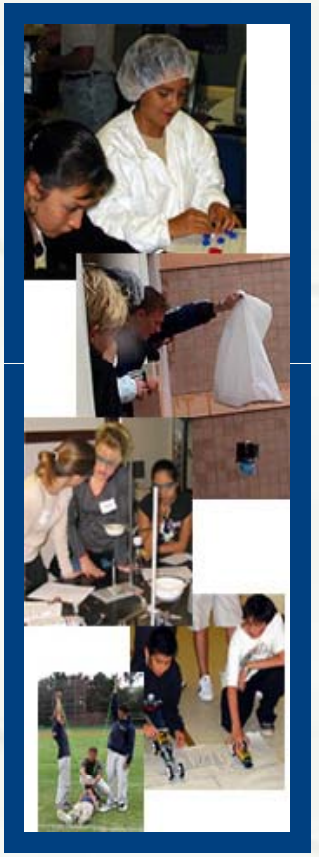
INSCITES: Insights on Science and Technology for Society

Dr. Fiona Goodchild

California NanoSystems Institute

UC Santa Barbara

EDUCATION at CNSI



UCSB Affiliates
friends linking campus and community

SCIENCE LITE

Small Wonders in Our Future

Umesh Mishra

Professor, UCSB Department of Electrical & Computer Engineering

First in a three-part series of lectures on the science (and art) of miniaturization and how it affects our lives

INSCITES Overview

- Funded by NSF Distinguished Teaching Scholar award to Professor Evelyn Hu, ECE /Materials

- INSCITES has 3 phases
  - Graduate Student Teaching Scholars (GSTS) select technology and develop curriculum, taking a holistic approach to its impact on society
  - GSTS team teach this course at the introductory – general education level (*Spring*)
  - GSTS assess student performance and evaluate course parameters and impact

Interdisciplinary Context

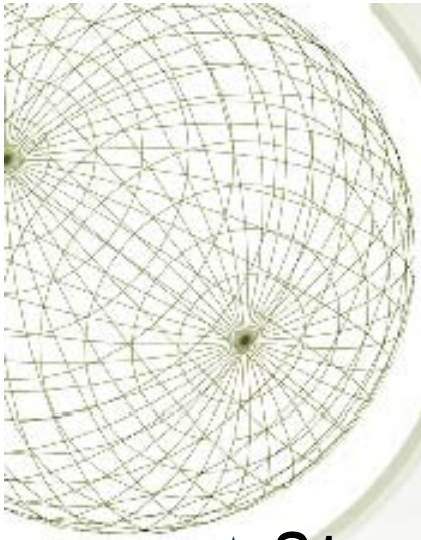
- Hosted by two centers
  - California NanoSystems Institute (CNSI)
  - NSF Center For Nanotechnology in Society (CNS)
- Mentors
  - Evelyn Hu, ECE/Materials, CNS, CNSI
  - Patrick McCray, History, CNS
  - Fiona Goodchild, Education, CNS, CNSI
  - Meredith Murr, Molecular Biology, CNSI
- Graduate Student Teaching Scholars
  - Multidisciplinary - at least one from science/engineering and from social science/humanities

"Big ideas" for INSCITES

- Pervasiveness of technology in everyday life
- Multidisciplinary nature of discovery and innovation
- Impact of nanoscience

2007 Course description

- First year elective - No pre-requisites
- 20-25 students
- Two 75-min lectures/week
- One 3-hour lab/week
- Six Interdisciplinary student teams
- Reading: 1984 (Orwell)
  - selected articles and papers



