Jointly Exploring the Frontiers of Engineering Research

The Jacobs School All-Staff Breakfast and School Address

Calit2@UCSD

September 11, 2007

Dr. Larry Smarr

Director, California Institute for Telecommunications and Information Technology

Harry E. Gruber Professor,

Dept. of Computer Science and Engineering

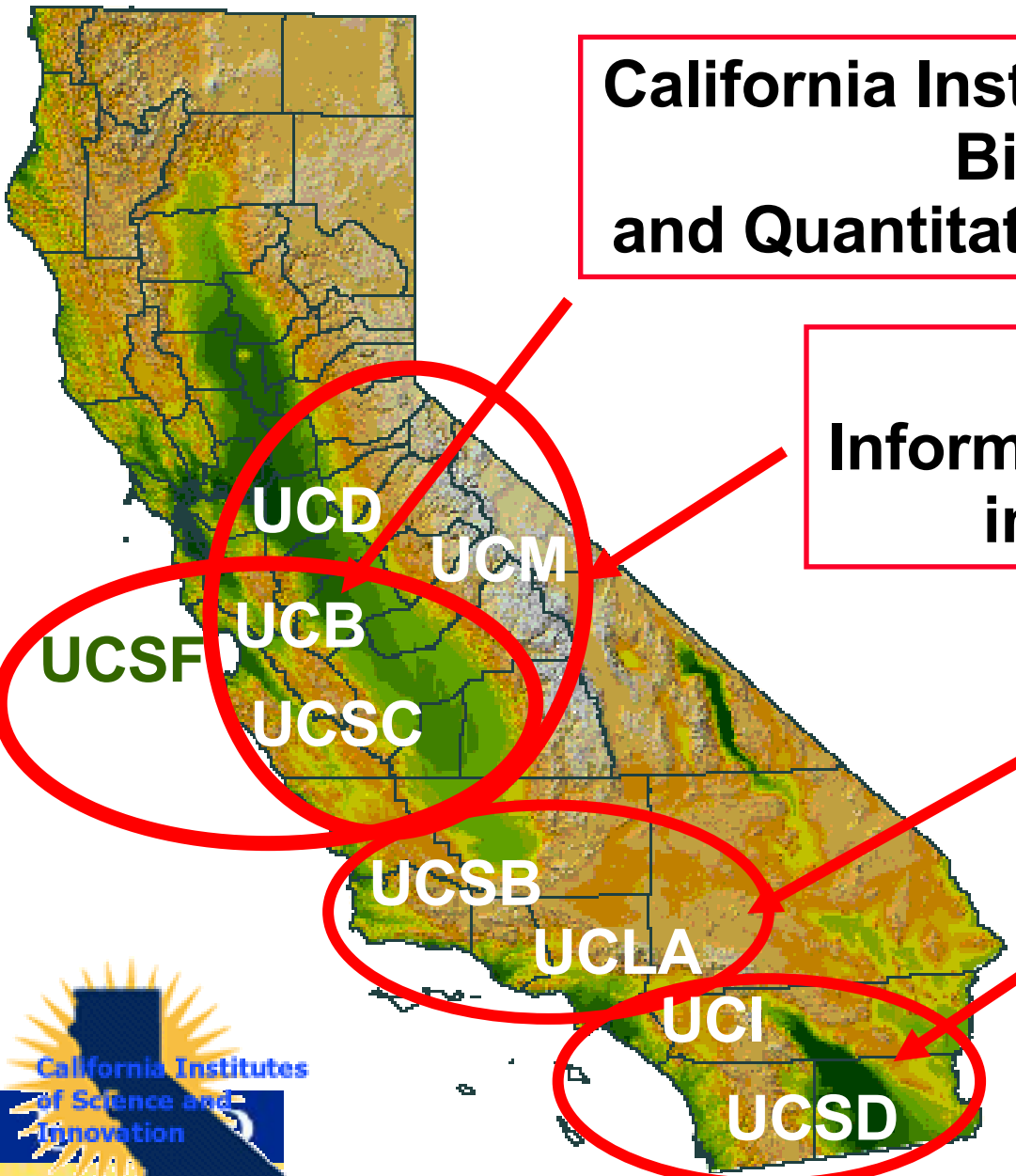
Jacobs School of Engineering, UCSD

UCSD

UCIrvine

it²

California's Institutes for Science and Innovation
A Bold Experiment in Collaborative Research



California Institute for Bioengineering, Biotechnology, and Quantitative Biomedical Research

Center for Information Technology Research in the Interest of Society

California NanoSystems Institute

California Institute for Telecommunications and Information Technology

California Institutes of Science and Innovation

UCI

www.ucop.edu/california-institutes

it²

Calit2 Continues to Pursue Its Initial Mission:

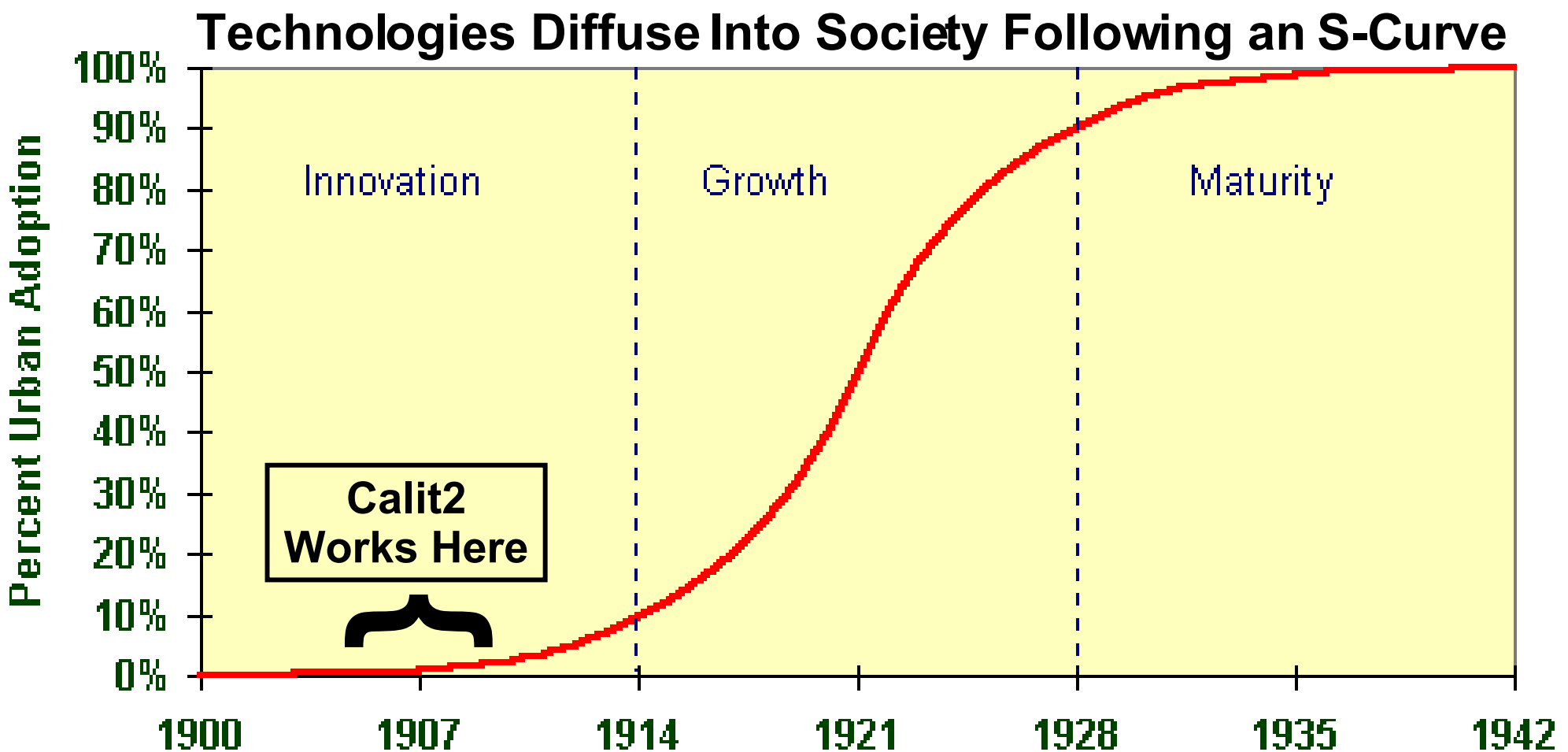
Envisioning How the Extension of Innovative Telecommunications and Information Technologies Throughout the Physical World will Transform Critical Applications Important to the California Economy and its Citizens' Quality Of Life.

Calit2 is a University of California "Institutional Innovation" Experiment on How to Invent a Persistent Collaborative Research and Education Environment that Provides Insight into How the UC, a Major Research University, Might Evolve in the Future.

