a wiki site, <https://transhuman.pbwiki.com>. Their work has attracted the attention of a journalist from the Wall Street Journal who has interviewed Hays and intends to write an article.

Contributions Beyond Science and Engineering:

Special Requirements

Special reporting requirements: None

Change in Objectives or Scope:

NSEC/CNS-ASU proposes a change in objective to reorient one of its two Thematic Research Clusters (TRC) from its original theme of Freedom, Privacy, and Security, to a new theme of Equity & Responsibility.

Animal, Human Subjects, Biohazards: None

Categories for which nothing is reported:

Organizational Partners

Contributions: To Any Beyond Science and Engineering

Draft**Findings**

CNS-ASU received its funding in Oct 05 and spent a significant share of YR 1 staffing up. The Center was quite early in its development at the time of its first Annual Report. As the project activities above suggest, significant research is underway, and findings are beginning to be reported for many activities. Most findings below are preliminary.

RTTA 1**RTTA 1/1 RPA:**

- Shapira et al. find that:
 - A complex search term reveals a large number of NSE publications in four distinctive but mutually overlapping areas;
 - Nano-districts – defined by publication and patent numbers – are emerging in clusters in the US, Europe, and East Asia, as well as in a small number of other areas; and
 - Through patent citation data, NSE appears to be emerging as a general purpose technology, more akin to information technology than to pharmaceuticals.

RTTA 1/2 PVM:

- No findings as such to report, although conceptual development and outputs exist.

RTTA 1/3 WA:

- Fichtner and Van Horn find that:
 - NSE is not a well-developed private sector in the Phoenix-Tucson region;
 - Firms report that it is somewhat difficult to find workers with nanotechnology-related skills (41%);
 - Firms report that research scientists in nanotechnology need interdisciplinary skills (73% said Crucial or Very Important); and
 - A smaller percentage of firms (46%) report that safety and health skills are crucial or very important for scientific employees.

RTTA 2**RTTA 2/1 POP:**

- Scheufele and E Corley find that:
 - There has been little or no increase in public awareness or knowledge of nanotechnology in the US since 2004;
 - Similarly, attitudes toward nanotechnology and federal funding for it remain, on average, positive and akin to 2004 levels; and
 - Attitudes appear to be more a function of perceptions benefits from nanotechnology rather than of other factors, including knowledge.

RTTA 2/2 MI:

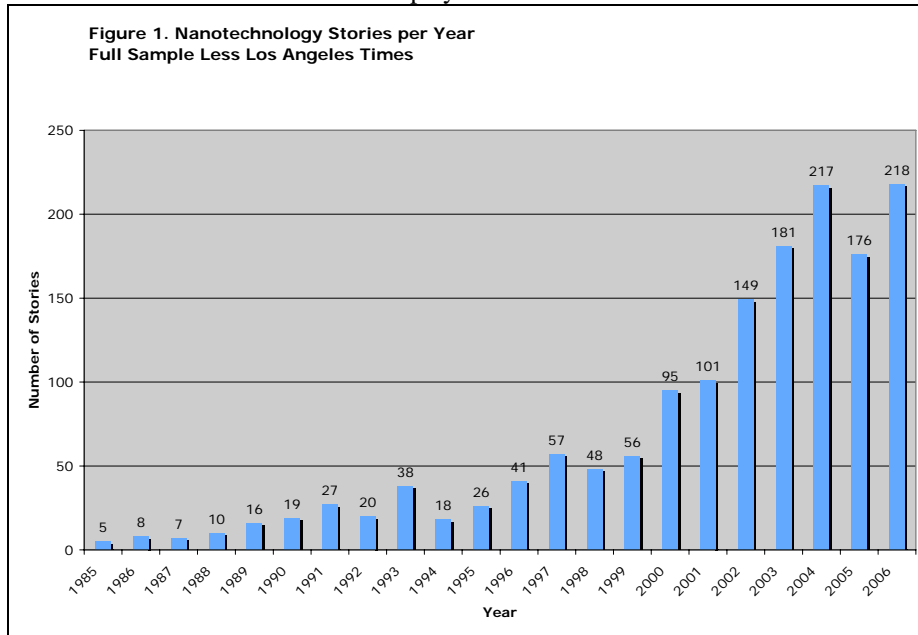
- Dunwoody et al. find that:
 - The first nanotechnology stories in the sample appeared in 1985, the year that researchers at Rice University discovered “fullerenes” or “buckyballs” and
 - A search of the database of 21 newspapers generated 1533 articles through 2006, excluding *LA Times* coverage. The tracking of the number of stories each year is illustrated in Figure 1 below.

RTTA 2/3 SV:

- E Corley and Scheufele find that:
 - Scientists overwhelmingly support nanotechnology research, generally, and the federal funding of the research, specifically;
 - NSE researchers associate lower levels of risk, and higher levels of benefits, with nanotechnology research than the public does;
 - On average, the scientists believe that university scientists, regulatory agencies and industry scientists should play the largest formal role in communicating the risks and benefits of nanotechnology to the public; and

Draft

- On the other hand, scientists believe the religious organizations, the White House, and the news media should play the smaller role in that communication.

**RTTA 3****RTTA 3/1 SD**

- Selin finds that scenarios differ in their contexts of production and in their motivation of concepts of the past, present, and future.
- See below for example of illustrated scenario.

RTTA 3/2 IS

- InnovationSpace demonstrates that transdisciplinary groups of students can be engaged to develop novel product concepts for nanotechnologies.
- See below for visuals of the IS product designs.

RTTA 3/3 CC

- No findings as such to report yet.

RTTA 3/4 NCTF

- No findings as such to report yet.

RTTA 4**RTTA 4/1 RA**

- K Corley and Conz find that researchers do not have a strong identity regarding NSE or nanotechnology.
- K Corley and Conz find that some collaborating researchers have a desire for collaboration and/or integration with social science through the demands of their own scientific and organizational contexts.
- Garcia-Mont finds that Hispanic/Latino/a NSE researchers do not express a strong ethnic identity or a strong influence of that identity on their work.

RTTA 4/2 E

- Schneider et al. find that boundary organizations like CNS-ASU can help bridge different “ways of knowing.”
- Conz and Guston find that CNS-ASU is a complex, evolving, and expanding network of participants.
- Gallo finds that the NNI is rhetorically and organizationally consistent with NSF’s participation in previous large-scale projects, although current funding of societal aspects of NSE attempts to address previously ignored issues.

Draft***TRC 1*****TRC 1 FPS**

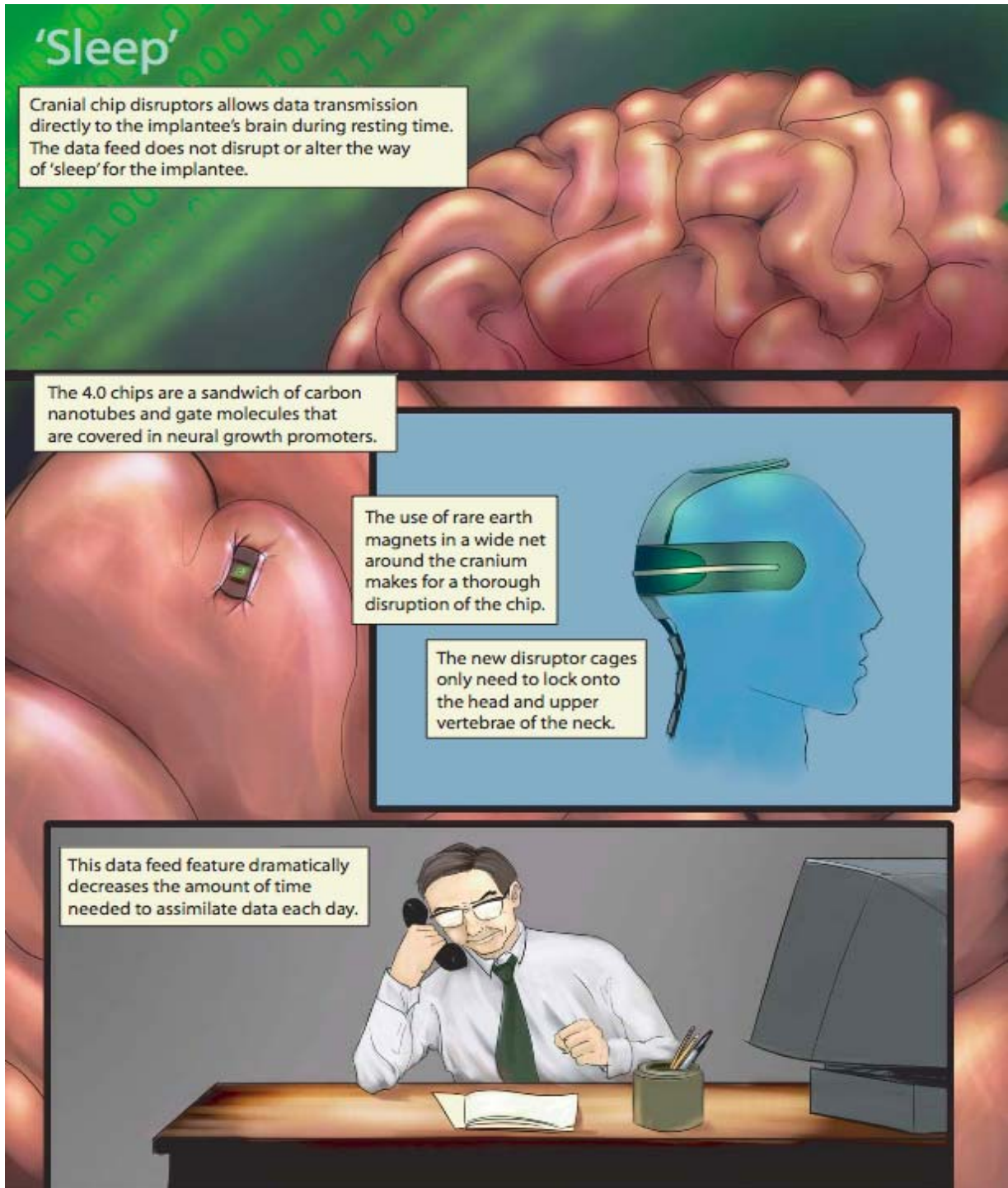
- Monahan and Wall find:
 - Scientists are turning to DoD funding because of funding limitations elsewhere;
 - Chemical-agent detection with nanosensors is much more prevalent in discourse than the development of or need for nano-weapons; and
 - There is a recurring equation by nanoscientists of “personal health” with “security,” by which they mean a very individualized mode of personal security over one’s body and body functions.

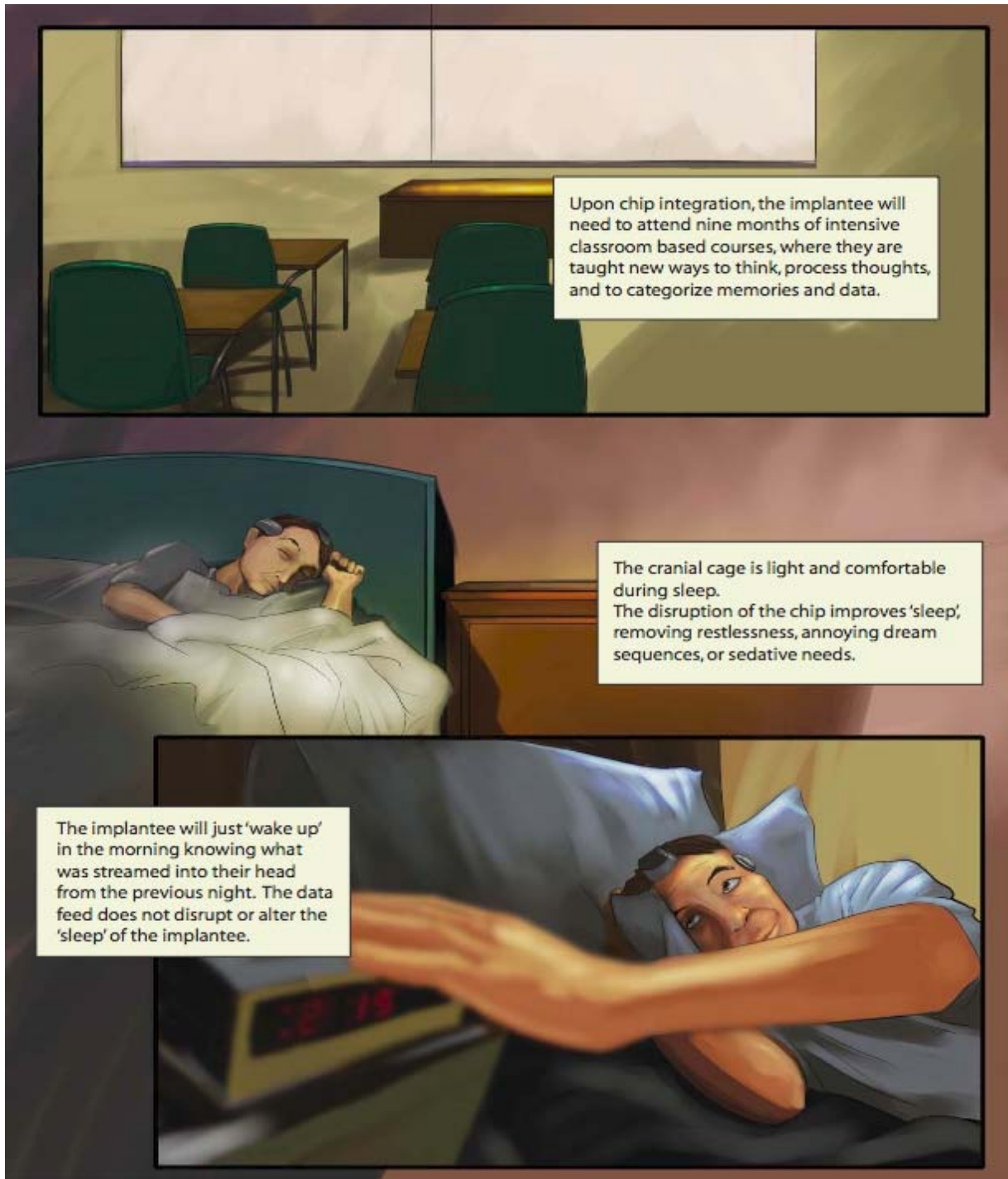
TRC 1 E&R

- Wetmore and McGregor find that one can create a productive two-way learning environment between collaborating NSE researchers and social scientists/humanists that enriches discussions of scientific responsibility.