Learning Goals

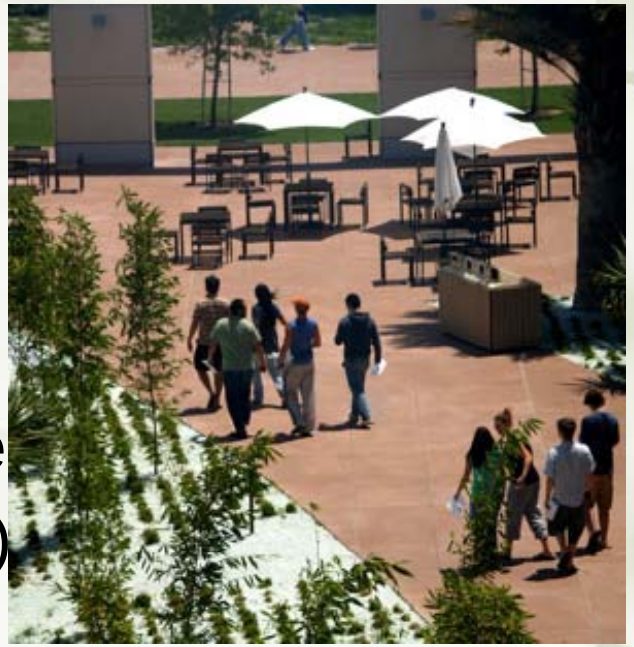
- Students will understand scientific principles of topic technology
- Students will recognize forces required to bring technology to fruition
- Students will reflect on own role in terms of technology adoption/impact

Spring 2007

- You Tube and Other Big Brother Stories: Technology and Culture of Surveillance in Modern Society
- Graduate Student Teaching Scholars
  - Erin Lennon - Chemical Engineering
  - Hussam Mousa - Computer Science
  - Lily Welty - History

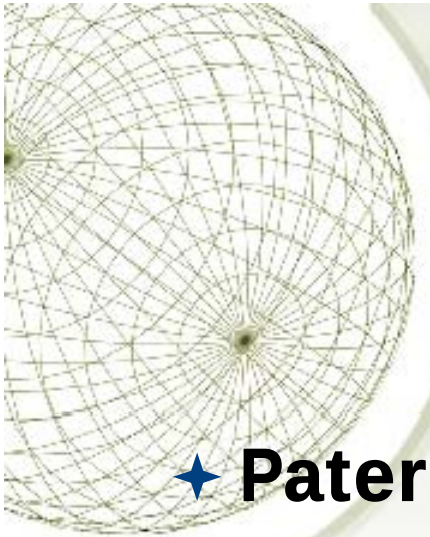
Syllabus

- Course Modules
  - Psychology of Being Watched
  - Biometrics and Security
  - Environmental Sensing
  - Chemical Analysis
  - Computer/Internet surveillance
  - GeoTracking (GPS and Satellite)
  - Government Role



Student Work

- Activities
  - On-line team challenge
  - Small group discussions
  - Team-based debate
    - *In 20 years, law enforcement convictions will be primarily based upon an international DNA database.*
    - *Advanced technology in the commercial marketplace reduces civil liberties*
- Assessment
  - Pop quizzes
  - Lab reports
  - Final term paper



Lab Sessions

- **Paternity Blood Testing and Typing**
- **Chemical Surveillance**
- **Movie:** *GATTACA*
- **Social Science Survey Research**
- **Internet Privacy and Security for Users**
- **Movie:** *Enemy of the State*
- **GPS Tracking Exercise**

Online Team Challenge (OTC)

- Exploring internet surveillance
- Team of 3-4 developed on-line identity
  - Specified demographic data, interests, occupation, etc. to develop a credible profile
  - Documented on-line interactions in social networking sites, as well as browsing history
  - Tracked how targeted ads change as they added more identifying information and visited more web sites