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Calit2 "Lives in the Future" By Building Systems of Emerging Disruptive Technologies

Co-Evolution of Personal Automobile and Highway/Petroleum Infrastructure



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Source: Harry Dent, The Great Boom Ahead

it²

Scenarios in This New World

- Customized **medical care** based on genotype plus real-time vital signs
- Intelligent **transportation** systems to enable efficient traffic flow
- Real-time **environmental data** collection to inform decision making and policy setting
- Vast networked **gaming** environments in which to learn, communicate, work
- Digital **entertainment networks**, CineGrid



These scenarios are all based on…
- integrated systems of underlying technologies
- applied to real-world problems
- affecting California's economy and quality of life

"Someday, all this will be infrastructure."

Source: Warren Miller, New Yorker, April 11, 1988

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Two New Calit2 Buildings Provide New Laboratories for "Living in the Future"



- "Convergence" Laboratory Facilities
  - Nanotech, BioMEMS, Chips, Radio, Photonics
  - Virtual Reality, Digital Cinema, HDTV, Gaming
- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks



www.calit2.net

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Preparing for a World in Which Distance is Eliminated…

it²

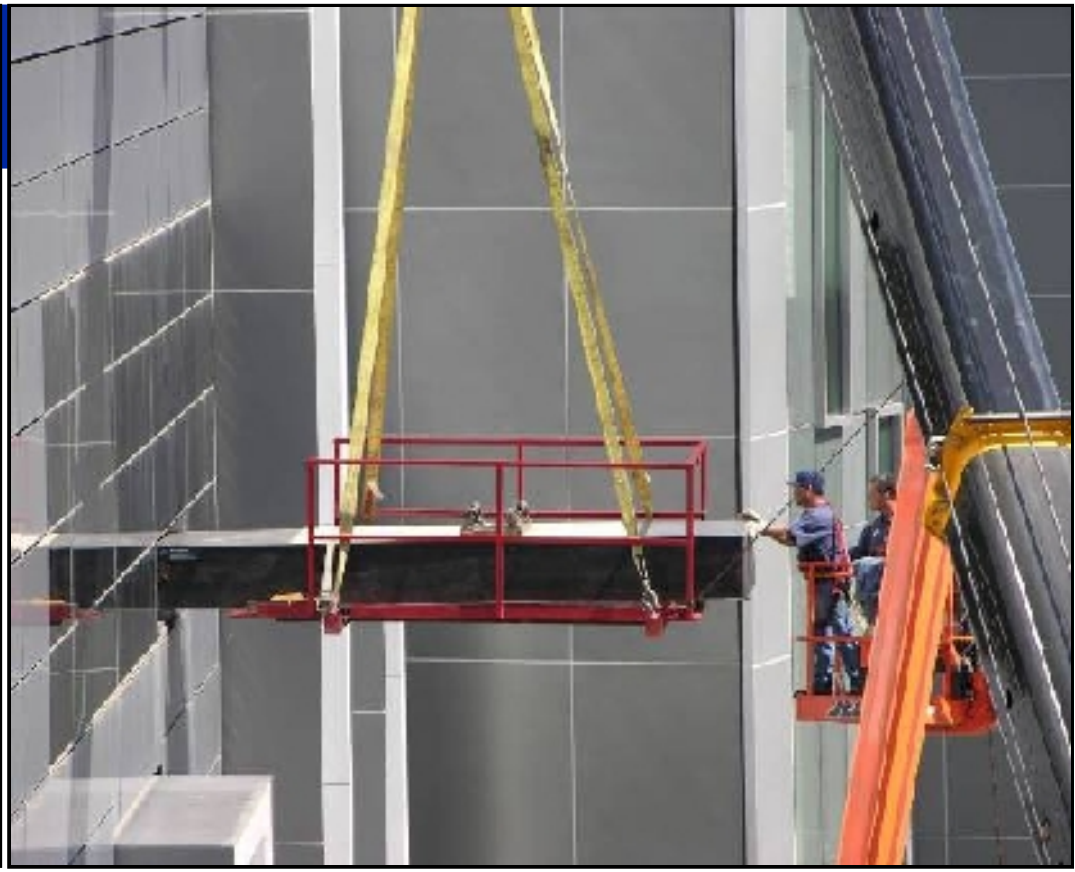
The Big Table moves into Calit2's Photonics Testbed: Saturday March 25th 2006



Saturday morning matinee



Calit2's freight elevator



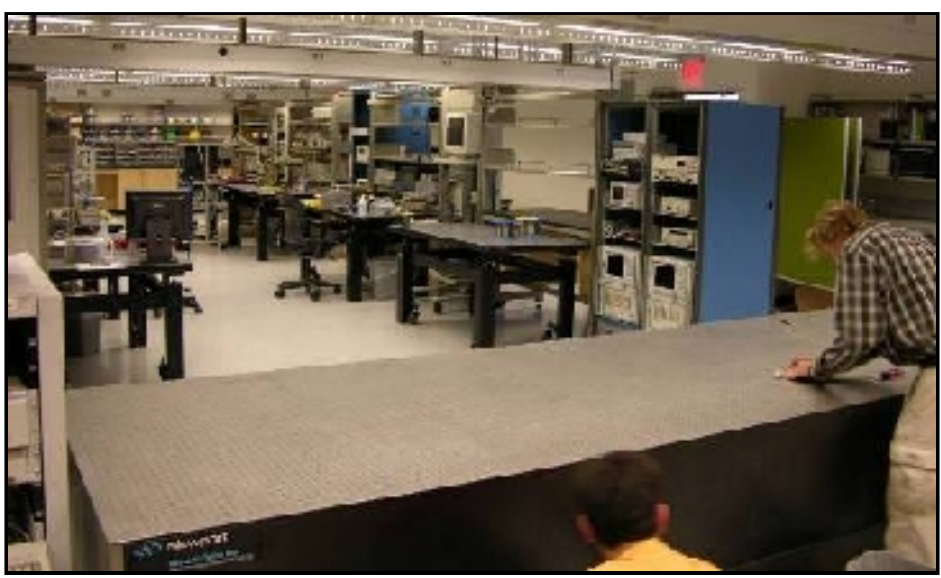
Tight alignment tolerances!



Mail call…



The boss watches



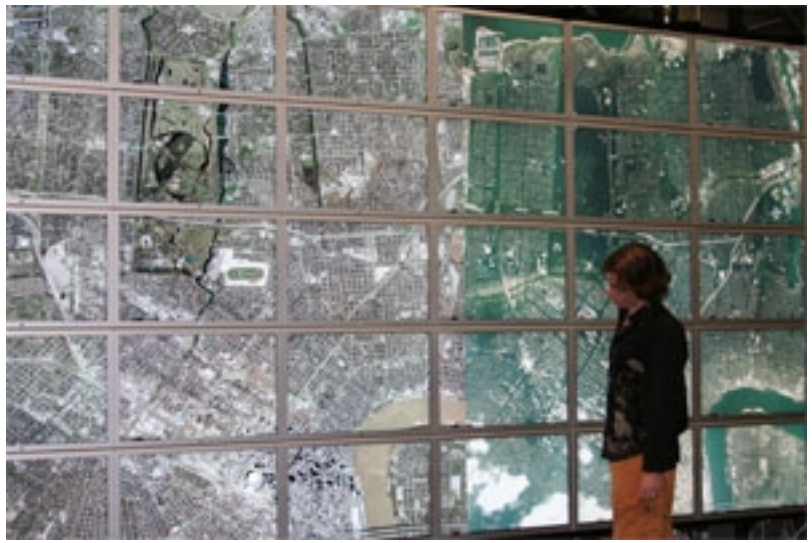
Home sweet home

Nearly One Half Billion Pixels in Calit2 Extreme Visualization Project!

Connected at 2,000 Megabits/s!







UCI HIPerWall Analyzing Pre- and Post- Katrina

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Falko Kuester, UCSD; Steven Jenks, UCI

Calit2 is Experimenting with Open Reconfigurable Work Spaces to Enhance Collaboration







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Photos by John Durant; Barbara Haynor, Calit2

Calit2 Buildings Have Attracted Many Events -- Support Staff Are Key



Mayor Gavin Newsom (right) accepts his Big Broadband award from FirstMile.US president Susan Estrada and Calit2 director Larry Smarr. *(Photos by Barbara Haynor)*