TRC 2

- Kim finds that the study of directed evolution illustrates an alternative history to the standard, material science-dominated view of nanotechnology.
- Moore finds:
 - Three models of human-Diety relations: humans as dominant creatures in a hierarchical relation, stewards of creation, and co-creators with a deity in a progressive way of dealing with nature;
 - Social justice is a key theme throughout contemporary Christian positions--both Catholic and protestant; and
 - An unexpected frequency with which religionists and transhumanists invoke, refer to, and attempt to dialog with one another.
- Hogle finds that the ability to create cells and to redirect relationships among cells and materials enables “human biological” material to sense, repair, and remediate in ways that make unclear what is human, biological, and technological.





Upon chip integration, the implantee will need to attend nine months of intensive classroom based courses, where they are taught new ways to think, process thoughts, and to categorize memories and data.

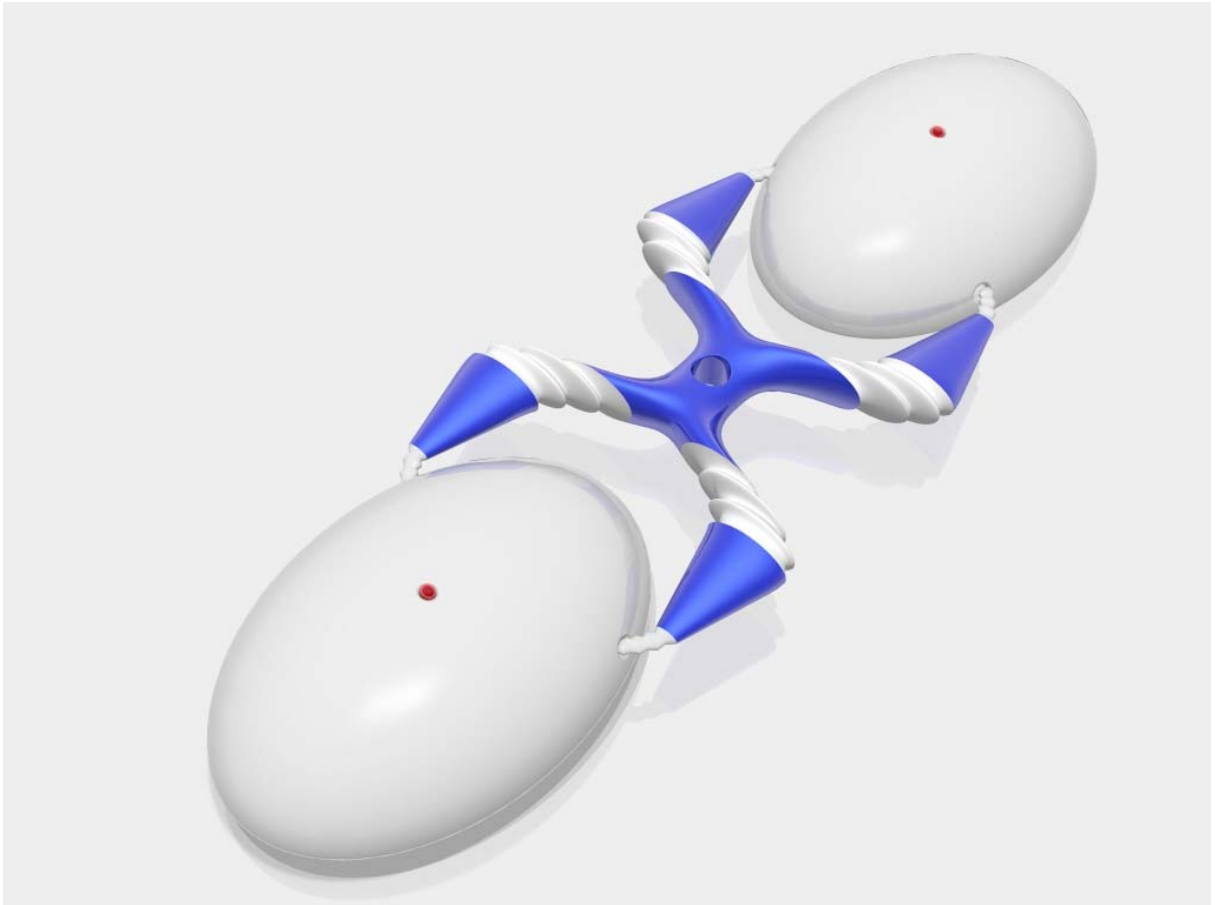
The cranial cage is light and comfortable during sleep. The disruption of the chip improves 'sleep', removing restlessness, annoying dream sequences, or sedative needs.

The implantee will just 'wake up' in the morning knowing what was streamed into their head from the previous night. The data feed does not disrupt or alter the 'sleep' of the implantee.

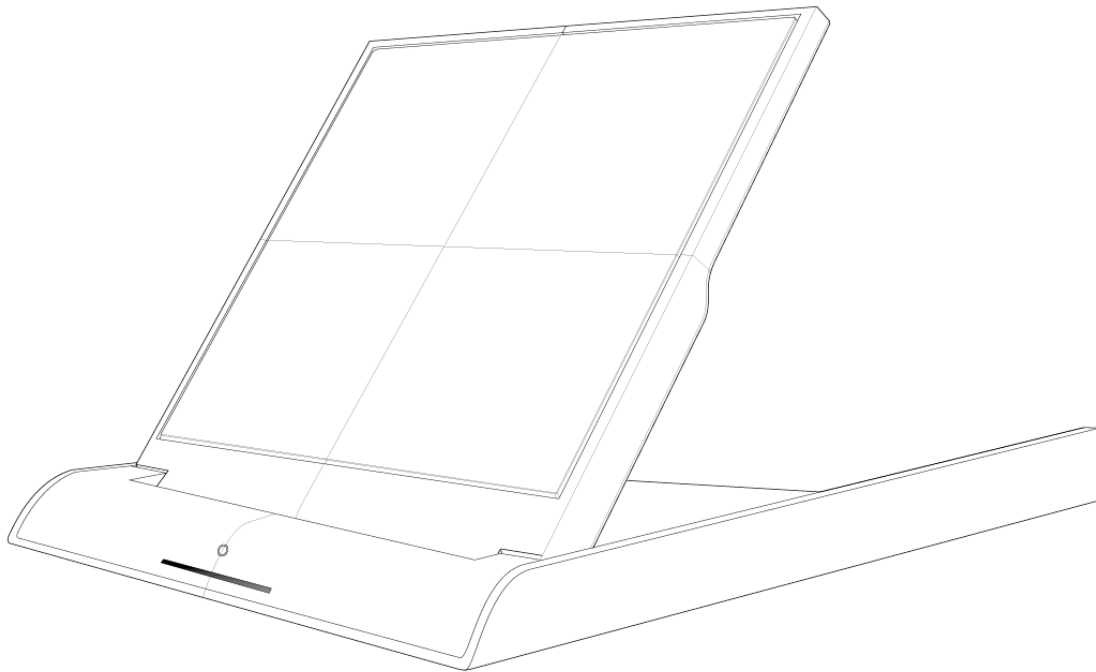
The “Current” kiosk:

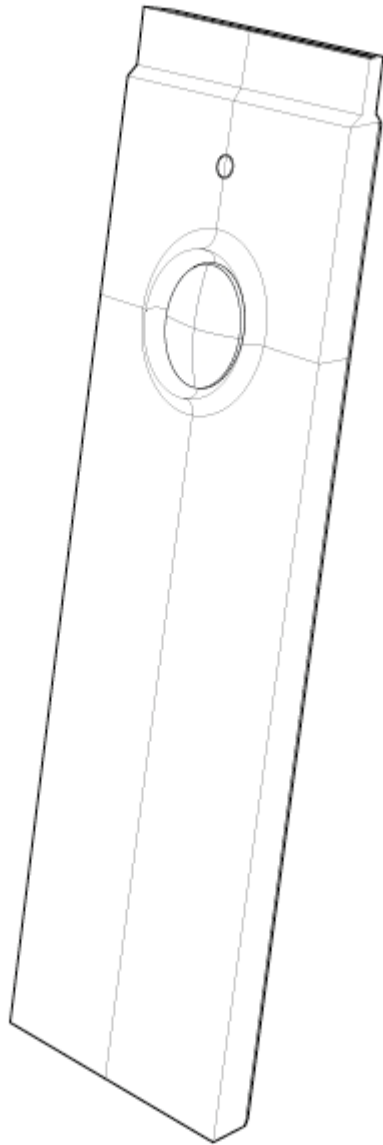


The “Electricitree” fuel cell:



The "Dialogue" user interface and reader:





Introduction

The Center for Nanotechnology in Society at Arizona State University (CNS-ASU) is a federally-funded academic research, education, and outreach center focused on the complex societal relations forming around nano-scale science and engineering research (NSE). Beginning in October 2005 with the first year of a five-year grant from the National Science Foundation, expected to total \$6.2 million over that period, CNS-ASU gathered scores of researchers and educators across ASU and several other public research universities to pursue an ambitious array of interdisciplinary programs.

CNS-ASU pursues a vision of research and engagement that emerges from the 21st Century Nanotechnology Research and Development Act of 2003 (P.L. 108-153) in which Congress challenged the community to ensure “that advances in nanotechnology bring about improvements in the quality of life for all Americans.” To ensure this kind of progress, Congress required not only the support of research on the societal implications of nanotechnology, but also the collaboration between social scientists and humanists on one hand and NSE researchers on the other, as well as the active engagement of the public to elicit their values and perspectives. In pursuit of this vision, CNS-ASU:

- Conducts fundamental and problem-oriented research on the cultural, ethical, legal, educational, and environmental (“societal”) implications of nanotechnologies;
- Expands, through innovative undergraduate, graduate, and postdoctoral programs, the community of scholars with the skills to create new insight into the societal dimensions of NSE;
- Engages publics, policy makers, business leaders, and NSE researchers in dialogues about the goals and implications of NSE, and use this process to build a network committed to making NSE socially beneficial and addressing NSE-related societal conflicts; and
- Builds partnerships with NSE laboratories to introduce greater reflexiveness in the R&D process, so that problems may be addressed as ideas are being generated, evaluated, and developed, rather than after products enter society and the marketplace.

Decades before NSE's most important outcomes begin to unfold, complex social relations are now forming around it. CNS-ASU probes the hypothesis that a greater capacity for reflexiveness, that is, social learning that expands the range of available choices, in knowledge-producing institutions can help guide trajectories of knowledge and innovation toward socially desirable outcomes, and away from undesirable ones.

A partnership among Arizona State University and (at this time) six other major public universities – University of Wisconsin-Madison, Georgia Institute of Technology, North Carolina State University, University of Colorado-Boulder, University of Georgia, and Rutgers, The State University of New Jersey – CNS-ASU implements an interdisciplinary program of research and engagement called “real-time technology assessment” (RTTA), which consists of four methods of inquiry:

1. Mapping the research dynamics of the NSE enterprise and its anticipated societal outcomes;
2. Monitoring the changing values of the public and of researchers regarding NSE;

3. Engaging researchers and various publics in deliberative and participatory forums; and
4. Reflexively assessing the impact of the information and experiences generated by our activities on the values held and choices made by the NSE researchers in our network.

CNS-ASU also organizes its research around two broad and cross-cutting Thematic Research Clusters. TRC 1, originally conceived as Freedom, Privacy, and Security, is potentially being converted to Equity and Responsibility due to changes in personnel. The second, TRC 2, focuses on Human Identity, Enhancement, and Biology.

Each RTTA and TRC activity is described in the Research section below. Most projects are making significant progress, but several are staged intentionally for a later start date. The contributions of each of the collaborating universities are discussed immediately below.

Arizona State University

Arizona State University is the intellectual and administrative center of CNS-ASU. In addition to research activities and training across the four RTTA and two TRC areas, ASU offers an array of educational and outreach activities, as well as collaborative endeavors with NSE researchers on campus. ASU will be a site for the National Citizens' Technology Forum (NCTF) in Sp 08.