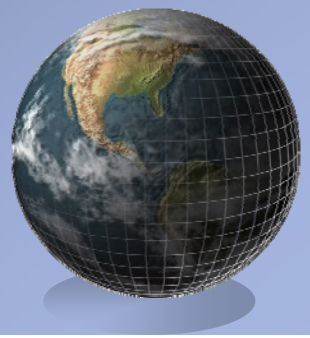
Favorite Topic

Navigation Signal Timing and Ranging Global Positioning System

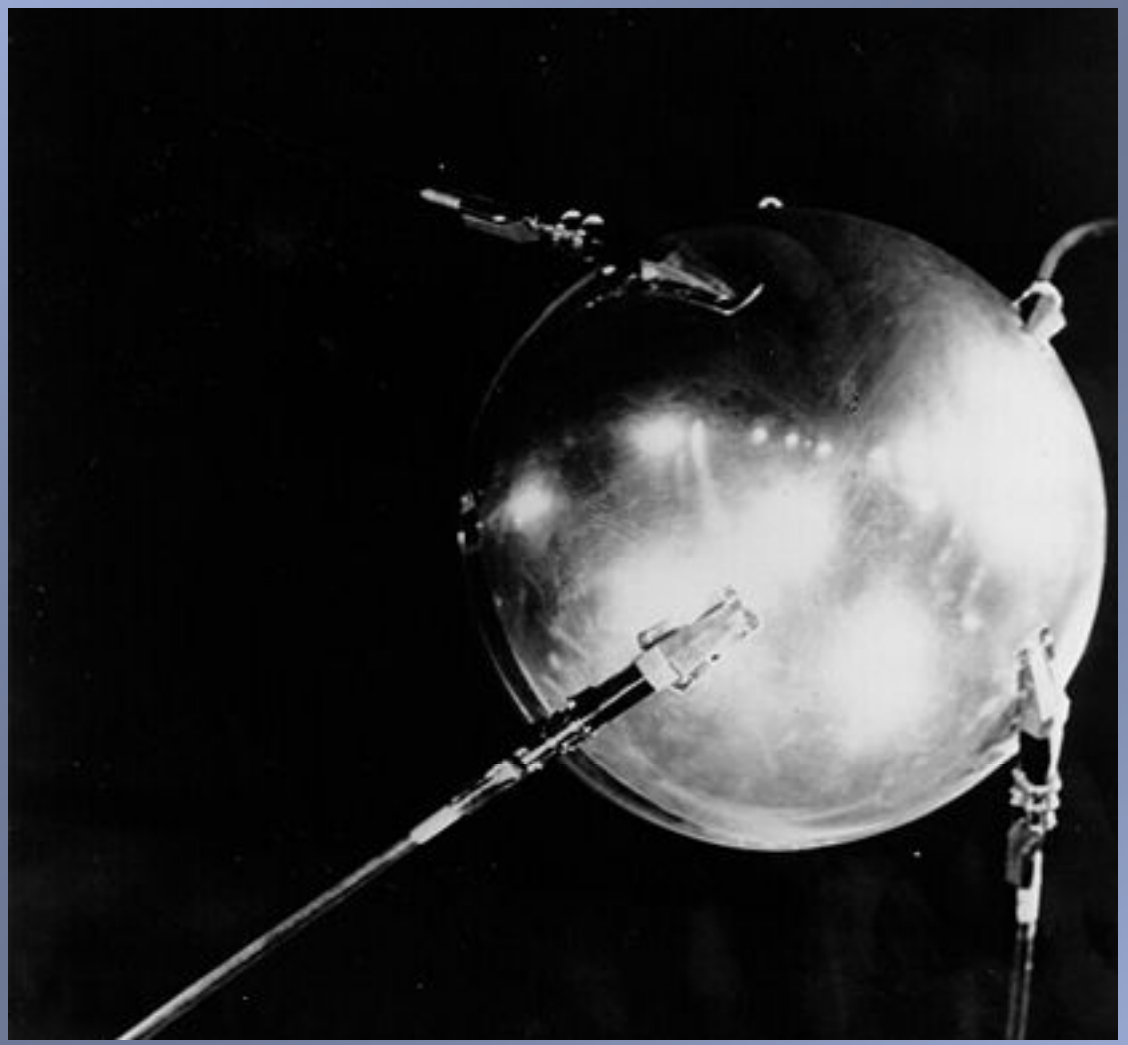
NAVSTAR GPS

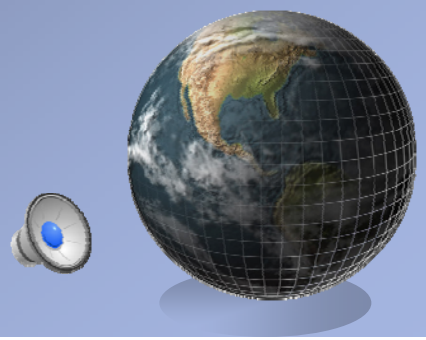
Five-Minute Drill

List three key scientific capabilities you would need in order to develop a functioning spy satellite.