AUTOMOTIVE SOFTWARE WORKSHOP SAN DIEGO 2006

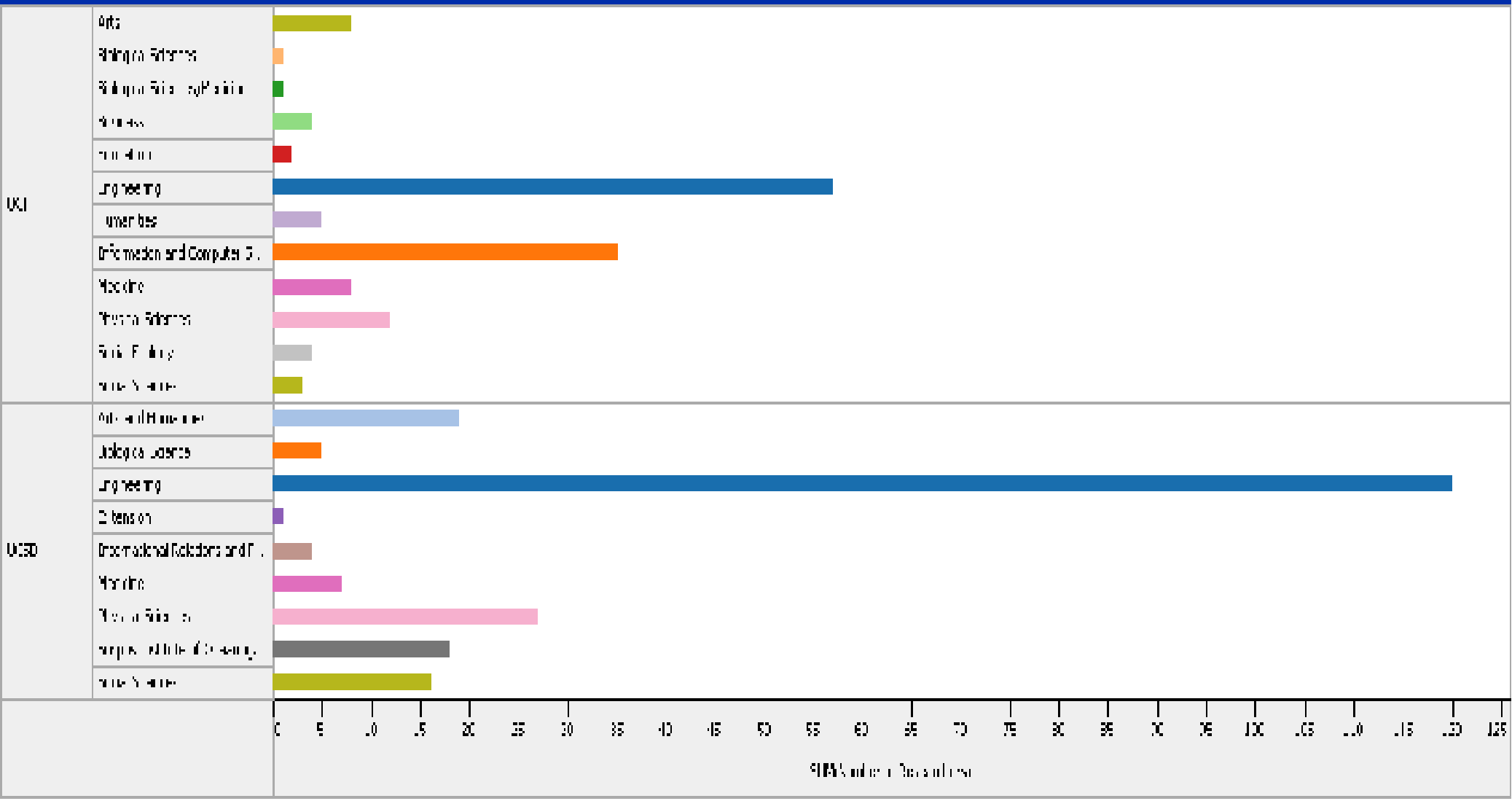
Calit2@UCSD Hosts Multiple Events Per Week



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Integration of Technology Consumers and Producers: Calit2 Works with Over 300 Faculty in Over Two Dozen Departments Per Campus



Calit2 Brings Computer Scientists and Engineers Together with Biomedical Researchers

- **Some Areas of Concentration:**
  - Algorithmic and System Biology
  - Bioinfomatics
  - Metagenomics
  - Cancer Genomics
  - Human Genomic Variation and Disease
  - Proteomics
  - Mitochondrial Evolution
  - Computational Biology
  - Multi-Scale Cellular Imaging
  - Information Theory and Biol
  - Telemedicine

CASB

INSTITUTE FOR GENOMICS AND BIOINFORMATICS
University of California, Irvine

NanoTumor Center

camera
Marine Microbial Ecology

ICSI

JCSG
Joint Center for Structural Genomics

NBCR
National Biomedical Computation Resource
an NIH supported resource center

NCMIR
NATIONAL CENTER for MICROSCOPY and IMAGING RESEARCH
at San Diego, an NIH supported resource center

BIOMEDICAL INFORMATICS RESEARCH NETWORK

WISARD

lifechips

Information Theory and Applications

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UCIrvine

Southern California Telemedicine Learning Center (TLC)

it2

Calit2 Facilitated Formation of the Center for Algorithmic and Systems Biology

Tri-Conference at the Center for Algorithmic and Systems Biology

CASB http://casb.ucsd.edu

UCSD, November 30-December 3, 2006, San Diego, CA, USA

algorithmic biology
systems biology
computational proteomics

UC San Diego and the California Institute for Telecommunications and Information Technology (Calit2) will host three conferences devoted to the disciplines of algorithmic biology, systems biology and computational proteomics. In partnership with the International Society for Computational Biology, the RECOMB Satellite Conferences on Systems Biology and Computational Proteomics will provide a forum for new methods that broadly address either or both of these areas. Algorithmic Biology will feature leaders in the field of computational biology who will discuss the emerging challenges at the interface of biology and computer science.

ALGORITHMIC BIOLOGY
NOVEMBER 30, 2006

- PAVEL PEVZNER, UCSD (CHAIR)
- SERAFIM BATZOGLOU, STANFORD
- DAVID HAUSSLER, UC SANTA CRUZ
- MANOLIS KELLIS, MIT
- RON SHAMIR, TEL AVIV UNIV
- MICHAEL WATERMAN, USC



CALIT2 AUDITORIUM
ATKINSON HALL, UCSD
LA JOLLA, CALIFORNIA

SYSTEMS BIOLOGY
DECEMBER 1-2, 2006

- TREY IDEKER, UCSD (CHAIR)
- MARTHA BULYK, HARVARD MEDICAL
- ERIC DAVIDSON, CALTECH
- DAVID EISENBERG, UCLA
- ANNE-CLAUDE GAVIN, EMBL HEIDELBERG
- MARK GERSTEIN, YALE
- DAPHNE KOLLER, STANFORD
- BING REN, UCSD
- RON SHAMIR, TEL AVIV UNIV

Calit2 | the UC Discovery Grant

COMPUTATIONAL PROTEOMICS
DECEMBER 2-3, 2006

- VINEET BAFNA, UCSD (CHAIR)
- MARSHALL BERN, XEROX PARC
- STEVE BRIGGS, UCSD
- NEIL KELLEHER, UNIV OF ILLINOIS
- NEVAN KROGAN, UCSF
- FOREST WHITE, MIT
- RICHARD SMITH, PACIFIC NORTHWEST NATIONAL LAB