University of Wisconsin-Madison

University of Wisconsin-Madison is the recipient of a major subcontract from CNS-ASU. Center co-PI Miller moved from Madison to ASU beginning AY 06-07, and Scheufele became the subcontract PI. The subcontract focuses on the performance of fundamental research in the two TRC areas. Due to the change in vendor for the public opinion survey, the Wisconsin subcontract also includes significant funds for RTTA 2/1 public opinion polling and RTTA 2/3 scientists' values, as well as the originally planned RTTA 2/2 media influence. The subcontract also provides significant resources for student and post-doctoral training. Madison will be a site for the NCTF.

Georgia Institute of Technology

Georgia Institute of Technology is the recipient of a major subcontract from CNS-ASU, for which Shapira is the PI. The subcontract focuses on research in RTTA 1: Research and Innovation System Assessment, particularly research program assessment. GA Tech will also be a site for the NCTF.

North Carolina State University

North Carolina State University has a major subcontract with CNS-ASU, for which Hamlett is the PI. The subcontract focuses exclusively on conducting the NCTF in RTTA 3: Deliberation and Participation. There were no formal, funded activities in YR 1, and organizing activities have begun in YR 2 in preparation for holding the NCTF in YR 3 (Mar 08).

Rutgers, The State University of New Jersey

Rutgers, and its Heldrich Center for Workforce Development, has a major subcontract with CNS-ASU, for which Van Horn is the PI. The Heldrich Center is responsible for conducting regional nano-workforce supply and demand assessments in years 2 (Phoenix), 3 (Atlanta), and 4 (Madison).

University of Georgia

University of Georgia has a subcontract with CNS-ASU for the work of senior investigator Bozeman, who at the time of the funded proposal was at GA Tech. He is the leader of RTTA 1/2 public value mapping, and he will continue in this role under this subcontract.

University of Colorado-Boulder

UC-Boulder had a subcontract in YR 1 to support the completion of Fisher's dissertation. In the current year, it is preparing for YR 3 when it will be a site for the NCTF. In YR 2, a doctoral student, Maricle, will receive OISE-designated research travel funds as well.

University of New Hampshire

UNH will receive a subcontract in YR 3 for participation as a site in the NCTF.

University of California, Santa Barbara

UCSB, the lead university on the other NSEC/CNS, is the planned site for the sixth and final NCTF, and CNS-ASU is currently preparing a supplement to fund their participation.

Activities

Research

Research Title: RTTA 1 – Research and Innovation Systems Analysis (RISA)

Led by: Philip Shapira (GA Tech)

Team Members: See below.

Activities Underway and Planned: The goal of RTTA 1 RISA is to characterize the scope and dynamics of the NSE research enterprise, public and private, and the plausible linkages between it and public values and outcomes. RISA has three separate activities. See below for details.

Outcomes: See below.

Research Title: RTTA 1/1 – RISA/Research Program Assessment (RPA)

Led by: Philip Shapira

Team Members: Faculty – Mauricio Iacopetta (GA Tech); Alan Porter (GA Tech); Jan Youtie (GA Tech).

Students – Sharyn Finney (UG); Charles (Luke) McCloud (UG); Pratik Mehta (G); Jayesh Patil (G); Li Tang (G); Jue Wang (G) (all GA Tech)

Activities Underway and Planned: The research activities of the Georgia Tech RTTA 1/1 group in the time period included:

- Bibliometric and patent database development (the core data activity of the group);
- Completion of work on nanotechnology definition and bibliometric search terms, including refinement of inclusions and exclusion terms;
- Publication and patent data downloading and cleaning, including reorganization of publication and patent databases into annual files;
- Exchanges with Michel Zitt (Infra, France), to compare European PRIME and CNS-ASU@GT nano profiling definitions and with Ron Kostoff and others working on bibliometric analysis of nano;
- Association of records with geographical identifiers and development of data and maps on nanodistricts worldwide and in the US, using both nano publication and patent data;
- Intensive efforts to clean and associate geography to US and Chinese nano publication and patent records, including identifying leading nano research institutions and patenting organizations, fields of research, and linkages;
- Analysis of nanotechnology as a general purpose technology;
- Scripting methods for rapid search and retrieval of records within our nano datasets on a given topic, including requests for:
 - o analysis of nano research and publication in New Zealand, benchmarked with data for Singapore, Ireland, Finland, US, Japan, Germany
 - o ongoing discussion of possible analysis of California nano publishers with CNS-UCSB.
- Preparation and dissemination of short survey to NanoGiga Conference participants on research emphases, leading institutions, and potential products;
- Identification and selection of nano clusters in China (Beijing, Tianjin, Shanghai) for more detailed analysis and field work (June-July 2007), including identification of interview targets and drafting of protocols.

Outcomes: Other CNS activities are making use of RTTA 1/1 outputs, including the use of the search terminology for the construction of the newspaper search in RTTA 2/2, a search for nano authors (2000-05) requested by E Corley for the RTTA 2/3 survey of nanoscientists, a search for nano neuro* and brain research, requested by Robert for TRC 2, and (prospectively) assistance to post-doctoral fellow Kim in studying directed evolution and an alternate history of nanotechnology in TRC 2. For other outcomes, see Findings and Publications and Presentations sections.

Trends in Professional Literature. An adjunct activity to the RTTA 1/1 RPA activities, and making use of the data it is generating, is an analysis of trends in the academic and professional literatures to explore the impact salient nanotechnological events have had on the production of nano-related journal articles.

Led by: E Corley

Team Members: Faculty: K Corley (ASU)

Post-doc: Conz (ASU)

Graduate students: Hays (ASU); Valdivia (ASU)

Activities Underway and Planned: This team, working entirely at ASU, is collaborating with the GA Tech team to train ASU users in VantagePoint, the bibliometric software, and adapt the GA Tech bibliometric database to fit the needs of this inquiry. The team has begun identifying key nano-related milestones with help from efforts underway in RTTA 1 and RTTA 2 and will conduct an event-history analysis to discern any impacts of such events on the literature.

Outcomes: None to report yet.

Research Title: RTTA 1/2 – RISA/Public Value Mapping (PVM)

Led by: Barry Bozeman (University of Georgia)

Team Members: Faculty: Lindsay (ASU);

Post-doctoral: Fisher (ASU)

Graduate students: Ben Clark (G; UGA); Vickie Edwards (G; UGA) [both funded from other sources]

Activities Underway and Planned: The goal of RTTA 1/2 PVM is to assess the social outcomes, or “public value” of NSE research activities. There were five particular activities in YR 2:

1. conceptual development, culminating in Bozeman's book, *Public Value and Public Interest* (Georgetown University Press, in press), which further develops the PVM approach and expands into new domains;
2. the first draft of a case study entitled “Social Impacts Potential of Nanotechnology for Water Filtration,” which focuses on the technologies currently employed and under development, the R&D providers, firms and early applications. The next step is to systematically apply a PVM approach and convert the case study into a beta test of the PVM approach;
3. a special issue of *Research Policy* on “Implications of Nanotechnology,” co-edited by Bozeman, which should become one of the most highly visible works to this point on the social and economic contexts of nanotechnology;
4. a workshop on PVM, attended by faculty, post-docs and graduate students from ASU, UGA, and NYU, held at CSPO in Oct 06 and co-sponsored by CNS-ASU, CSPO, and Guston’s former NSF-funded project on the Public Value of Social Policy Research (SES 0532637; report available at <http://cns.asu.edu/cns-library/documents/PVMfinal.pdf>); and
5. a pilot PVM project involving the participant-observation of post-doc Fisher in Lindsay’s Center for Single Molecule Biophysics at ASU’s Biodesign Institute. Fisher is meeting with Lindsay’s research group, conducting interviews with them, conducting archival work and developing workshops to understand and augment the public value of research from this lab. This project is also part of RTTA 4/2.

Outcomes: UGA and ASU are also developing a proposal to pursue PVM for NSF’s forthcoming SciSIP competition, with case studies including nanotechnology. See Publications and Presentations for other details about outcomes.

Research Title RTTA 1/3 – RISA/Workforce Assessment (WA)

Led by: Carl Van Horn (Rutgers)

Team Members: Faculty: Aaron Fichtner (Rutgers); Scott Reynolds (Rutgers)

Activities Underway and Planned: The goal of RTTA 1/3 WA is to conduct regional workforce supply and demand analysis in each of the three regional labor markets represented by major components of CNS-ASU – Phoenix, Madison, and Atlanta. Field work in the Phoenix-Tucson region began in YR 2 and will follow in the other two regions in subsequent years.

WA will attempt to determine whether the demand for nanotechnology workers exceeds the supply of qualified workers in the region and whether education and training is adequate in regional markets to meet the needs of firms using nanotechnology. The key industries in Arizona likely to be using nanotechnology include Aerospace (33,000 employees), experiencing stable employment; Microelectronics (27,000 employees), with a recent decline in employment; and Biotechnology (5,547 employees), showing recent job growth.

Surveys have been distributed to technology firms in Arizona in Sp 2007 with the assistance of the Arizona Nanotechnology Cluster, Arizona Technology Council, Arizona Bioindustry Organization, Bioindustry Organization of Southern Arizona, and other industry / education contacts. Thirty firms have responded to the survey as of this writing. Additional efforts are underway to increase the number of responses. Telephone and in-person interviews have been conducted with more than 15 firms and stakeholders.

The major planned activity for 2007 is the completion of the regional workforce assessment for Arizona through: active pursuit of additional responses to the web-based survey; additional face-to-face interviews to further explore key questions such as the need for nanotechnology workers to be trained to address or minimize possible workplace safety and health risks and changing skill requirements of technicians in manufacturing due to the use of nanotechnology; and convening a meeting of firms and educational institutions to discuss possible strategies to address issues in the findings of the assessment.

Future efforts for 2008 include commencing the regional workforce assessment for Atlanta using a methodology refined from the AZ experience.

Outcomes: See Findings for some preliminary results.

Research Title: RTTA 2 – Public Opinion and Values (POV)

Led by: Dietram Scheufele (Wisconsin) and Elizabeth Corley (ASU)

Team Members: See below.

Activities Underway and Planned: The goal of RTTA 2 POV is to monitor, among both scientists and the lay public, the understanding of and values relating to NSE and its potential outcomes, track these variables over time, and examine the role of the media in reflecting and influencing them. POV has three separate activities. See below for details.

Outcomes: See below.

Research Title: RTTA 2/1 – POV/Public Opinion Polling (POP)

Led by: Dietram Scheufele (Wisconsin)

Team Members: Faculty: Elizabeth Corley (ASU)

Activities Underway and Planned: As communicated earlier to NSF staff, the progress of RTTA 2/1 was severely delayed due to the negligent implementation of the initial survey instrument by the Institute for Social Science Research (ISSR) at ASU. ISSR failed to secure gender of respondents in constructing the sample and used software for the creation of the data file that was known to be faulty. An inquiry by the ASU associate VP for research found that ISSR should

return 75% of the contracted funds to CNS-ASU and that CNS-ASU should also not be held for the indirect costs of these funds since it would then have to contract with a non-university entity for the completion of its research.

CNS-ASU initiated a new subcontract, through UW-Madison, with the UW-Madison Survey Center, to field a national public opinion survey via CATI with a dual-frame RDD/Listed Household Sample, a sample size of 1000, and multiple call-backs to minimize systematic nonresponse biases. The survey has been designed to allow comparisons both over time and across countries. The 2007 survey will track attitudes, media use patterns, and levels of information that had first been measured in the 2004 national survey as part of the NSF NIRT #SES 0403783. The survey will continue to track these attitudes through the duration of CNS-ASU. The 2007 survey also uses a series of measures in parallel to items in the 2006 64.2 Eurobarometer, allowing us to compare attitudes about regulatory policies and nanotech more generally across more than 30 countries. The 2007 survey is also designed for comparison to a 2006 Badger Poll (Wisconsin), and to 2008 post-tests for the RTTA 3/4 National Citizens' Technology Forum. Milestones met include drafting and pre-testing the survey in Sp 07 and fielding the survey in April-June 2007. As of this writing, 680 of the telephone interviews have been completed. Preliminary analysis should be available by the end of Sp 07.

Outcomes: Results from the survey will provide critical information for RTTA 3/4 National Citizens' Technology Forum, as well as key comparative information for the two other RTTA 2 projects below. See Findings for some preliminary results.

Research Title: RTTA 2/2 – POV/Media Influence (MI)

Led by: Sharon Dunwoody (Wisconsin)

Team Members: Faculty – Dietram Scheufele (Wisconsin)

Students – Elliot Hillback (G), Tsung-Jen Shih (G), Michael Dahlstrom (G), Kajsa Dalrymple (G), Shirley Ho (G), Eun-sung Kim (G), Brescia Cassellius (UG), and Charles Walsh (UG)

Activities Underway and Planned: The goal of RTTA 2/2 MI is to explore the complicated role of the media in reflecting and influencing public opinion around nanotechnology through content analysis of media coverage of nanotechnology and through experimental interventions involving the award-winning science web site, The Why Files (www.whyfiles.org). Dunwoody and Scheufele began to develop an instrument for conducting a content analysis of media stories on nanotechnology in Sp 06. The overall goals of the content analysis is to measure in a methodical way the incidence, content, and “flavor” of news coverage about nanotechnology in the US. In F 06, the research group began its first round of data collection.