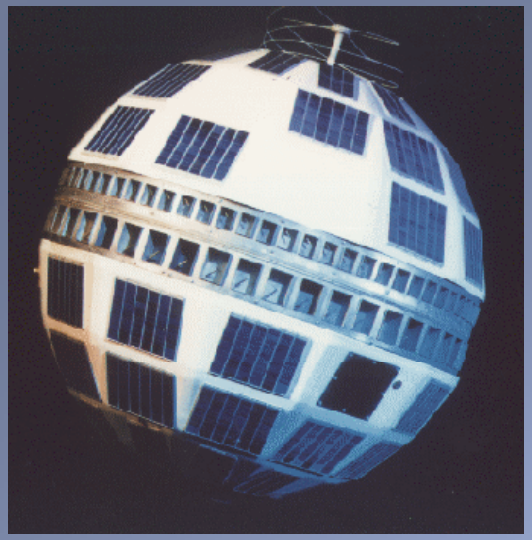


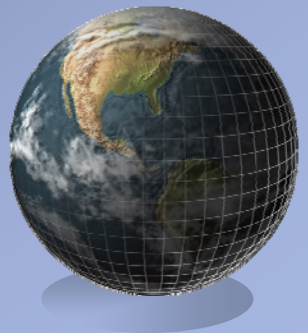
War Gone Cold





Satellite Communication





Grapefruits in Space