UCSD SPONSORS

ISCB | molecular systems biology

CASB



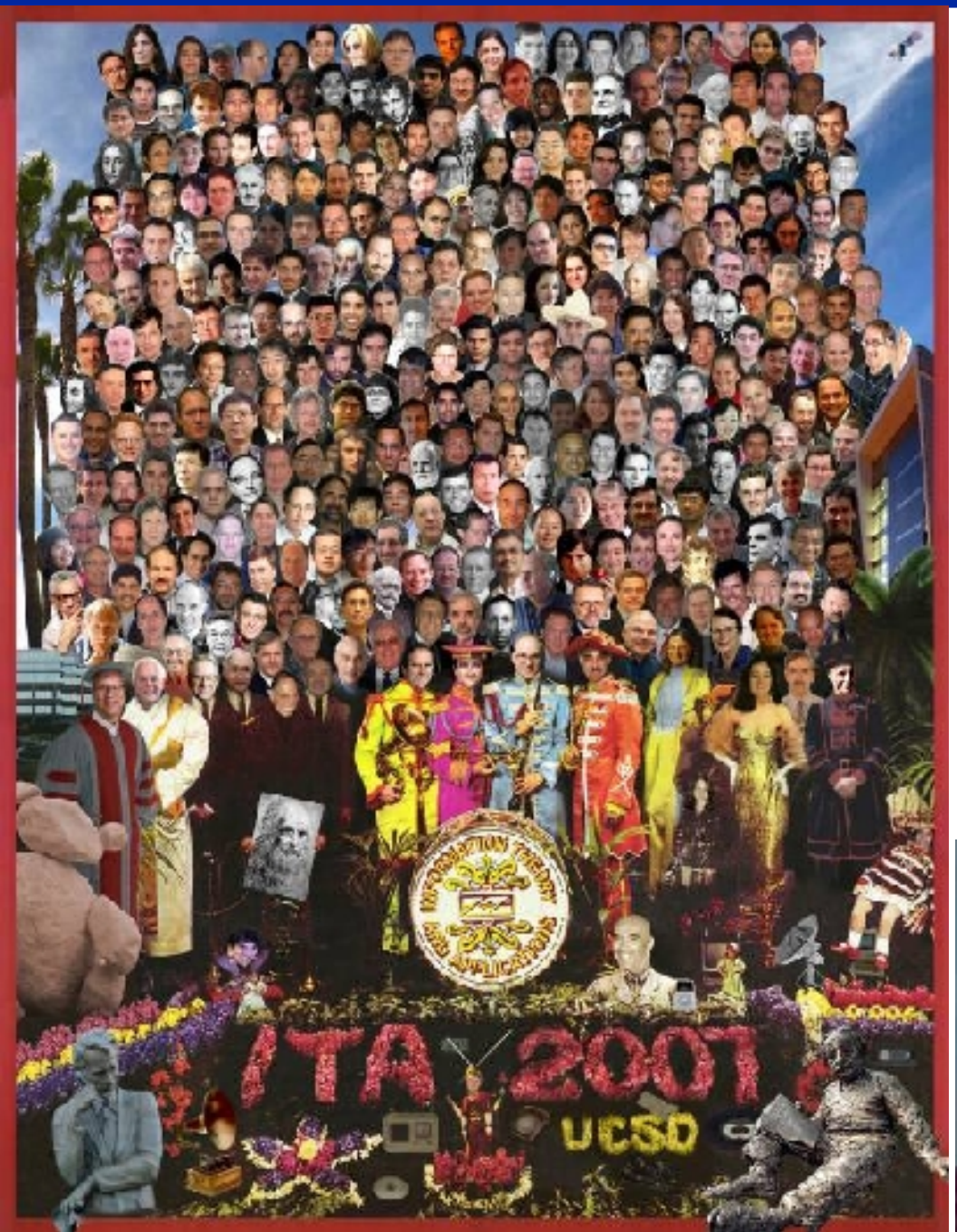




http://casb.ucsd.edu/

it2

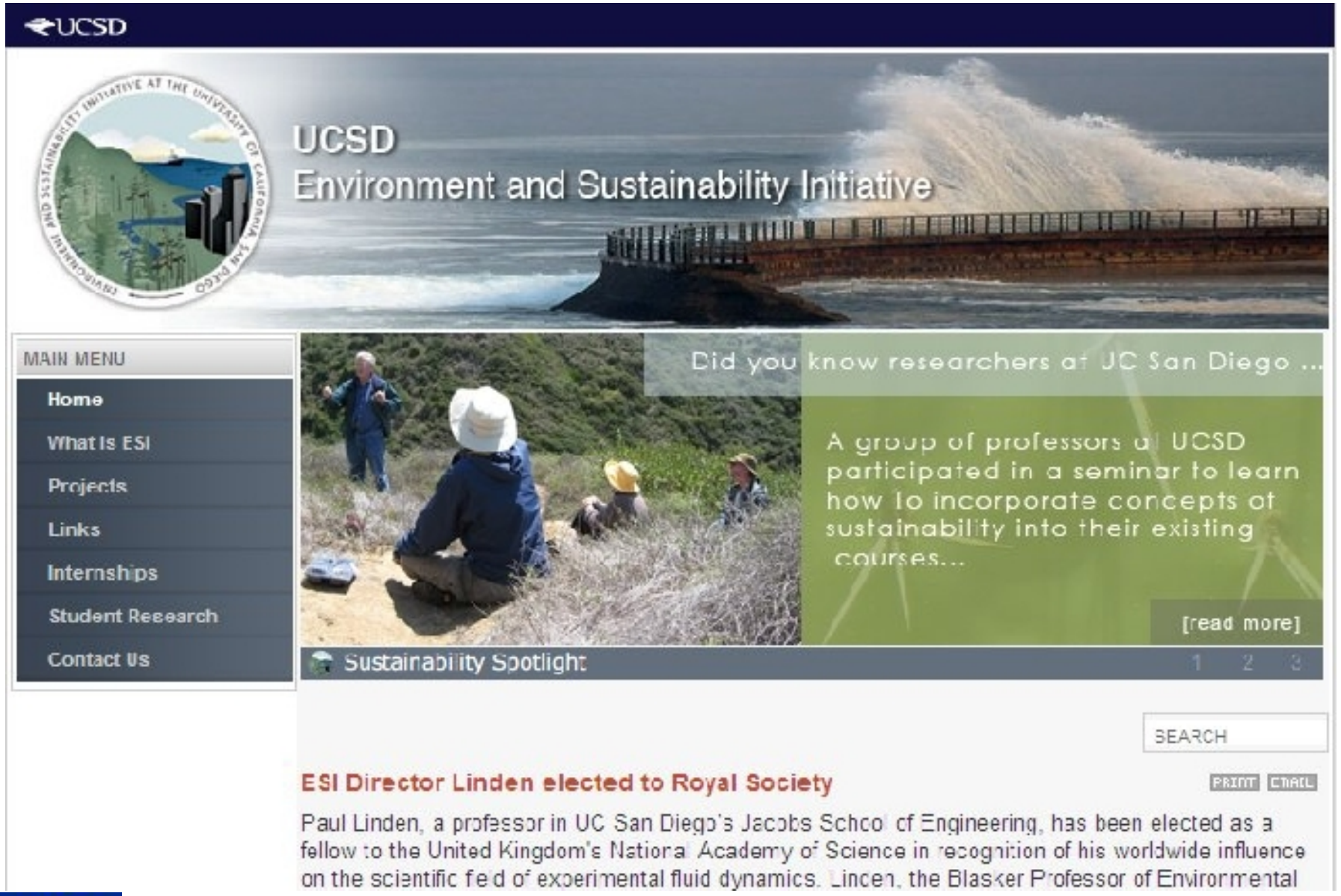
The New Center for Information Theory and Applications in Calit2 Has Become a Global "Watering Hole"



- Study of Information Theory Fundamentals and Applications to Communications, Computer- and Life-Sciences, Finance, Statistics, and Related Disciplines
- Inaugural Workshop
  - 439 Participants from 21 Countries, 25 Companies, and 84 Universities, Presented 183 Technical Talks
- 40 Faculty, Researchers, Post Doctoral Scholars and Visitors
- Workshops, Short Courses, Seminars



UCSD's Environment and Sustainability Initiative is Headquartered in Calit2's Atkinson Hall