The research examines three broad types of information: the “demographics” of stories (publication type, date, word count, etc.), the topics covered (funding, risks/benefits, regulations, etc.), and the “how” the information is covered (framing of story, use of narrative, analogies, metaphors, depiction of uncertainty, sources used, etc.). The research uses the Nexis online database to include as many stories as possible from a sample of 21 daily newspapers selected to provide diversity in circulation size, geographical representation, and ownership. All 21 newspapers are accessible through Nexis at least as far back as 1994, with coverage of several newspapers pre-dating the coverage of nanotechnology.

The group is currently training human content analysis coders, a requisite process to yield statistically consistent and reliable data collection among individual coders.

Outcomes: The kind of content analysis pursued here offers three main benefits: First, it provides insight into nanotechnology “issue cycles” in the news – how news coverage waxes and wanes and how events, developments, or other factors can spark or change the “flavor” of news coverage about nanotechnology. Second, it provides a better understanding of how the news media behave in covering science and technology, particularly emerging topics for which public awareness or understanding may be low (as is the case with nanotechnology). Third, it links the 2007 public opinion survey with both earlier and forthcoming public opinion surveys about nanotechnology, allowing us to see if media content and presentation may affect public knowledge and opinion about nanotechnology in particular and science in general. See also Findings for some preliminary results.

Research Title: RTTA 2/3 – POV/Researchers' Values (SV)

Led by: Elizabeth Corley (ASU)

Team Members: Faculty – Dietram Scheufele (Wisconsin), Kevin Corley (ASU)

Post-doc – David Conz (ASU)

Grad Student – Aíxa García-Mont (ASU)

Activities Underway and Planned: The goal of RTTA 2/3 RV is to understand in a broad way the knowledge of and attitudes toward nanotechnology in society among NSE researchers. During grant YR 2, the research team began data collection for a national survey of NSE researchers to supplement the public opinion survey, on one hand, and the more in-depth interviews in RTTA 4/1 with NSE researchers on the other. In Fa 06, researchers began developing the instrument and the bibliometric analyses for the sampling frame for this project. Using data from RTTA 1/1 RPA, the sampling frame began with a population of 91479 raw publication records using the complex nanotechnology search filter. These were additionally filtered for “U.S. Only” and “Times Cited ≥ 5 ” and captured the first author or contact author for papers published in 2005 or the first half of 2006. Graduate students were also excluded from the sample. This four-stage filtering process was designed to ensure that the survey sample focused on the most highly cited, most active US-affiliated NSE researchers. The final filtering process yielded 1022 names. The expected final number of respondents is between 260 and 300 (yielding a response rate of 25-35%). As of early May 2007, data have been collected and coded for about 270 respondents. Data collection will continue into early June 2007.

After the data collection for both the Scientists' Survey and the Year 2 RTTA2 Public Opinion is complete, it will be interesting to compare the scientists' responses with the perceptions of the public. Future analyses will include these comparisons across the public and scientists, but also across the different types of scientists in the sample. For example, the results will be analyzed to explore the range of scientists' responses across different variables, including: 1) affiliation (industry, academic, or government), 2) discipline of doctoral degree, 3) discipline of current research position, 4) presence of government-funded research, 5) presence of industry-funded research, 6) political affiliation, 7) religious affiliation, 8) age, and 9) gender.

Outcomes: Like the public opinion poll, the scientists' survey will be used as important input for the National Citizens' Technology Forum. See Findings for some preliminary results.

Research Title: RTTA 3 – Deliberation and Participation

Led by: Dan Sarewitz (ASU) and Patrick Hamlett (North Carolina State)

Team Members: See below.

Activities Underway and Planned: The goal of DP is to develop multiple, plausible visions of nanotechnology-enabled futures, elucidate public preferences – especially values from underserved communities – for various alternatives and, using such preferences, help further refine future revisions and enhance contextual awareness. DP has four separate activities. See below for details.

Outcomes: See below.

Research Title: RTTA 3/1 – DP/Scenario Development (SD)

Led by: Dan Sarewitz (ASU)

Team Members: Post-doc – Ira Bennett (ASU); Cynthia Selin (ASU)

Students – Zach Pirtle; Brian Young (all ASU)

Activities Underway and Planned: The goal of RTTA 3/1 SD is to develop a variety of plausible, technically validated and “open source” nanotechnological futures that can structure and focus deliberation about the social meanings of NSE. Milestones include the drafting of a set of ten scenarios, their illustration in graphic novel style for communication purposes, and the vetting plan, which includes direct expert elicitation and the construction of a wiki site. The direct expert elicitation has been done in conjunction with NSE researchers at the Biodesign Institute here at ASU. Further expert elicitation this spring and summer will be aimed at constructing speculative technology roadmaps to be explored as part of RTTA 1/1 innovation system analysis. The wiki site, finally developed after some technical delays, is quasi-experimental: On “Nano-Futures,” as the site is named, the scenarios will be open for revision and discussion to controlled sets of broader audiences – NSE researchers, social scientists, publics (ASU alums), non-profits working on nanotechnology issues, Foresight Institute members, science policy experts, and others. Beyond these specified communities, other CNS affiliates domestically and abroad (e.g., NISE Net) have expressed interest in participating in the exercise and/or using the scenarios. The scenarios begin as what we call “naïve product scenarios” to which the various communities will add technical and societal detail that they think is relevant. The results of each community's engagement will be tracked and analyzed for comparative purposes, thus constructing potentially more robust scenarios while also contributing to a greater understanding of how diverse communities think about the societal implications of nanotechnologies. The open source method is innovative and builds on the theory and method in scenario planning, public engagement of science, and the social studies of nanotechnology generally. The vision behind it is also consistent with the vision of the RTTA 3/1 NCTF, in that both activities seek to explore the potential of distributed, electronically-mediated deliberation on technological futures.

Selin was hired specifically because of her expertise in scenarios; she is engaged in theoretical and methodological assessment of scenario development and wikis including comparison to other widely used scenario techniques such as those used by Shell Oil. She will also design and

hold a scenario design workshop with about 12 Biodesign NSE researchers to explore the context of prioritized research objectives in light of researchers' views on "social benefit." This work will allow further comparison of alternative approaches to scenario construction and their value for deliberation.

Outcomes: The wiki site has been developed and preliminary vetting completed. The release date is on hold as we consider a collaboration with NISE Net, particularly the Exploratorium in San Francisco, to redesign the interface taking advantage of their considerable informal science education experience. Scenarios are also grist for work by other groups within and without CNS-ASU. They have been used to inspire imagination among the student participants in RTTA 3/2 InnovationSpace. Scenarios (and future iterations of them) will also link with: RTTA 3/4 to help structure NCTF deliberations; RTTA 1 to inform and be informed by bibliometric and patent data about areas of nanotechnological development relevant to the scenarios; RTTA 2 to inform survey development and be informed by survey findings; RTTA 4 to support deliberative activities to inform science decision contexts; and the TRCs, to support more concrete development of theories and cases. Scenarios will also be translated into Spanish for distribution in Latin America via Guillermo Foladori, a colleague in the International Nanotechnology in Society Network.

Research Title: RTTA 3/2 – DP/InnovationSpace (IS)

Led by: Prasad Boradkar (ASU)

Team Members: Adelheid Fischer (ASU) and three cross-function teams (see UG education for statistics)

Activities Underway and Planned: The goal of RTTA 3/2 IS is to create a track within a set of pre-existing, cross-disciplinary undergraduate courses to explore constructive issues of design for nanotechnology products. These courses, IND465: Collaborative Design and Development I and II, involve seniors from the colleges of design, engineering, and business. In AY 06-07, three cross-functional teams worked to produce product plans for nanotechnologies, beginning with the scenarios developed in RTTA 3/1 SD but developing their own approaches. Teams reached out to potential users of such technologies through focus groups and "rapid ethnographies" to help ensure the proposed products meet real needs. Given that the nanotechnologies they deal with are still in the laboratory or on the drawing board, teams also conducted crude roadmaps, including technical milestones for the development of the products they envisioned.

Outcomes: In their first semester, the three IS teams initially designed nine products (including models and posters) that were then selected down to one product per team. The original nine designs were displayed at the All-Hands meeting in Apr 07. The final designs were selected and developed in detail: "Electricitree" – a system of engineered bacteria and nano-enabled fuel cells to extract additional energy directly from trees; "Dialog" – a "lab-on-a-chip" product for home diagnosis of health status from urine; and "Current" – an energy-generating floor covering enabled by nano-piezo-electrics. These three final designs are on display, along with designs for other IS clients (Intel, Herman Miller) at an exhibit on 7 May and will be available for viewing at the site visit, along with their supporting materials. See Contributions for visuals of these designs, which will also serve as inputs to the analyses conducted in RTTA 3/3 CriticalCorps

below. An honors student from the “Dialog” team will be writing a thesis next year on the societal aspects of this innovation.

Collaboration with the IS team over similar activities led to the submission of a Nano-scale Undergraduate Education (NUE) proposal, Design for Environmentally and Socially Integrated Nanotechnologies (DESIN; Boradkar, PI), which was rejected despite strong peer reviews (E, VG, VG), but a similar application to the National Collegiate Inventors and Innovators Alliance received a \$30K grant.

Research Title: RTTA 3/3 – DP/CriticalCorps (CC)

Led by: Prasad Boradkar (ASU)

Team Members: Renata Hejduk (ASU)

Activities Underway and Planned: The goal of RTTA 3/3 CC is to help illuminate the social significance and consequences of nanotechnological design concepts as they are developed. Applying the techniques of cultural criticism to the scenarios developed in RTTA 3/1 SD and the products envisioned in RTTA 3/2 IS, as well as other sources, the CC team will situate artifacts, scenarios, and new venture proposals within cultural, social, political, environmental, and economic contexts. CC research will commence after Sp 07 when the scenarios and IS products are ready for analysis.

Outcomes: The Association of Collegiate Schools of Architecture (ACSA) has cited the relationship among CriticalCorps, InnovationSpace, and CNS-ASU as a model of progressive thinking in both architectural and urban practice and education. Aside from the obvious uses of nano-materials research that will influence architectural practice, ACSA sees the social critique of the products, spaces, and landscapes investigated by this collaboration as being in the forefront of how architecture and its related fields will begin to interact with the field of nanotechnology.

Research Title: RTTA 3/4 – DP/National Citizens' Technology Forum

Led by: Patrick Hamlett (North Carolina State U.)

Team Members: Faculty – Michael Cobb (NCSU), Susan Cozzens (GA Tech), David Guston (ASU), Carl Mitcham (Colorado), Daniel Kleinman (Wisconsin), Tom Kelly (University of New Hampshire); Stacy van der Veer (University of New Hampshire), Barbara Harthorn (UC Santa Barbara – planned)

Students – Rob Davis (UG), Shannon DiNapoli (G), both ASU

Activities Underway and Planned: There were no funded activities for the NCTF in YR 2 of the Center, although a collaborative workspace on the web has been established and is currently active. The team has successfully negotiated with CNS-UCSB to locate the sixth site at Santa Barbara, and we are in the process of submitting a supplement for a subcontract from CNS-ASU to CNS-UCSB to fund that site.

Undergraduate honors student Davis, who had been a student in Ramakrishna’s “Perspectives in Nanotechnology” in Sp 06 and had seen PI Guston give a guest lecture, performed an honors project under the direction of Guston with co-PIs Miller and Sarewitz as second and third readers, respectively. The project explored the possibilities of stakeholder analysis for nanotechnologies in general and for the NCTF in particular and catalogued a large number of organizations from all sectors for each local CTF region. A brief survey of the Tempe-area organizations is in process.

Outcomes: A web-based collaborative workspace has been established and is active on the NCSU system. Hamlett is in the process of planning training for local team members to take place electronically in Su 07. A preliminary list of regional stakeholders for each CTF region has been compiled. The NCTF is a critical integrating function for the Center's research, education, and outreach activities.

Research Title: RTTA 4 – Reflexivity Assessment and Evaluation (RAE)

Led by: Kevin Corley (ASU; replacing Ed Hackett) (and formerly Anne Schneider [ASU], who is stepping down from a leadership role and as co-PI)

Team Members: See below.

Activities Underway and Planned: The goal of RAE is to understand how the knowledge generated by CNS-ASU influences the values and choices made by NSE researchers and others, and to assess and evaluate the impact and role of CNS-ASU activities more generally. See below for details.

Outcomes: See below.

Research Title: RTTA 4/1 – RAE/Reflexivity Assessment

Led by: Kevin Corley (ASU)

Team Members: Faculty – Elizabeth Corley (ASU), David Guston (ASU)

Post-doc – David Conz (ASU)

Grad Student – Aíxa García-Mont (ASU)

Activities Underway and Planned: In YR 1, the research team developed a theoretical framework to examine the identity, knowledge, and practice of NSE researchers regarding nanotechnology in society and the interaction among those three variables (F 05). The team developed and tested a protocol to explore this framework and developed the sample (Sp 06), and in Sp and Su 06, K Corley and Conz conducted initial field interviews, which were digitally recorded, transcribed, and cleaned. Coding and analysis commenced in F 06. These interviews will serve as a baseline against which to measure changes among NSE researchers with which CNS-ASU interacts over time.