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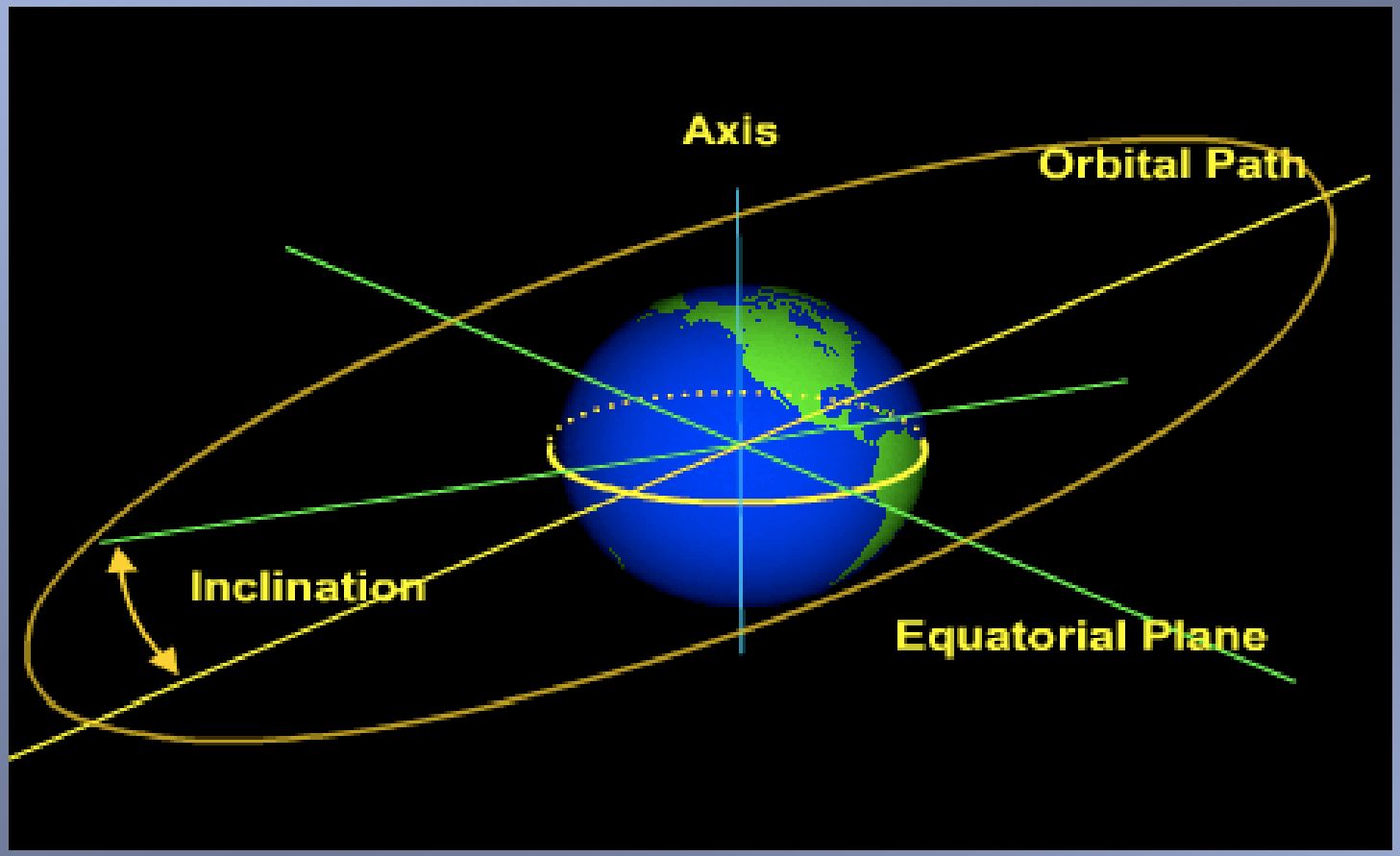
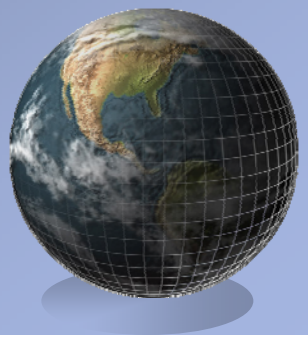
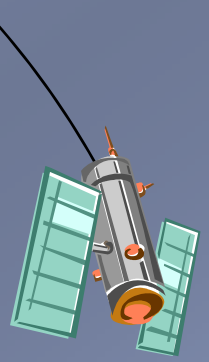