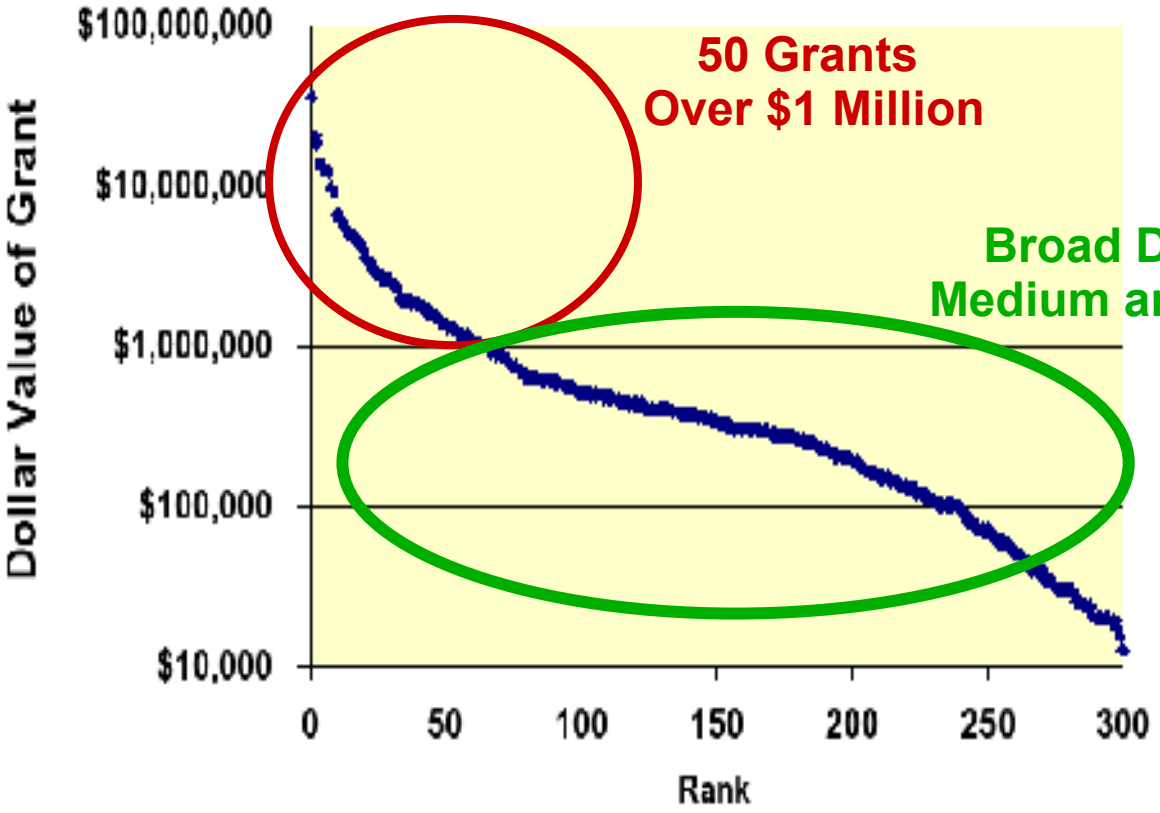


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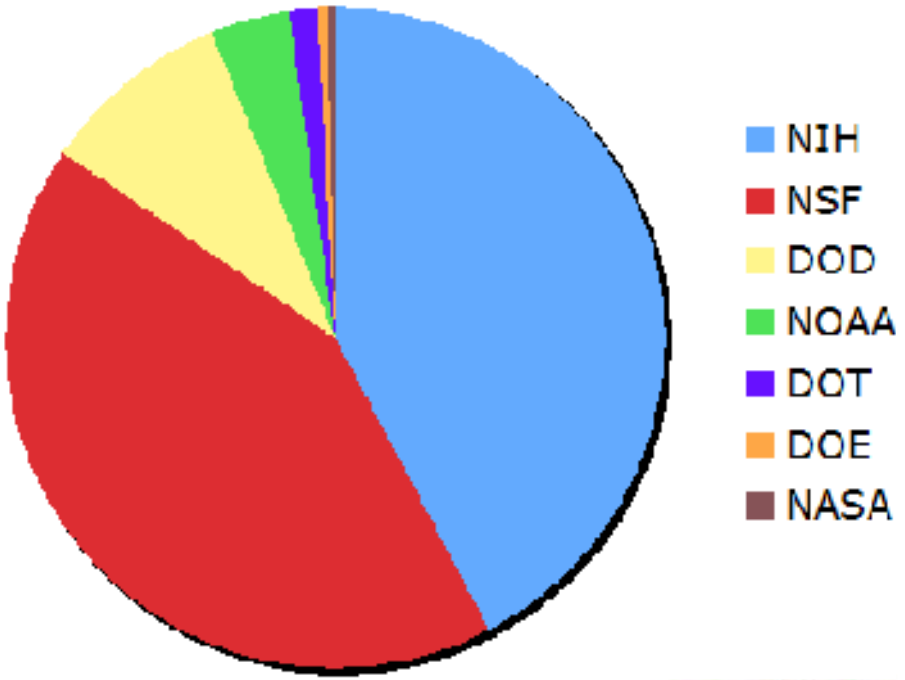
http://esi.ucsd.edu

it²

Federal Agencies Have Funded $350 Million to Over 300 Calit2 Affiliated Grants



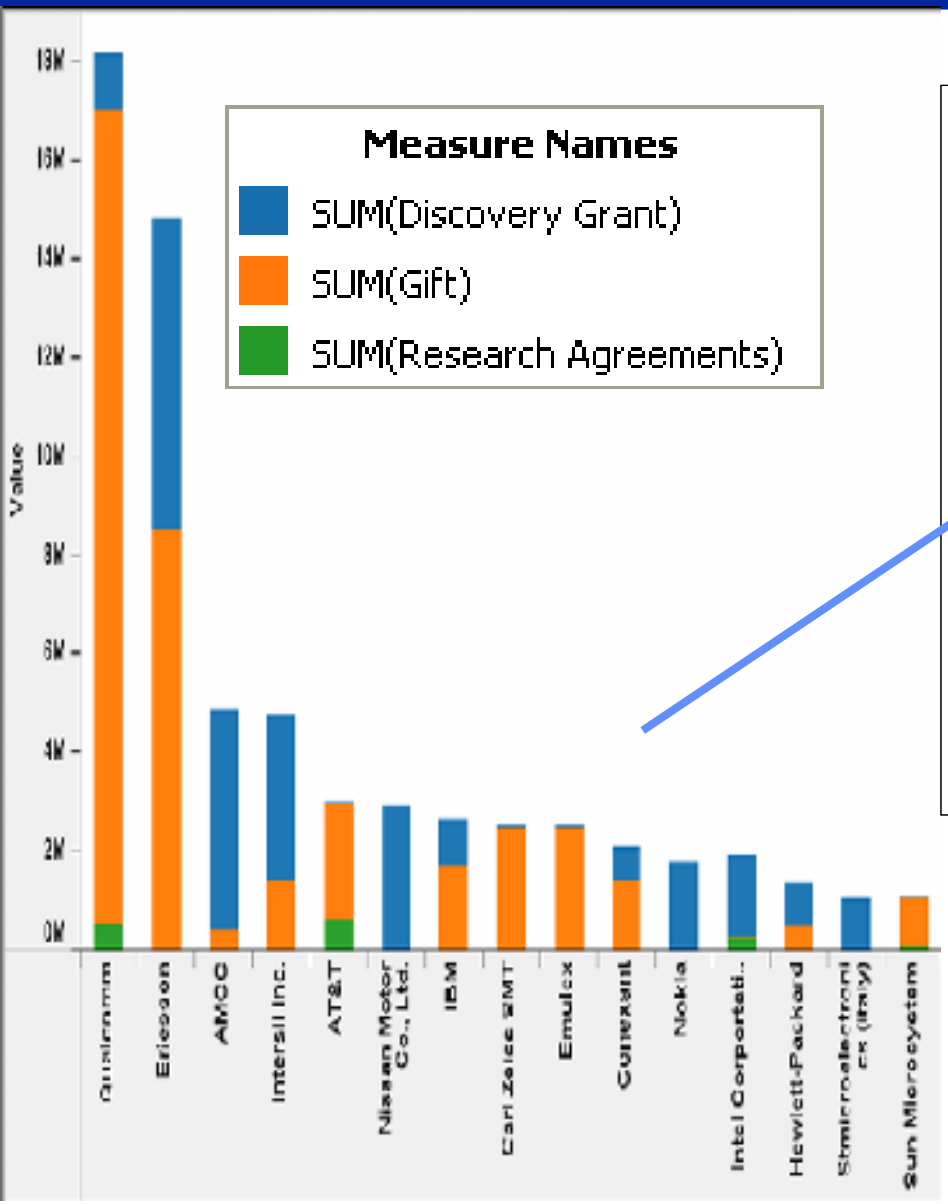
Creating a Rich Ecology of Basic Research



Federal Agency Source of Funds

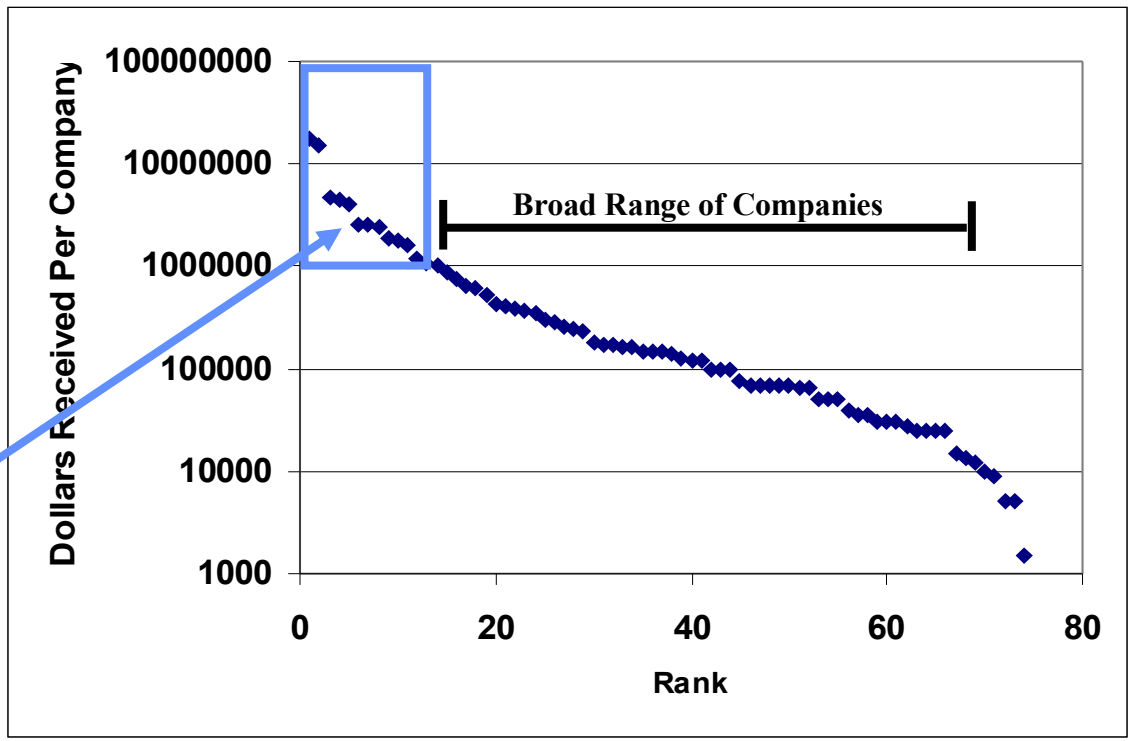
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In Spite of the Bubble Bursting, Calit2 Has Partnered with over 130 Companies