The second round of data collection begins in Sp 07. The interview protocol has been adapted from YR 1's baseline interviews to reflect activities that occurred within CNS-ASU over the past year that our sample of NSE researchers would have participated in. The interviews themselves are scheduled to occur over the months of May and June (depending on our informants' schedules) and analysis should be completed by F 07. This timing for the adaptation of the protocol (F), the interviews (late Sp), and the analysis (Su) will be repeated each cycle.

This activity is closely linked with RTTA 2/1 Public Opinion Survey and RTTA 2/2 Scientists' Values. The three activities can be used comparatively to develop a very detailed understanding of similarities and differences between the ways that lay citizens and scientists understand and value nanotechnology.

In a related activity, graduate student Garcia-Mont adapted K Corley's identity-knowledge-practice protocol to use specifically with Latino/a and Hispanic NSE researchers in the US and

Puerto Rico. The research explores the possible relationship between the subject's ethnic identity and his/her choices and practices as a potentially socially aware researcher. In YR 2, Garcia-Mont performed background research, literature reviews, and constructed a snowball sample for data collection from such researchers in university and government laboratories. Field work (semi-structured interviews in English and/or Spanish) and analysis is expected to be complete by the end of Su 07. This activity is also linked to RTTA 2/3 researchers' values.

Outcomes: The RA team completed 27 baseline interviews with NSE researchers at Biodesign and elsewhere at ASU in Su 06. These 27 respondents comprised nine tenured faculty, three untenured faculty, four post-doctoral researchers, and eleven graduate students. The second round of interviews is currently underway. Relevant findings from these interviews will be incorporated back into CNS-ASU program design. Garcia-Mont has completed eight of an expected 30 interviews. See Findings for some preliminary results.

Research Title: RTTA 4/2 – RAE/Evaluation

Led by: David Guston (ASU) [formerly Anne Schneider (ASU), who is stepping down from co-PI and leadership positions]

Team Members: Students – Erik Fisher (Colorado); Risto Karinen (ASU); Kalil Abdullah (ASU); Zach Pirtle (ASU); Taylor Jackson (ASU)

Activities Underway and Planned: A variety of activities in RAE/Evaluation are oriented toward understanding what the role of CNS-ASU is in the larger context of nanotechnology-in-society, how well its programs are conceived, and how well they are operating. On evaluation specifically, CNS-ASU has established a Board of Visitors (BoV) to make two site visits during the first five years of the Center. We held the first BoV meeting in conjunction with the All-Hands Meeting held in Apr 07. See Governance below for an account of the BoV meeting.

Schneider is collaborating with consultant Ingram (Irvine) and colleagues Khademian (Virginia Tech) and Feldman (Irvine) on developing a broader, more comparative and robust understanding of boundary organizations as collaborative management tools for drawing together within an organization a variety of different "ways of knowing." In this project, CNS-ASU is one case study of a boundary organization, among other cases including juvenile crime, agriculture, neighborhood planning, and budgeting.

This reflexive study of the role of boundary organizations like CNS-ASU is being expanded through collaboration with a project, recently funded (NSF 0621004) at Harvard University, under PI William C. Clark, on "Integrating Knowledge and Policy for the Management of Natural Resources in International Development: The Role of Boundary Organizations" (<http://www.ksg.harvard.edu/sed/borgs/index.html>). Center director Guston is PI of an ASU subcontract on the Harvard study. The Harvard study organized a workshop on boundary organizations that drew together not only the variety of cases, including CNS, from Schneider, et al., and the international development case, but also additional cases from the NSF-funded Decision-Making Under Uncertainty program – ASU's Decision Center for a Desert City (DCDC) and the collaboration between ASU and Colorado-Boulder, Science Policy Assessment and Research on Climate (SPARC).

Schneider has also commenced work on a project on “The Social Construction of ‘Broader Impact’,” in which she codes the abstracts from NSF NSE grant awards to assess what kind of claims researchers make about “criterion 2.” This project is linked both to understanding the environment in which CNS-ASU operates as a research entity interested in the “broader impact” of NSE, and to the ways of knowing project in its attempt to discern if NSE researchers can get outside their own “way of knowing” in addressing “criterion 2.” It also has concerns that overlap with the planned revision of TRC 1 to Equity and Responsibility.

Outcomes: Schneider, et al. have developed their ideas in a paper recently accepted to Public Administration Review and a second currently under review there, as well as in a paper to be presented at the annual meeting of the American Political Science Association in Fa 07 and a workshop that Schneider et al. have organized for May 07 in Washington, DC. The boundary organizations workshop held in Fa 06 produced a workshop report (<http://cns.asu.edu/cns-library/documents/BoundaryOrgWorkshopReport.pdf>) that supports a more reflexive environment for practice at CNS, DCDC, and SPARC and which fed into this work by Schneider, et al.

Analysis of CNS-ASU Social Networks. This activity is focused on visualizing the CNS-ASU network of participants and understanding the implications of changes to its social network over the course of the project.

Led by: David Guston (ASU)

Team Members: Students: Dave Conz (G), Julia Weakley (UG), both ASU

Activities Underway and Planned: Post-doctoral fellow Conz is mapping the social network of CNS-ASU personnel based on the information supplied in the Center’s annual reports using software called Netdraw. Basic mapping has occurred for YR 1, and mapping for YR 2 will begin following approval of this report. Characteristics of the network that will be of particular interest include growth of the network, density of relationships within particular aspects of CNS-ASU, and changes to relationships across various aspects of CNS-ASU, e.g., integration among various CNS research activities.

Outcomes: Conz has produced a preliminary network analysis of relations among CNS-ASU YR 1 participants. See Contributions for a sample visual. Because changes can be mapped once we have added YR 2 data, the network analysis may become a useful tool for management and evaluation.

Rhetorical and Operational Foundations of NNI. This project, part of Gallo’s doctoral thesis, investigates the rhetorical and operational foundations of the National Nanotechnology Initiative (NNI) as viewed through the history of the NSF. It provides historical background to the emergence of NSE as a national priority by examining the rhetorical and operational history of the NSF’s past involvement with large-scale research initiatives.

Led by: Dietram Scheufele (Wisconsin)

Team Members: Jason Gallo (Wisconsin)

Activities Underway and Planned: In AY 06-07, Gallo completed two research trips to the Washington, DC area, collecting primary source documents from the National Archives Annex

in College Park, MD and interviewing several NNI officials for background information (off the record) in an Aug 06 trip and returning to the National Archives in College Park and the Library of Congress in Washington, DC in a Jan 07 trip. Gallo has also used the oral history collection of the Charles Babbage Institute in Minneapolis, MN to supplement his research. All documents were digitally photographed and indexed for later use.

Outcomes: Preliminary conclusions of this research suggest that NNI has followed traditional patterns of rhetorical support for large-scale programs that are research intensive and include potential technological innovation. Government funding of the NNI, and especially the funding of the basic science components of the initiative, are justified by stating that upstream investment in science leads not only to downstream technological development, but also to positive societal outcomes. While the use of this rhetoric has a long and well-documented history, critiques of this rhetorical strategy often highlight how it insulates scientific activity from social responsibility. Gallo's research indicates, at least initially, that while much of the rhetoric of nanotechnology funding differs little from its historical antecedents, the societal impact components built into the NNI and NSF grants for nanotechnology research are attempts to address many of the social concerns that were previously ignored.

Research Title: Thematic Research Clusters (TRCs)

Research Title: TRC 1 – Freedom, Privacy, and Security (FPS)

Led by: Torin Monahan (ASU) (for YR 1)

Team Members: Faculty – Mark Suchman (Wisconsin); Priscilla Greenwood (ASU)

Students – Tyler Wall (ASU); Azra Panjwani (ASU); Lea Shanley (Wisconsin)

Activities Underway and Planned: CNS-ASU is in the process of negotiating with NSF a shut-down of FPS activities as TRC 1 due to the previously reported withdrawal TRC 1 leader Monahan from the Center.

The goal of FPS has been to develop theory and explore cases of surveillance and nano-sensing technologies, including issues of effectiveness, potential ubiquity and embeddedness, and impacts on practices of surveillance and on the individuals and communities subject to surveillance. It has had three principal activities:

Monahan and Wall conducted an interview and observation protocol to explore current and potential nano-sensor projects at the Biodesign Institute at ASU. The project assesses the assumptions and values underlying the design of these nano-sensors and explores anticipated conditions for their use, especially uses on and in the human body. One underlying goal of this research is to probe how NSE-based sensor technologies may be applied in ways that may exceed their intended uses and proliferate in daily life. First, literature reviews were conducted on the overlaps between nanotechnology and security operations. Second, semi-structured interviews were conducted with 12 nanoscientists at ASU: 2 from the Center for Applied Nanobioscience, 4 from the Center for Bio-Optical Nanotechnology, 3 from the Center for Single Molecule Biophysics, and 3 from the Center for Bioelectronics & Biosensors. Third, all interviews were transcribed and analyzed for themes.

Graduate student Panjwani is developing mathematical models of surveillance systems as they could be influenced by nanotechnology. Working under the direction of Greenwood and Sarewitz, Panjwani is surveying the literature on mathematic models of non-random methods of surveillance, e.g., profiling, and is creating linear, time-iterative models that take into account the increase in the number of individuals searched, and the increasing accuracy with which they are searched, presumed by advances in nano-sensing. This task proves more difficult than initially anticipated, forcing attempts to quantify variables such as the psychological impact of nano-surveillance on target populations.

Shanley, under the supervision of Suchman, has been investigating a major, recent tagging and tracing initiative involving geographic information technologies and electronic devices (e.g., radio frequency identification (RFID) tags) to track the ownership and location of livestock and the provenance of animal products. The project examines the fate of premises registration and animal identification programs in four mid-western states. Data collection has begun in Wisconsin and will be extended to three additional states (probably Illinois, Iowa and Minnesota) in order to explore potential variations and contrasts suggested by our preliminary findings. In each state, researchers are interviewing Animal Identification Coordinators and representatives from relevant industry organizations, such as the Wisconsin Livestock Identification Consortium (WLIC). As time permits, additional interviews will be conducted with local producers, state veterinarians, state legislators, and federal agency personnel. Interview questions will be semi-structured and will focus on privacy and confidentiality issues related to the premise registration and animal identification systems. Among other questions, interviews will address the possible impact of diminishing size and visibility of animal tagging devices and the possible impact of expansion of animal identification program to include tracing animal products all the way to the consumer, both items designed explicitly to highlight the possible future impacts of nanotechnology in this policy domain. Results are expected by Aug 07.

Outcomes: None to report yet.

Research Title: TRC 1 – Equity and Responsibility (ER) - Proposed

Led by: Jameson Wetmore (ASU), Susan Cozzens (GA Tech)

Team Members: Faculty –Anne Schneider (ASU); Gregor Wolbring (U of Calgary)
Students: Walter Valdivia (ASU);

Activities underway and planned: CNS-ASU proposes to establish a TRC in Equity and Responsibility to replace FPS. The proposed co-leaders, Wetmore and Cozzens, have already done significant work in the area of science, technology, and equity – most importantly a forthcoming (Mar 07) special issue of Science and Public Policy that Wetmore guest-edited and to which Cozzens contributed on “Science, Policy, and Social Inequities.” The research agenda for ER is in the planning stage, and a break-out group met during the Apr 07 All-Hands Meeting to discuss potential projects and partners. The preliminary plans include:

- additional work on nanotechnology and religion as an inquiry into both responsibility and equity (see below);
- further developing Wolbring’s idea of ableism;
- a continued and expanded collaboration with the Woodbury lab (see below), including a joint workshop with RTTA 4; and

- strengthening ties with Oxford University's project on Researching Inequality through Science and Technology (ResIST).

Those involved in ER would also work closely with a number of other scholars in CNS to help integrate ideas of equity and responsibility into the Citizens Technology Forum, the scenario project, etc.

Outcomes: See below.

Nanotechnology and Religion.

Led by: Jamey Wetmore

Team Members: Students: Tobie Milford (UG) and Rachel Smith (UG), both ASU

Activities underway and planned: Wetmore has been working with undergraduate researchers Milford and Smith to explore the political aspirations and impacts of religious thinkers on nanotechnology research and policy. Milford and Wetmore plan to conduct a small workshop in Sp 08 that will bring together religious thinkers and nanoscale researchers in an attempt to foster dialogue between the two groups. They will also collaborate with TRC 2 HIEB work on "Institutional Responses to New Life Forms: Religious Institutions" by Moore at Wisconsin.

Outcomes: Wetmore presented preliminary findings at the Gordon Research Conference on Science and Technology Policy in Aug 06 and to CNS-UCSB in Feb 07. He is currently drafting a paper detailing the preliminary findings for Nature Nanotechnology.