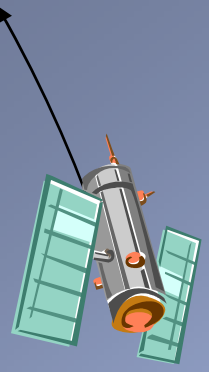
Grapefruits in Space

- Johannes Kepler

$$Velocity_{Satellite} \sim \frac{1}{\sqrt{Altitude + Radius_{Earth}}}$$

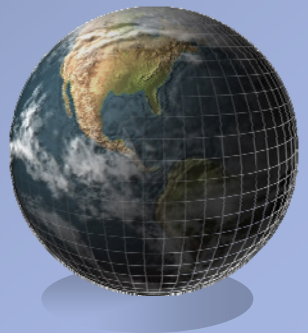


100 miles
17,500 mph
90 minutes

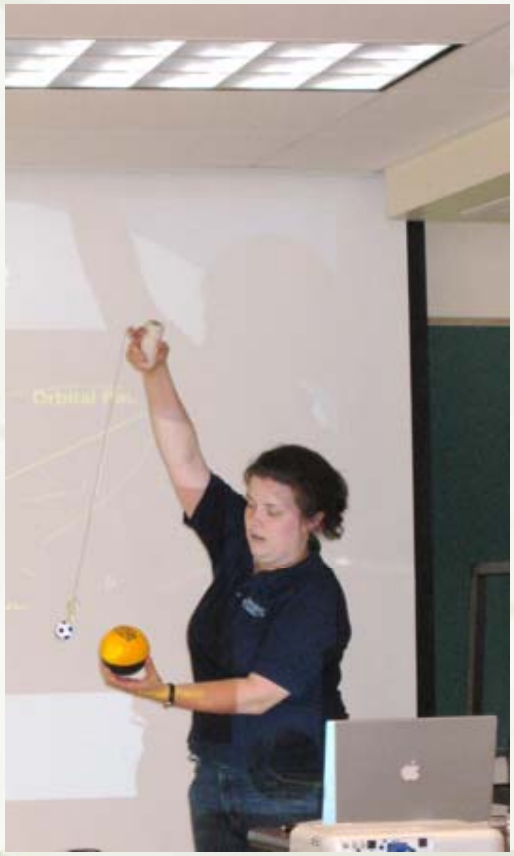


22,200 miles
6,880 mph
1440 minutes

EARTH



Teaching in Action



Spring 2007 Class Composition (out of 19)

- **Gender**
  - **Female: 6**
  - **Male: 13**
- **Major Discipline**
  - **Science/Engineering: 8**
  - **Humanities/Social Science: 8**
  - **Dual major in Science/Engineering and Humanities/Social Science: 2**
  - **Undeclared: 1**
- **College Standing**
  - **Freshman: 12, Sophomore: 5, Junior: 1, Senior: 1**
- **Ethnicity**
  - **Although we did not formally collect demographic information, about half of the class was Hispanic.**

Student Evaluation

- **What did you like about the course? (selected responses)**
  - **It was fresh new material that was interesting both on paper and in class**
  - **I liked the range of topics - they were all very interesting and modern. My favorite part of the class were the labs because I love hands on experience**
  - **I loved the enthusiasm from all the TA's and the amount of interactive projects and class discussions**
  - **I liked how it covered what is happening in today's world. I enjoyed that we discussed over the future & etc.**
  - **All the teachers were amazing!**

Student Ratings

- Please rate how much you learned in each module (please circle one: 1=very little, 5= a great deal)

	Number of Responses for each Rating				
Surveillance Module	**1**	**2**	**3**	**4**	**5**
Biometrics	0	1	1	3	13
Chemical	1	0	6	7	4
Environmental	0	2	5	8	3
Computer/Internet	0	1	3	7	7
GeoTracking	0	3	2	8	5
State Surveillance	1	0	4	5	8

Student reflections

- **What did you learn from your relationship with the INSCITES instructors? (selected responses)**
  - **I learned that hard science majors are not stuffy or boring like I might have imagined.**
  - **I learned A LOT of new and interesting things mostly having to do with computers and technology. They were very knowledgeable and I enjoyed interacting with them**
  - **I learned more of what graduate students are into, and some hints on college life**
  - **be up front & ask lots of questions**
  - **I learned how to speak in public better**

Evaluation

- Did this class make you consider a change in major (n=18)? 3 Yes, 15 No
- If you are a humanities/social science major: Does this class make you more willing to take another science/engineering course ?

  9 Yes, 4 No, 6 Blank
- If you are a science/engineering major: Does this class make you more willing to take humanities/social science courses ?

  4 Yes, 3 No, 11 Blank
- Would you recommend this class to a friend ?

  16 Yes, 2 Maybe, 0 No

The Future

- Spring 2008

Green Works: Exploring Technology and the Search for Sustainability

- Making Choices about Technology
- LED Lighting
- Solar Power
- Electric Cars

Educator Workshop

- Designing Undergraduate Courses that Integrate Nanotechnology and Society
- September 10-12th, 2008
- UC Santa Barbara
- Keynote Speaker: Aldrin Sweeney,

  Editor, Journal of Nano Education

CNSI CALIFORNIA NANOSYSTEMS INSTITUTE

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VOTE
STUDENTS'
PARTY
Dodgers
Navigation Signal
Timing and Rangi
Global Positioning
System
NAVSTAR
GPS