Industrial Partners > $1 Million

More Than 80 Have Provided Funds or In-kind



Over $80 Million From Industry So Far

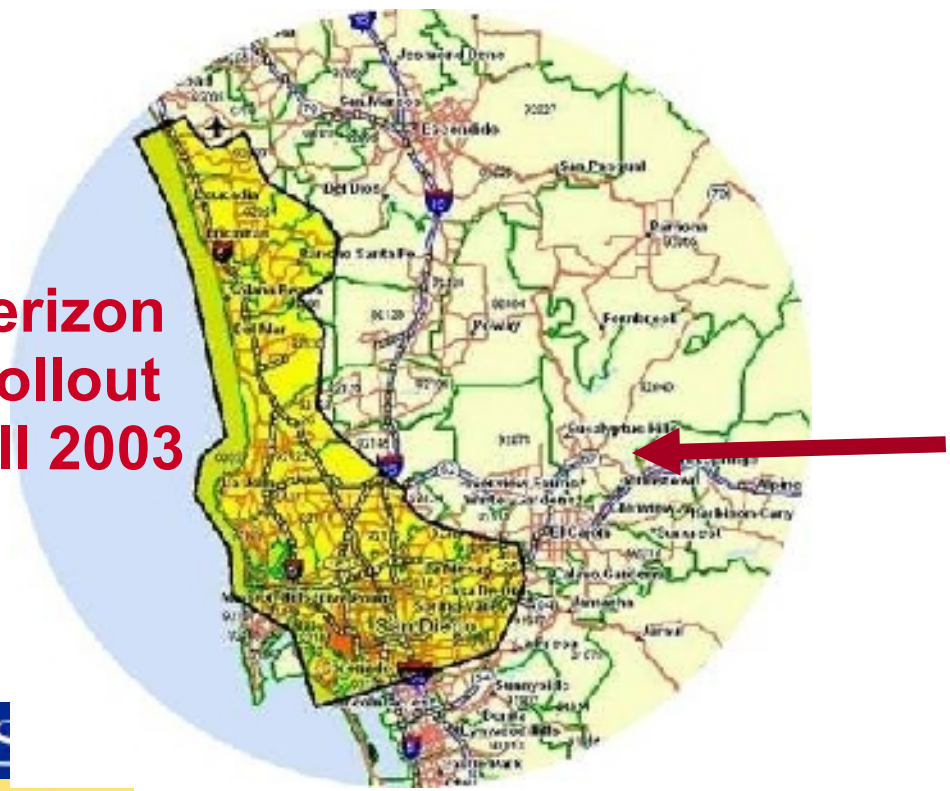
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Only Three Years From Research to Market
New Broadband Cellular Internet Technology

- First US Taste of 3G Cellular Internet
  - UCSD Jacobs School Antenna
    - Three Years Before Commercial Rollout
- Linking to WiFi Mobile "Bubble"
  - Tested on Campus CyberShuttle
- Verizon Introduces in San Diego



Rooftop Qualcomm
1xEV Access Point



Verizon
Rollout
Fall 2003



CyberShuttle March 2002

UCIrvine

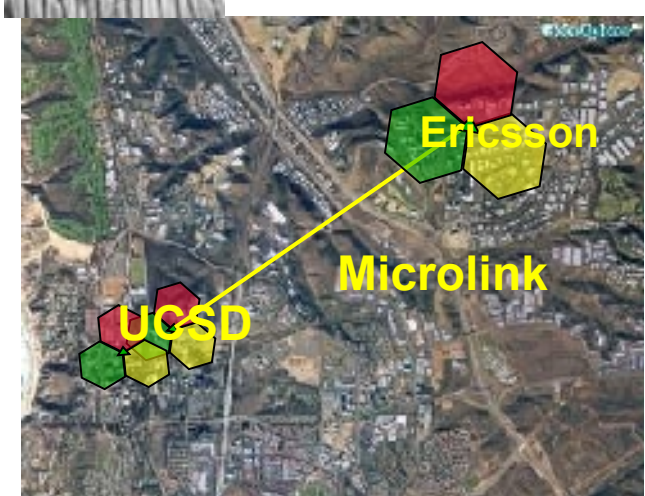
www.calit2.net/news/2002/4-2-bbus.html

Ericsson: A Calit2 Industrial Partner with Breadth and Depth

- **Sponsored Research: Non-Exclusive Royalty Free**
  - $ 6.2 Million with UC Discovery Match
  - 17 Professors, 17 Students, 4 Post-docs
- **27 Student Fellowships**
- **Two Endowed Chairs; Two Faculty Fellowships**
- **Collaborations**
  - Magnus Almgren: Taught Course in ECE
  - Jaap Harsten, Bluetooth Hands-On Course
- **Infrastructure**
  - Base Stations, Always Best Connected
- **Help with**
  - New Federal Grants: $22.5 Million
  - Inspired Two Startups







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Calit2 Provides Real Time Personalized Commute Information



Expanding Soon to Include Orange and LA Counties

866-500-0977
Over 1,000 Calls Per Day!

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http://traffic.calit2.net

Calit2 Teams with the UCSD Jacobs School to Provide Community Service for Undergrads











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Calit2 Has Introduced Innovative Wireless Systems to Support SoCal First Responders















Aug. 22, 2006 MMST Disaster Drill at Calit2@UCSD Involved Over 200 First Responders







Calit2 Has Developed Research Partnerships with California's Major Trading Partners

- **International Commerce Drives 25% Of California's Economy**
- **Largest Export Market is Computers and Electronic Products**
- **Top Five Export Markets for California:**
  - Mexico
  - Japan
  - Canada
  - China
  - South Ko
- **India is a Critical Growth Market for California**
  - California is the Top State Exporting to India
  - Exports Between California and India Increased ~30% from 2004 and 2005
- **India and US Have an Action Plan to Double Bilateral Trade in 3 Years**

CICESE



Canada - California Strategic Innovation Partnership Summit



PRAGMA

U.S.-INDIA SUMMIT

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iGrid 2005

it²

Preparing Students for the Global Workplace of the 21st Century

- **Pacific Rim Undergraduate Experiences PRIME 2007**
  - **15 UCSD Undergrads**
    - **NSF- Funded with Calit2**
  - **Students Work With Researchers During Summer in:**
    - **Australia, Japan, Taiwan, China**
  - **Ten are from the Jacobs School**
    - **BE, ECE, CSE, SE**



Samson Hang and Ya 'Betsy' Kao are doing research at the National Center for High-performance Computing (NCHC) in Hsinchu, Taiwan.



(left to right) Young Chun, Ava Pierce, Ellen Tsai and David Jackson (not shown) are doing research at Osaka University in Japan.



(left to right) Alex Liu, Hsing Pao, Ryan Terrell and Lynn Gregori are doing research at the Computer Networking Information Center, Chinese Academy of Sciences (CNIC, CAS) in Beijing, China.



(left to right) Michelle Di Fiore, Stephany Chang, Saleh Amirrazi, Elisabeth Kain and Heather Griffith are doing research at Monash University in Melbourne, Australia.

Calit2 and the Jacobs School are Pioneering New Fields of Engineering

- Nano Engineering
- Health Engineering
- Art Diagnostics Engineering
- Digital Cinema Engineering
- Ocean Observatory Engineering

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Calit2 Nano3 Clean Rooms Helps "Jump Start" The New Jacobs School Dept. of Nanoengineering