The Woodbury Lab Project

Led by: Jamey Wetmore (ASU)

Team Members: Faculty: Joan McGregor (ASU); Neal Woodbury (ASU)

- Post-docs: Ira Bennett (ASU), Erik Fisher (ASU), Cynthia Selin (ASU)

Students: Brice Laurent (G; Corps des Mines; visiting ASU)

Activities Underway and Planned: The Woodbury Lab project is a joint endeavor among McGregor, Wetmore, and Woodbury to determine if discussions between active research scientists, social scientists, and humanists could help all groups better grapple with the complex social and ethical aspects and implications of cutting edge technologies and scientific research than uni-directional efforts like lecturing. The project was conducted over F 06 and Sp 07, focused on a series of meetings that McGregor and Wetmore organized with Woodbury's laboratory in the Center for BioOptical Nanotechnology. McGregor and Wetmore developed a series of modules designed to spark open-ended discussion about basic issues that scientists and the public must deal with when thinking about the implications of technology and research. These broad discussions created a comfortable atmosphere for thinking about issues that scientists are rarely encouraged to think about. In addition, all groups involved wanted to tackle a more concrete question, so the leaders organized as a capstone for the project a mock public hearing on the question of whether the recent Berkeley regulation of nanoparticles should be adopted by other municipalities. The mock hearing gave the scientists a chance to think about the political dimensions of their work and an opportunity to formulate ways in which they could offer advice to policymakers. The hearing also helped those from the humanities and social

sciences better understand the scientific complexities and shortcomings of the Berkeley regulation.

Outcomes: McGregor and Wetmore have drafted a paper detailing the project and their findings and will soon submit it for publication in *Science & Engineering Ethics*. Woodbury has also requested from CNS additional, close collaborations like this project.

Research Title TRC 2: Human Identity, Enhancement and Biology (HIEB)

Led by: Linda Hogle (Wisconsin) and Jason Robert (ASU)

Team Members: Students – Shannon DiNapoli (G; ASU); Ricky Leung (G; Wisconsin); Zach Pirtle (UG; ASU); John Parsi (G; ASU); Sean Hays (G; ASU); Arielle Silverman (UG; ASU); Jeremy Stoloff (G; ASU)

Activities Underway and Planned: The goal of HIEB is to explore the historical, philosophical, cultural, and political dimensions of the interactions between human biology and human values in the context of new nanotechnologies. HIEB has components at Wisconsin, led by Hogle, and at ASU, led by Robert. Both components have proceeded largely autonomously but with considerable consultation, including several face-to-face meetings, between Hogle and Robert. HIEB will also be the focus of YR 3's Speaker Series at ASU, assisting the development and integration of the research theme.

At ASU, the primary focus is on the use of nanotechnology in the neurosciences, with a special emphasis on the prospects for nano-enabled, invasive brain-computer interfaces. This research domain exemplifies the three dimensions of TRC 2 – questions of human identity, the prospect of human enhancement, and the intersection of nanotechnology with biology and biotechnology. Robert's research involves ethical and conceptual analysis of this emerging interaction of nanotechnology and the neurosciences. Specific activities include: a range of writing projects on specific ethical and societal issues in nanotechnology; a data-based assessment of the research agenda for so-called nano-ethics; collaborative activities with ASU neuroscientist Steve Helms Tillery; and the development of community engagement exercises aimed at enabling anticipatory governance of emerging science and technology.

Student research in HIEB at ASU includes Pirtle's undergraduate honors thesis, under Robert's direction on the methodological and conceptual dimensions of research on the societal and ethical implications of nanotechnology (http://cns.asu.edu/cns-library/documents/Pirtle_HonorsThesis_CNS.pdf). A second student, Silverman, is about to begin the data analysis for her undergraduate honors thesis, focusing on blind persons' perceptions of invasive neural prosthetics for vision repair/augmentation/restoration. Robert and Silverman received IRB approval for an online survey in Su 06 and conducted it in F 06 to Sp 07. Data analysis should be complete by end of Su 07, and Silverman will defend the thesis in AY 07-08. Robert also supervised the work of (unfunded) graduate student Stoloff on papers on the regulation of nanomedicine by FDA and the conduct of ethical translational research in nanomedicine.

At Wisconsin, Hogle continues her research on regenerative medicine and how techniques from nano-scale science, stem cell culture, tissue engineering, and synthetic biology are being

combined in novel ways with older sets of knowledge, transforming understandings of wound healing and biocompatibility. The ability to create cells and to redirect relationships among cells and materials enables “human biological” materials to sense, repair, and remediate in ways that make it unclear what is human, biological and technological.

Hogle is also responsible for supervising an array of student and post-doctoral research. In a project entitled “Institutional Responses to New Life Forms: Religious Institutions,” research associate Moore is mapping existing views on new life forms (artificial cells, minimal genome, synthetic antibodies, self-assembly molecules) as articulated by a variety of Christian, Jewish, Islamic and other religions. In examining major religions’ efforts to make sense of emerging biotechnologies, she prepared an extensive bibliography (117 references) of recent articles, formal statements and white papers, and web sites on the subject, with a focus on religious views of nanobiotechnologies, in particular as they related to: 1) concepts of enhancement; 2) proper relationships of humans to a Deity; and 3) proper relationships of humans to Nature. She also analyzed internet sites and conducted phone interviews with individuals from the Pacific School of Religion and other authorities on religion and science.

Leung continued his sociological study of nanobiotechnology in China, particularly on how scientists create networks with Chinese scientists residing and working in other countries. Findings from his study contribute toward the understanding how global institutions and networks of expertise evolve. He is expected to complete the dissertation based on this research in Su 07.

Post-doctoral fellow Kim is exploring directed evolution as a platform technique for bridging nanotechnology, synthetic biology, and biotechnologies. He has explored an example of experimental systems that invert traditional principles of processing and production into nanoscale logics of self-assembly. Specifically, directed evolution employs engineering, protein chemistry toward the goal of discovering useful molecules for drug discovery. Such nanoscale biomimicry techniques are employed to make nature better – defined as more efficient. Following the development of fields such as directed evolution and synthetic biology in action will provide understanding of how values and novel technologies interact. The study of directed evolution also illustrates an alternative history to the standard narrative of nanotechnology (that focuses on materials science) in which protein engineering is designed to perform functions at smaller scales that are meant to mimic nature.

Outcomes: Findings from HIEB will be used in the NCTF, which will most likely adopt a theme related to HIEB for its inquiry. See both Findings and Publications and Presentations below.

Education

CNS-ASU goals in education are proceeding well. At ASU, we offered two new, nano-related undergraduate courses in SP 06, and added our full complement of undergraduate courses in AY 06-07, including InnovationSpace and Learning Community (see below for details). We offered a new nano-related graduate course in Sp 06 which was repeated in Sp 07. Enrollment in the courses has been substantially interdisciplinary.

Undergraduate:

In YR 1 CNS-ASU developed and offered two undergraduate courses related to nanotechnology, “Elements of Public Policy - Science and Technology Policy (Nanotechnology in Society)” (POS 426) and “Perspectives in Nanotechnology” (HON 394/BIO 394). For syllabi for these courses, please see <http://cns.asu.edu/program/training.htm>. One student, Rob Davis, in HON/BIO 394, taught by senior investigator Ramakrishna, followed up on his interest by approaching Guston about chairing an undergraduate honors thesis in nano-in-society, which he completed in Sp 07 ([http://cns.asu.edu/cns-library/documents/Davis-SAFinalManuscript\(2\).pdf](http://cns.asu.edu/cns-library/documents/Davis-SAFinalManuscript(2).pdf)).

In YR 2, Ramakrishna again offered In HON 394/BIO 394: “Perspectives in Nanotechnology” in F 06. Syllabus at <http://cns.asu.edu/program/documents/nanoperspectivessyllabus.doc>. The objectives of the course were to: build sufficient S&T knowledge base of terms and concepts central to nanotechnology; gain some familiarity with the trends of current research in the field and appreciate the importance of societal implications; develop sufficient knowledge of nanotechnology to understand and evaluate the scientific, technological, societal issues of the nanotechnology revolution; offer a novel hybrid academic-entrepreneurial educational experience that will serve as the basis of formation of E-teams for business opportunities; and educate a new generation of learners who can work across traditional disciplinary boundaries to realize the enormous opportunities and challenges of nanotechnology.

In YR 2, CNS-ASU added four additional undergraduate courses.

In F 06, CNS-ASU senior investigator Privateer taught “Studies in the Transhuman” (ENG 598/FMS 494). The course used perspectives from film and popular media to examine issues raised by convergent technologies, including nanotechnology, and possible transhuman futures. The students – including CNS-ASU affiliated graduate students Hays and Parsi – created a blogging website at <http://studiesinthetranshuman.blogspot.com/> which has received significant traffic and attention.

In Sp 07, CNS-ASU post-doctoral fellow Selin taught “Justice and the Future” (JUS 394). The course was organized around three main modules – conceptions of the future, analyzing the future, and justice and the future. It explored a diverse range of sources of the future, including film, popular media, literature, congressional hearings, corporate strategies and scholarly accounts. Nanotechnology was a principal case study. Students learned how to engage analytically with different forms of ‘evidence’ of the future. See <http://cns.asu.edu/program/documents/07SPSelinfinalsyllabusJUS394.doc>. An alumna of the course, Tara Egnatios, has been hired by the Center as an undergraduate intern.

Learning Community. In Sp 06, Guston, Woodbury, and Conz taught an advanced (sophomore and higher) Learning Community (LC) focusing on the issues emerging in NSE. In the nine-credit LC, Woodbury taught a three-credit section on introductory nanotechnology, Guston taught a three-credit section on the politics and policy of nanotechnology, and Conz taught a three-credit section on the social aspects of nanotechnology. CNS-ASU provided a number of guest lecturers – researchers like senior investigator Wetmore and post-doctoral fellows Bennett and Selin, as well as monthly seminar speakers (see Outreach). The LC syllabus is available on the website (<http://cns.asu.edu/program/documents/07SPLCSyllabus.pdf>).

InnovationSpace. CNS-ASU developed for AY 06-07 a year-long, senior-level InnovationSpace course on NSE that provides design, business, and engineering students training for a real-world product outcome (see also RTTA 3/2). A joint venture among ASU's College of Design, the Fulton School of Engineering, and the Carey School of Business, InnovationSpace involves faculty and students from each school in a hands-on, product development laboratory to develop user scenarios, define new product offerings, create product appearance models, generate brand ideas, build or conceive engineering prototypes, and create business plans and visual materials to communicate the end results. The nanotechnology InnovationSpace deployed 3 teams of four students each. Post-doctoral fellows Bennett and Selin helped mentor the students through their investigations of nanotechnology, and Bennett, Selin, Guston, and visiting PhD candidate van Merkerk all provided guest lectures on nanotechnology and anticipation. In addition, CNS-ASU Speaker Series participants Soueid and Kundahl visited InnovationSpace to engage with the faculty and students on the NSE product design projects. An alumnus of the course, Tim Shaw, will pursue an undergraduate honors thesis in AY 07-08 following up on the product that he helped develop.

Graduate

In Sp 06, CNS-ASU introduced a graduate seminar, 'Science, Technology, and Societal Outcomes' (BIO/POS/JUS 598), that trains natural scientists, social scientists, and humanists in the methods of Real-Time Technology Assessment, as well as other theory and practice in the social studies of science and technology. For the Sp 06 syllabus, please see <http://cns.asu.edu/program/training.htm>. Wetmore and Bennett offered the course offered again in Sp 07. Alums from the Sp 06 course include CNS-Biodesign fellows Spadola and Lappe, as well as CNS-ASU graduate student and communication coordinator Wheelock.

In Sp 07, TRC 2 co-leader Robert introduced a new graduate seminar, Bioethics and the Brain, which included significant material from the HIEB research program. For the syllabus, please see ..\..\EDUCATION\Bioethics and the Brain BIO-HPS591-Spr07Syllabus.pdf .

In Sp 07, Marchant, Abbott and Sylvester taught a new course entitled "Nanotechnology Law and Policy" at ASU's Sandra Day O'Connor College of Law. The syllabus is available at ..\..\EDUCATION\nano law policy marchant Syllabus.doc.

CNS-ASU intends to develop a second graduate seminar that will extend the InnovationSpace concept to the graduate level, involving students and faculty from the schools of engineering, design, and business, as well as liberal arts and sciences. We have not yet identified faculty willing to take on this task, and so we are delayed in implementation from the original plan.

In YR 2, CNS-Biodesign fellows Spadola and Lappe began to explore the research that will constitute their 'PhD plus' – the component of their dissertations on the societal context of their research. Spadola will write about the societal aspects of the highly sought “\$1,000 genome,” and Lappe will explore the societal aspects of directed evolution through scenarios and science fiction writing.

Education at Wisconsin:

In Sp 07, Linda Hogle taught a course on 'Regenerative Medicine, Ethics and Society,' including nanotechnology, to both natural and social science students. The course description is available at ..\..\EDUCATION\hogle med ethics soc sp07.mht

Education at other subcontractors:

Although there are training activities occurring at other CNS-ASU subcontractors, there are no curricular activities to report at this time.

Student Activities

Undergraduate Honors Theses.

CNS intern Pirtle (Mechanical Engineering) completed an undergraduate honors thesis in Sp 07 on the philosophy of science roots of the democratization of science, with a focus on the emergence of the 21st Century Nanotechnology R&D Act. HIEB co-leader Robert was the first reader and Center director Guston was the 2nd reader. Through an award from the Barrett Honors College, University of Tennessee, Knoxville philosopher of science Heather Douglas was brought in to be third reader. http://cns.asu.edu/cns-library/documents/Pirtle_HonorsThesis_CNS.pdf.