10,000 sq. feet State-of-the-Art Materials and Devices Laboratory



45 Faculty with Nano Projects at Calit2@UCSD

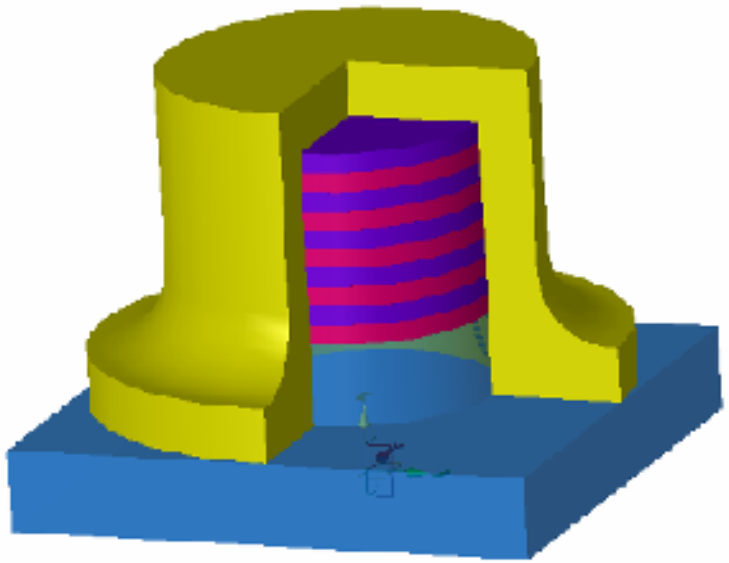
nano3
SCIENCE ENGINEERING MEDICINE

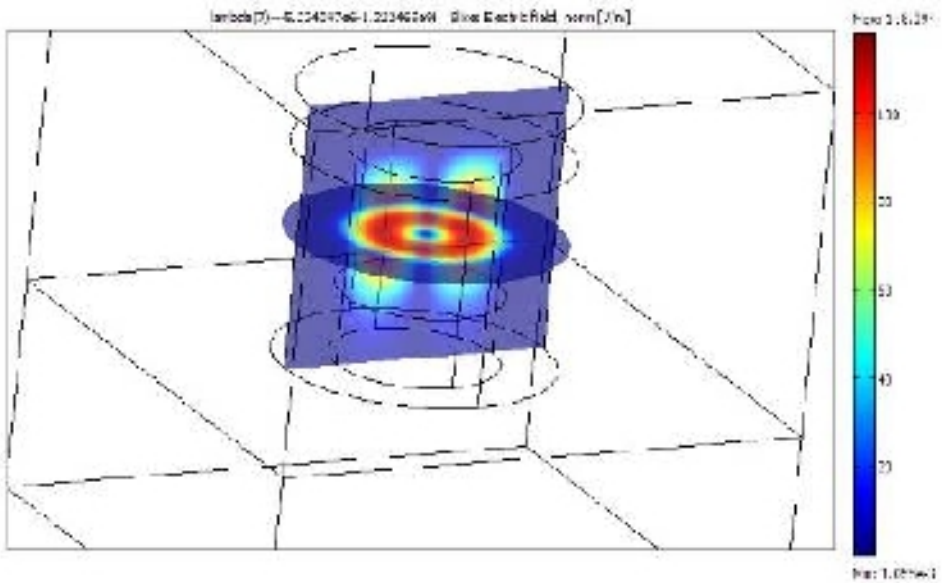
http://nano3.calit2.net/

Source: Bernd Fruhberger, Calit2

Nanoscale Plasmonic Lasers: Calit2 Support for Fundamental Research

- **Goal: Subwavelength Source of Coherent Radiation**
- **Team: Fainman, Lomakin, Slutsky, Orenstein, Tu**
- **Funding: DARPA ($2.7M over 4 years)**





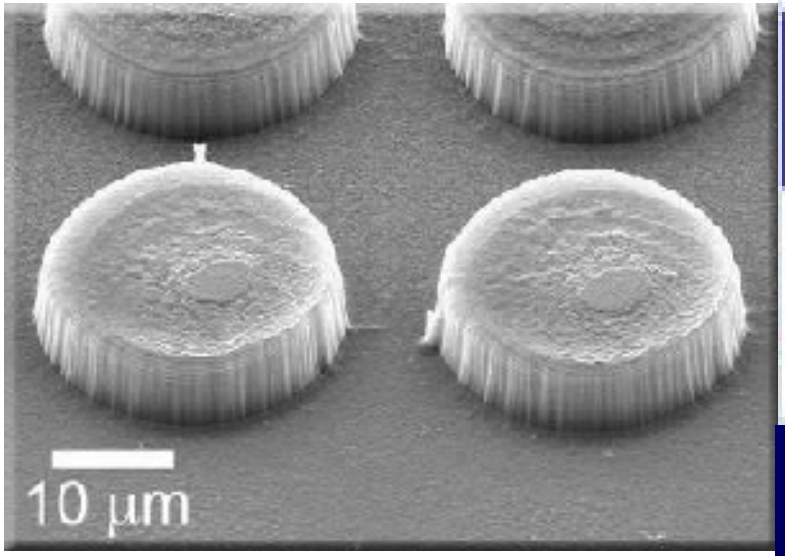
3D simulation: Electric field magnitude

- ✓ *Lasing wavelength:* 1550nm
- ✓ *Line width:* 13nm
- ✓ *Cavity dimensions:* 280nm radius x 580nm tall
- ✓ *Estimated gain requirement at room temperature:* 1290 cm^{-1}
- ✓ *Gain material:* InGaAsP/InP or InAlGaAs
- ✓ *Substrate (transparent at* λ *>900nm):* InP
- ✓ *Further optimization under way*

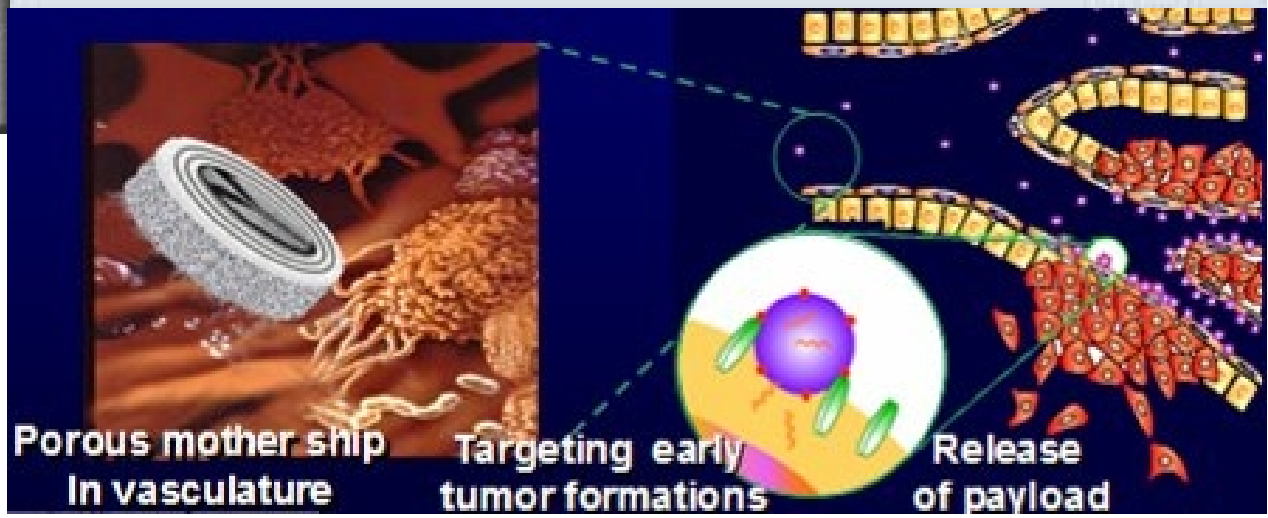
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Nano-Structured Porous Silicon Applied to Cancer Treatment

Nanodevices for In-vivo Detection & Treatment of Cancerous Tumors



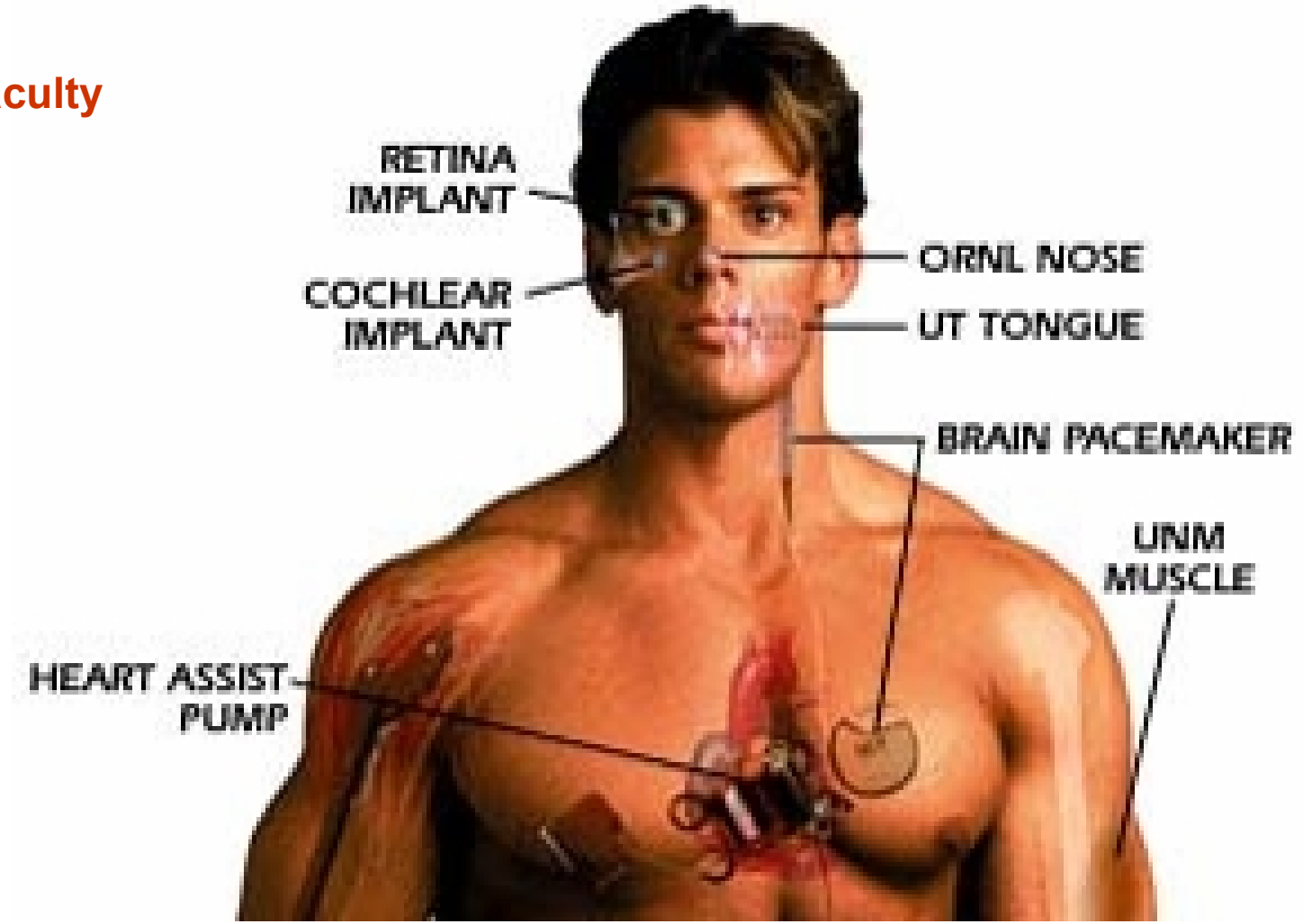
Nanostructured “Mother Ships”
for Delivery of Cancer Therapeutics