Rob Davis (Political Science) completed an undergraduate honors thesis in Sp 07 on stakeholder analysis for nanotechnology and the potential role of stakeholders in the National Citizens' Technology Forum. Guston was the first reader, Miller the second reader, and Sarewitz the third reader. ([http://cns.asu.edu/cns-library/documents/Davis-SAFinalManuscript\(2\).pdf](http://cns.asu.edu/cns-library/documents/Davis-SAFinalManuscript(2).pdf)).

Arielle Silverman (Biology in Society) will be writing an honors thesis on enhancement technologies and the visually impaired based on a survey she is constructing; she is working primarily with Robert and is expected to finish Sp 08.

Tim Shaw (Mechanical Engineering), a student in the 06-07 InnovationSpace, plans to write an honors thesis to follow up on the societal aspects of the "Dialogue" product plan that he helped create in that course.

Journal.

In YR 1 of the Center, CNS undergraduate intern Abdullah coordinated the founding of the ASU chapter of the Triple Helix: The International Journal of Science, Society, and Law. ASU's first edition came out in fall 2006, featuring an article by CNS undergraduate intern (<http://www.cspo.org/documents/pirtletriplehelix.pdf>) on philosophical justifications for societal implications research on nanotechnology. CNS undergraduate intern Anderson succeeded as president in Sp 07. The second edition is due out June 2007. Guston serves as the principal faculty advisor for the journal at ASU.

International Activities

As both NSE research and the social science and humanist scholarship on its societal interactions are international endeavors, CNS-ASU engages in a number of ad hoc and organized international activities including:

International Nanotechnology and Society Network

CNS-ASU is a governing partner, along with CNS-UCSB and the technology assessment group of NanoNed in the Netherlands (led by A. Rip), of the International Nanotechnology and Society Network (www.nanoandsociety.org). In YR 2, INSN held several meetings of portions of its expanding membership, including at the Society for the Social Studies of Science meeting in Vancouver and the CNS-ASU All-Hands Meeting. CNS-ASU commits some undergraduate, post-doctoral and faculty time to its work. Barben, Sarewitz, Selin, and Bennett, are planning an INSN workshop for Brussels in January 2008, which will serve strengthening the international exchange on core issues among the growing research community. They are coordinating the planning activities with A. Rip, the initiator of this workshop in Europe. Barben and Rip, and if possible Selin, will meet in Su 2007 in Europe to further elaborate the details of this important research and outreach activity.

International Visiting Scholars

Since the first annual report, CNS-ASU has hosted two doctoral students visiting from abroad:

- Rutger Van Merkerk visited Sep-Oct 2006 from the University of Utrecht in the Netherlands, where he is a student of Ruud Smits. His research includes comparing the Real-Time Technology Assessment (RTTA) approach of CNS-ASU with the Constructive Technology Assessment approach that is prominent in the Netherlands and is the basis of the technology assessment component of NanoNed, the Dutch nanotechnology project. Van Merkerk presented his findings to CNS researchers at a seminar in Oct and presented at the annual meeting of the Society for the Social Studies of Science in Vancouver on Nov 2006.
- Brice Laurent is visiting January through September 2007 from Corps des Mines in France, where he is a student of Michel Callon. His principle research concern is the role of public participation in the development of nanotechnology. He presented his work to CNS researchers at a seminar in Sp 07 and he is developing research collaborations with CNS post-doctoral fellow Fisher. He anticipates returning to ASU in Sp 08 to observe the NCTF.

International Research Travel

NSF's Office of International Science and Engineering (OISE) provided CNS-ASU with funds earmarked for international research travel with an emphasis on opportunities for junior scholars. In YR 2, the following international research trips have occurred or are planned for Su 07:

Valdivia (G; ASU) was invited (and received partial funding) to attend a course at Oxford University – organized by NanoBio-RAISE, a science and society program funded by the European Commission – on “Strategic Communication & Applied Ethics in Nanobiotechnology.” He also attended a seminar in Istanbul sponsored by ResIST, which researches inequality in science and technology, at the invitation of Peter Healey (Oxford University). Valdivia extended the trip to meet with a number of scholars to discuss concepts like RTTA and principal-agent theory (which is relevant to his dissertation research). He met with:

- Steve Rayner at the Martin Institute for Science and Civilization at Oxford University;
- Arie Rip and Barend van der Meulen at Twente University in the Netherlands;
- Ruud Smits at the Department of Innovation Studies of the University of Utrecht;
- Lieve Goorden and Marian Deblonde at the Research Center on Technology, Energy, and Environment (STEM), Universiteit Antwerpen;
- Martina Merz, SNF Förderprofessur, Universitat Luzern;
- Alain Kaufmann, of Interface Sciences - Société and NanoPublic, Université de Lausanne;
- John Adams, at the Geography Department, University College London; and
- Dietmar Braun at the Institut d'études politiques et internationales at the Université de Lausanne whose work underpins Walter's research.

Selin (post-doc; ASU) will travel to the UK with the aim of deepening her understanding of foresight, creating additional publications, advancing RTTA, and expanding CNS-ASU's network. She will work at the James Martin Institute for Science and Civilization at Oxford University, and with Bill Sharpe, also at Oxford, who is the editor of *Scenarios and Strategy* (London: Wiley, forthcoming 2007) – of which Selin's chapter “Rediscovering the Past in Future Approaches to Scenario Planning” serves as the focal point. Selin has also worked to institute a Pierre Wack Library at Oxford, which boasts several scenario scholars and a graduate program dealing with scenarios and strategy. (Wack is the founder of scenario planning at Shell.) A book on the life and times of Wack is underway, and

Selin serves on a committee overseeing it. She will also attend the 3rd International Conference on Organizational Foresight in Glasgow. In a separate trip, Selin will be speaking to the European Environmental Agency, the Risoe National Laboratory, the Copenhagen Business School, and the Danish Network on Nanoethics about the work of CNS-ASU and the Nano-Futures project.

Maricle (G; University of Colorado) is attempting to research how the field of science studies influences decisions about science in a comparative context. Given the way that reports from public officials, legislation, and prominent scientists emphasize the importance of better understanding the interactions between NSE and society, it is interesting to investigate how such sources may or may not have relied on the language and ideas that have emerged from science studies. Because common perception indicates that science studies carries more weight in UK science policy decisions than in those in the US, the research includes a comparative analysis between the US and the UK. Maricle will spend one week based at the James Martin Institute at Oxford University working with Steve Rayner and others. She will spend another week at the Science Policy Research Unit (SPRU) at the University of Sussex in Brighton working with Andy Stirling, Paul Nightingale, and others. Finally, she will spend one week in Swindon, interviewing and observing research policy decision makers at a number of research councils. Finally, she will attend the Science and Democracy Network meeting in Cambridge, UK.

Wang and Tang (G; Georgia Tech) will explore the emergence of nanotechnology research and innovation activities in China. The proposed research will look at the pattern of scientific development and find out what is contributing to knowledge accumulation in China's nano science. They will explore the role of research collaboration, including internationally, and the part this plays in facilitating China's emergence as a major player in the nano science community. Their research will help in deriving a validated base of evidence upon which subsequent work can be undertaken to assess societal, economic, and policy impacts of China's nanotechnology development. They will be accompanied by GA Tech leader Shapira.

Fisher (post-doc; ASU) will undertake a tour of institutes within the European Union that conduct research at the interface of STS, policy, and nanotechnology, in particular the Institute for Technology Assessment and Systems Analysis, Germany, Rathenau Institute, The Netherlands, Centre of Science, Technology and Ethics, Belgium. During a two week period, he will give five research talks, each tailored as much as possible to the particular interests of local researchers and groups. Several days of interaction with scholars in each location would allow for a rich exchange of ideas during which he will seek to learn about the particular policy context of each locale and about the research approaches being undertaken to engage those contexts and to inform researchers of how his research fits into CNS-ASU operations and goals. As time and resources permit, Fisher will visit nearby STS scholars who are working on nanotechnology to give additional talks or to engage in formal or informal events.

Other international travel in YR 2 (not funded by OISE) includes:

Bennett (post-doc; ASU) represented CNS-ASU at INC-3 in April in Brussels; he presented on RTTA, particularly the Nano-Futures project.

Karinen (G; ASU) attended "Deliberating Future Technologies: Identify, Ethics, and Governance of Nanotechnology" at the University of Basel, Switzerland in early May, where he presented a paper, co-authored with Guston, to be included in a book following the conference.

Wheelock (G; ASU), who provides technical and communications consultation for CNS-ASU, attended a Nano Public Outreach workshop in Leuven, Belgium in May.

Governance and Management

CNS-ASU is headed by a director, Guston, and an associate director, Sarewitz. Their work is supported by two full-time staff members at ASU, a program manager, Corinne (Cory) Dillon, and an administrative associate, Joi Trotter. There are weekly administrative meetings among the Director, program manager, and administrative associate.

CNS-ASU provides partial support for two other staff members: Melissa Cornish, a staff member at the Biodesign Institute, who serves as the liaison between CNS and its most important NSE research constituency on campus and Raul Alcala, a staff member with the Hispanic Research Center, who helps coordinate the recruitment and retention of under-represented minorities, particularly the undergraduate research meeting that occurred in Sp 07. In YR 2, Cornish relocated to North Carolina for personal reasons but continues in her position at Biodesign by telecommuting. Alcala left his position at HRC in Sp 07, and CNS-ASU and HRC are currently discussing the outlines of future collaborations, which will include a second iteration of the student research meeting. CNS-ASU also employs, through CSPO funds at Guston's discretion, the graduate student Roxanne Wheelock as a communication coordinator. Under these funds, Wheelock can continue until the end of the calendar year.

In addition to this professional staff, CNS management includes: an executive committee at ASU to advise and support the director; a set of leaders for each of the Center's major subcontracts; a set of leaders for each of the Center's major activities; a Board of Visitors; and a Nano-Industry Liaison Committee.

Executive Committee: The Executive Committee has consisted of the director, the four other co-PIs local to ASU (Sarewitz, Poste, Carlson, and Schneider), and senior investigator Allenby. It has met roughly twice each semester to review Center progress in hiring, organizing, interacting, etc. Following the site visit recommendations last year, CNS-ASU constituted a core committee of director Guston, associate director Sarewitz, and (newly named) associate director for education and outreach Miller to handle questions of basic operation. Guston, Sarewitz, and Miller communicate on CNS-related issues on a daily basis.

Institutional Leaders: Each large subcontract has a principal investigator/institutional leader with whom the director keeps in regular (i.e., monthly) contact. Leadership for these subcontracts is illustrated below. Leadership for the Wisconsin subcontract passed from PI Miller to senior investigator Scheufele as the former left Wisconsin effective mid-Aug 06 and joined the faculty at ASU.

Wisconsin: Dietram Scheufele
GA Tech: Philip Shapira
North Carolina State: Patrick Hamlett
Rutgers: Carl Van Horn
Colorado: Roger Pielke, Jr.

Research Team Leaders: Each RTTA activity and each TRC have leaders with whom the director keeps in regular contact. Leadership for the various activities is illustrated below. There has been some turn-over as senior investigator K Corley has replaced senior investigator Hackett as co-leader of RTTA 4 with the latter's decision to take temporary leave from ASU. Co-PI Schneider has also decided to step down as co-PI and co-leader of RTTA 4, but she will remain active in the Center. As reported to NSF earlier, TRC 1 co-leader Monahan agreed that he should step down and has withdrawn affiliation from the Center. CNS-ASU hopes to reconstitute TRC 1 as Equity and Responsibility under the leadership of Wetmore (ASU) and Cozzens (GA Tech).

RTTA 1 RISA: Philip Shapira (GA Tech)
RTTA 2 POV: Dietram Scheufele (Wisconsin); Elizabeth Corley (ASU)
RTTA 3 DP: Daniel Sarewitz (ASU); Patrick Hamlett (NCSU)
RTTA 4 RAE: Kevin Corley (ASU); Anne Schneider (ASU; stepping down)
TRC 1 : IN TRANSITION
TRC 2 HIEB: Linda Hogle (Wisconsin); Jason Robert (ASU)

Board of Visitors. CNS-ASU maintains an external advisory committee in the form of its Board of Visitors, which is scheduled to meet twice in the five years of the Center. Membership on the Board of Visitors is illustrated below. Members marked with an asterisk were able to attend the All-Hands Meeting.

Board of Visitors: Jonathan Fink* (VP for Research and Economic Affairs, ASU); Lawrence Bock (NanoSys, Inc.); Diana Hicks* (Georgia Tech); Steven Hilgartner (Cornell NNIN); Sheila Jasanoff (Kennedy School of Government, Harvard); Ray Kurzweil (Independent Inventor); Rachel Levinson* (Director, Office of Government and Industry Liaison, The Biodesign Institute); Richard Nelson (Columbia University); David Rejeski (Woodrow Wilson Center); Mark Schapiro (Center for Investigative Journalism); Michael Small (Carnegie Mellon); Al Teich* (AAAS); James Wilsdon (Demos).

Nano-Industry Liaison Committee. The original CNS-ASU proposal included a group of interested persons from nano-related industries to serve as contacts and advisors for the Center. The proposal did not foresee the Committee as one that met formally and face-to-face. The Center reconsidered that decision and invited the members of the Nano-Industry Liaison Committee, listed below, to the All-Hands Meeting in Apr 07. Although we received four positive RSVPs, only Moffitt – with whom we have had more substantive interaction one-on-one and who has made formal presentations on the Center's behalf – attended. The NILC meeting with Moffitt and the Executive Committee at the All-Hands Meeting was devoted almost exclusively to contemplating how to further engage the NILC and the nano-industry community.

Nano-Industry Liaison Committee: Gary Bild (Director Analytical R&D, Pfizer); Larry Bock (Chairman, Nanosys, Inc); Ellen Feigal (Vice President, Clinical Services, TGen); Herb Goronkin (Board Member, NanoBusiness Alliance); Anatoli Korokin (President, Nano and Giga Solutions); Michael Moffitt* (Vice President, Western Technologies); Michael Tracy (Director, Strategic and Research Alliances, The Biodesign Institute); Fred Weber (Founding Principal, Next Step Management).

CNS-ASU assesses its progress toward goals in a variety of ways. In addition to oversight from the Board of Visitors and the Executive Committee, and active management by the institutional and research team leaders, the Center also measures its progress through one of its RTTA activities -- RTTA 4/1 Reflexivity Assessment -- and through adherence to a research timetable required by the interconnectedness of Center activities. RTTA 4/1 assesses over time whether the NSE researchers with whom we are working reveal any change in their identities, knowledge, and practices regarding NSE and its societal implications. The timetable, and milestones toward it, exist because, for example, the scenarios developed by RTTA 2/1 are necessary for input into the National Citizens' Technology Forum.

Progress is checked at regular research meetings. In YR 2, director Guston met weekly with post-docs (except Barben, who was supervised by Miller) on a one-on-one basis. He met with graduate students and undergraduates on alternate weeks, with a joint meeting every fifth week. Guston also reviews monthly reports from subcontract PIs. A monthly teleconference among institutional leaders proved too difficult to schedule.

Because CNS-ASU is a direct expression of ASU's attempts to encourage new modes of operation, particularly the one referred to as "intellectual fusion," President Michael Crow and Vice President for Research and Economic Affairs Jon Fink take an active role in keeping abreast of the Center. The Center's tight relationship with CSPO and its critical relationship with the Biodesign Institute reinforce its role as a campus leader in pursuing the broad university agenda and, indeed, many NSE groups on campus have sought out CNS as a collaborator.

In YR 2, CNS-ASU fully occupied its own physical space in the same building (Social Sciences) and floor as CSPO. The suite, SS 225 A-N, houses the administrative associate Trotter, faculty member Wetmore, post-docs Selin, Fisher, Bennett and Conz, the current crop of graduate students including visitors (e.g., Laurent), and faculty member E Corley. CSPO continues to house the Director and the program manager. The Center expects to move, with CSPO, to redesigned and more spacious facilities on the third floor of Administration B in Su 07. CNS-ASU has a desk that it maintains in Biodesign, and it continues to make extensive use of conferring and convening space there.

All Hands Meeting. On 19-21 April 2007 CNS-ASU held its first All-Hands Meeting. Approximately 75 people attended various parts of the meeting, including members of the CNS-ASU team from each of its collaborating

universities, members of the CNS-ASU Board of Visitors and Nano-Industry Liaison Committee, and special invited guests from the domestic and international nano-in-society community. Details of the meeting, including the agenda, can be found at <http://cns.asu.edu/allhands/allhands.html>.

The meeting was a success by a variety of measures. A large number of Center personnel had the opportunity to present their work and, for the first time for many, interact with their colleagues elsewhere in the Center. Many new cross-cutting activities developed from the exchange of ideas among breadth of Center participants, as well as opportunities for Center personnel to collaborate with nano-in-society scholars from outside the Center who had been invited. And broader collaborations were reinforced or opened for exploration, e.g., ongoing efforts between CNS-ASU and NISE Net, and possible collaborations between CNS-ASU and Paul Rabinow's work on the human practices of synthetic biology.

As a condition of participation, we collected brief statements from the non-CNS participants. Since the meeting was held under "Gordon rules" of non-attribution, we will not reproduce those statements here, but they provided important critical feedback and expressed a great deal of admiration for the ambitious research, education, and outreach activities that CNS-ASU has organized.

Year 2 Responses to Year 1 site visit:

Comment in YR 1 site visit report: Foster more interaction of the research teams both at ASU and across the participating universities

Response to site visit report: "Horizontal communications is recognized as perhaps the most significant management challenge for CNS-ASU. With new assistance from the central administration, we are expediting the process of creating an intranet or other useful, secure electronic communications system for our participants at ASU and the other five universities. With residual funds from YR 1, we will be holding a YR 2 "all hands meeting" that will bring the bulk of the CNS-ASU network together in Tempe to share research and other activities."

Action in YR 2: Creation of an intranet continues to be delayed. CNS-ASU is, however, focusing on upgrading its website in Su 07, instituting a new, more research-oriented supplement to the monthly newsletter, and implementing Google "writely" for cross-platform communication around drafts, reports, etc. The All-Hands Meeting of CNS-ASU personnel in Tempe was organized and held 19-21 April 2007 (6.5 mos. into YR 2) as planned. See above for details of the meeting. Other items of note regarding horizontal communication include:

- In YR 2, ASU graduate students Hays and Valdivia began working under E Corley with data generated by GA Tech team;
- RTTA 2 team is full collaboration between D Scheufele (Wisconsin) and E Corley (ASU);
- RTTA 3 team includes ASU and NCSU personnel, and through preparations for the National Citizens' Technology Forum, NCSU is coordinating activities, including drawing materials from RTTAs and TRC 2, across the broadest array of teams and locations of the Center;
- RTTA 3 scenarios are being used by RTTA 1 and RTTA 2; and
- TRC 2 is full collaboration between Robert (ASU) and Hogle (Wisconsin), and post-doc Leung (Wisconsin) has begun interacting with GA Tech team to mine useful data from their database.
- The planned new TRC 1 would be a collaboration between Wetmore (ASU) and Cozzens (GA Tech), and Wetmore and More (Wisconsin) have begun to discuss collaborative efforts for nanotechnology and religion.

Comment in YR 1 site visit report: Ensure that scenarios are not duplicative, are appropriately justified as methodology, will make contribution to theory, and are distinct from science fiction.

Response to site visit report: "Post-doctoral fellow Cynthia Selin, who recently completed a dissertation on scenario development and other future-oriented methods, will be coordinating scenario development work across activities. The planned vetting process, involving a quasi-experimental design through on-line (wiki-like) editing, will ensure contributions to theory as well as technical validation."

Action in YR 2: As planned, post-doctoral fellow Selin leads the group to pioneer the wiki-like scenarios in what we conceive as "open source scenario development." Please see RTTA 3/1 for more details of progress, including grounding in current literatures and technical validation by collaborating scientists (to address "science fiction" point). Selin's research has included the qualitative comparison of scenarios developed by Shell, South Africa, and

CNS-ASU, which differ in a variety of contexts of design and use as well as in how they motivate the past, present, and future.

Comment in YR 1 site visit report: Encourage more interaction between social scientists and natural/physical scientists on research related activities, including conceptualization and planning of projects.

Response to site visit report: “It is not completely clear what the site visit team has in mind by ‘more interaction on research-related activities including conceptualization and planning of projects.’ In RTTA projects, NSE researchers: (RTTA 1) were involved through an iterative process in framing and validating the search definition for nanotechnology; (RTTA 2) will be surveyed for perspectives that will then feed into future research agendas; (RTTA 3) will be engaged in editing, vetting, and validating the scenarios; and (RTTA 4) are and will continue to be interviewed intensively for, among other things, feedback into the design of CNS activities. In TRC projects, NSE researchers: (TRC 1/FPS) are being interviewed in preparation for identifying potential participant-observation sites in which CNS researchers and NSE researchers will collaboratively define a research agenda; and (TRC 2/HIEB) are currently engaged in collaborative framing activities and mutual supervision of a graduate student. In education programs, the two CNS-Biodesign fellows are on track to conduct research leading to the PhD+, and since the site visit two additional students (who were participants in the European IPNS trip) have made serious inquiries about the PhD+. The PhD+ will allow NSE doctoral students to plan small research projects related to the societal implications of their own work under the guidance of CNS-ASU faculty. Examples of additional kinds of interaction that could be pursued would be appreciated.”

Action in YR 2: CNS-ASU has several areas of interaction between social and natural scientists around the conceptual development of projects:

- the PhD+, where CNS-Biodesign fellows Spadola and Lappe have now developed – after their experience in the YR 1 graduate class “Science, Technology, & Societal Outcomes” and in consultation with PI Guston and other CNS faculty, RTTA-like research projects on their own nano-related research that will be integrated into their doctoral theses;
- InnovationSpace, where three cross-functional teams of undergraduates in engineering, business, and design collaborate to create a product proposal in nanotechnology;
- the collaboration with the Lindsay Center for Single Molecule Biophysics, in which CNS post-doc Fisher has developed, in close consultation with Lindsay, a project to identify and explore stronger linkages among 1) NSE laboratory research decisions, 2) professional users and energy scholars perspectives, and 3) public policy goals. To date, this has entailed conceptualization and initial planning between Lindsay and Fisher; and nearly two months of regular participant-observation by Fisher of two NSE projects;
- the collaboration with the Woodbury lab in Bio-Optical Nanotechnology, in which CNS senior investigators Wetmore and McGregor have been engaged in discussions with lab staff at lab meetings as an exploratory and trust-building exercise in preparation for a more intensive “embedded” activity in the lab. This work has led Woodbury to approach CNS-ASU for more substantive collaboration, including the planned, co-funded embedding of YR 2 post-doctoral fellow Conz as research faculty in the lab.

Comment in YR 1 site visit report: Provide for more active and consistent involvement of the co-PIs at ASU and the participating universities in the management of the grant and its research, education, and outreach activities.

Response to site visit report: “The Executive Committee deliberated on its role in managing CNS-ASU. It concluded that its most important role would be providing the director and associate director with strategic-level thinking. It will thus continue to meet two or three times a semester for such activity. The Executive Committee will leave operational decisions to a newly designated management committee – director Guston, associate director Sarewitz, and co-PI and outreach coordinator Miller – which will meet monthly or more frequently if needed. In addition, the director will formalize his regular communications with RTTA and TRC leaders and attempt to schedule monthly joint teleconferences instead of one-to-one communication. We note that NSF encouraged CNS-ASU to streamline its management plan following the reduction in scope that led to the agreed-to terms and conditions. The Executive Committee believes, given the differences between the \$25 million ERCs that the management expectations were designed around, the \$15 million NSECs that inherited those expectations, and the \$6.2 million NSEC/CNS-ASU, that this streamlined management arrangement will suffice.”

Action in YR 2: The Executive Committee continued to meet regularly as before. The director found it impossible to implement the planned monthly group teleconferences but will persist in this attempt. Communication by phone and email by the director with individual team leaders occurred on average weekly per group, and contact among Guston, Sarewitz, and Miller is essentially daily on CNS-ASU matters.

Comment in YR 1 site visit report: Assure there is appropriate representation on the Nano-Industry Liaison Committee so that the ASU Center engages in innovative work and provides meaningful input to the nano-industry.

Response to site visit report: “CNS-ASU will consider the membership of the NILC more closely and will more actively include the NILC (and the Board of Visitors) in its activities, including invitations to the “all hands” meeting in April 07.”

Action in YR 2: Outreach to industry continues to be a challenge. CNS-ASU hosted a meeting of the NILC at its All-Hands meeting in April; we invited all seven members invited, four RSVP'd yes, but only one showed. Even so, this meeting was helpful in generating additional ideas for contact. Other industry outreach included participation in the Nano-Giga Meeting in March 2007 and hosting Mark Bunger from Lux Research as part of the monthly seminar series. Sending CNS-ASU personnel to such meetings as Nano-Giga that are geared toward industry is an expensive proposition, particularly due to high registration costs even for non-profit registrants, for low contact.

Comment in YR 1 site visit report: Seek physical space that would allow Center faculty and students to be housed together and to work closely with the physical/natural scientists involved in nanoscience research.

Response to site visit report: “The Executive Committee discussed the site visitors’ suggestion that CNS-ASU have a permanent physical presence in Biodesign and, while it would have certain benefits, it is currently impractical. In lieu of such a permanent presence, CNS-ASU will continue to strive for a high-profile visual presence in Biodesign and will work closely with Biodesign as it reconfigures its space to create 1) an occasional “extension” type of presence and 2) a more permanent “clinic” type of presence. Biodesign will continue to host a variety of the public and outreach activities that CNS sponsors. Meanwhile, CNS should be able to fully house its complete staff by mid-semester in its suite 225 in the Social Sciences building, which is centrally located on campus.”

Action in YR 2: The Biodesign Institute has provided CNS with desk space that CNS post-docs and junior faculty occupy on a rotating basis, per the “extension” and “clinic” model above. CNS continues to make full use of Biodesign space for monthly seminars, the Learning Community, and other collaborative and co-curricular events. Biodesign has no additional space currently available for such work, but in the event that we can arrange the co-funded position for Conz, he will have an office in Biodesign. Since the YR 1 site visit, CNS-ASU has occupied additional and sufficient space in SS 225. ASU is currently planning to move CNS-ASU and the Consortium for Science, Policy, and Outcomes into newer, better suited space in the Administration B building by Fall 07. This location should include space for “co-lab” activities where social and natural scientists – particularly at the graduate student level – can interact closely.