UCSD
UCIrvine
NanoTumor Center
nano3
SCIENCE ENGINEERING MEDICINE
it²

Lifechips--Merging Two Major Industries: Microelectronic Chips & Life Sciences

65 UCI Faculty

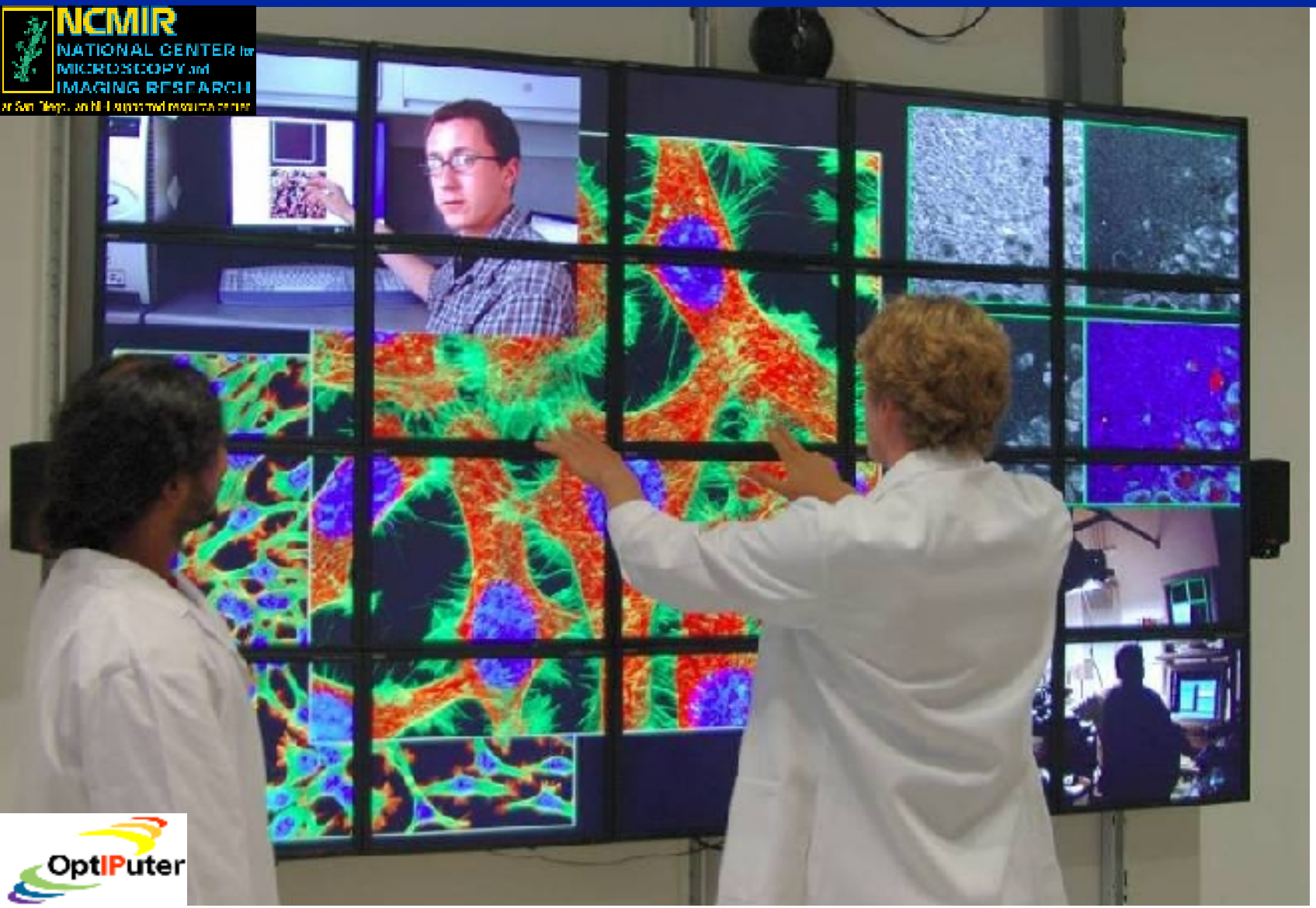


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lifechips
university of california, irvine
www.ifechips.org

it²

The OptIPuter Project: Defining a High Performance Collaboration Infrastructure for Eng-Med



Scalable Adaptive Graphics Environment (SAGE)

$13.5M Over Five Years

Picture Source: Mark Ellisman, David Lee, Jason Leigh

Calit2 (UCSD, UCI) and UIC Lead Campuses—Larry Smarr PI
Univ. Partners: SDSC, USC, SDSU, NW, TA&M, UvA, SARA, KISTI, AIST
Industry: IBM, Sun, Telcordia, Chiaro, Calient, Glimmerglass, Lucent

UCSD is Pioneering the Fusion of Engineering with the Arts



"As Dan Brown wrote in his blockbuster novel, *The DaVinci Code*, Italian art dagnostician Maurizio Seracini had unveiled the unsettling truth."

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Arts and Humanities

UCSD Jacobs School of Engineering

it²

Center of Interdisciplinary Science for Art, Architecture and Archaeology (CISA3)

CISA3

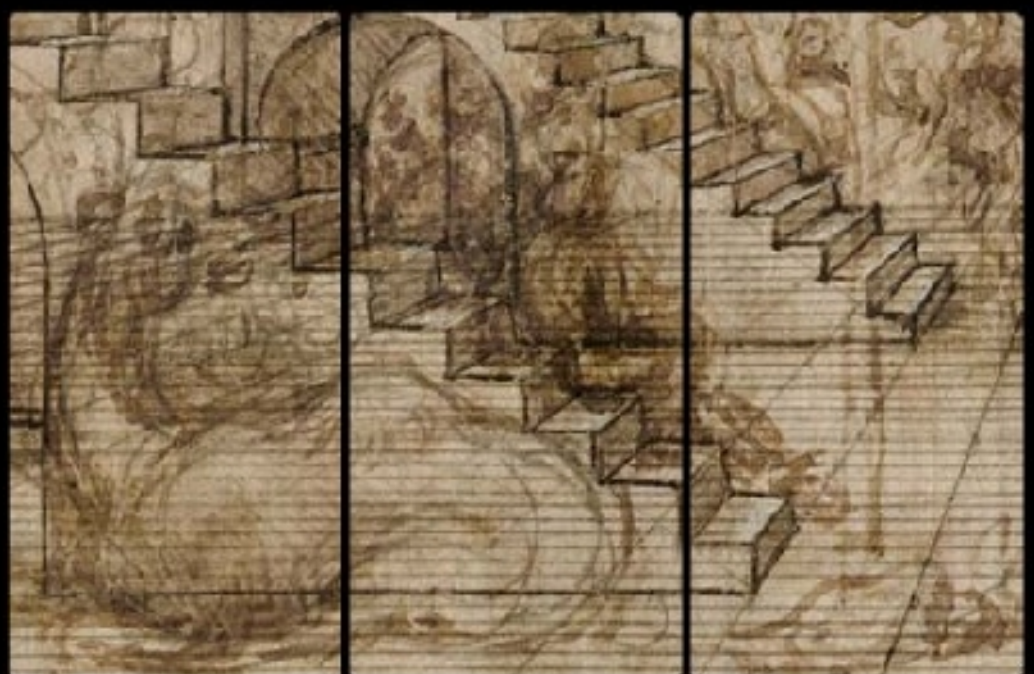
DAH UCSD Jacobs Calit2



Center of Interdisciplinary Science for Art, Architecture, and Archaeology

UC San Diego Division, California Institute for Telecommunications and Information Technology

Home | About CISA3 | Research | Technology | People | Partners | News & Events | Multimedia | Publications



Introduction to CISA3

Art, Science and Cultural Heritage

The University of California, San Diego's Center of Interdisciplinary Science for Art, Architecture and Archaeology (CISA3) is developing new tools and techniques to reconstruct and analyze the history of great works art, monumental structures as well as archaeological sites and artifacts. Announced in February 2007, CISA3 is part of the California Institute for Telecommunications and Information Technology (Calit2) at UC San Diego, in collaboration with UCSD's Jacobs School of Engineering and Division of Arts & Humanities.

next: Message from CISA3's Director

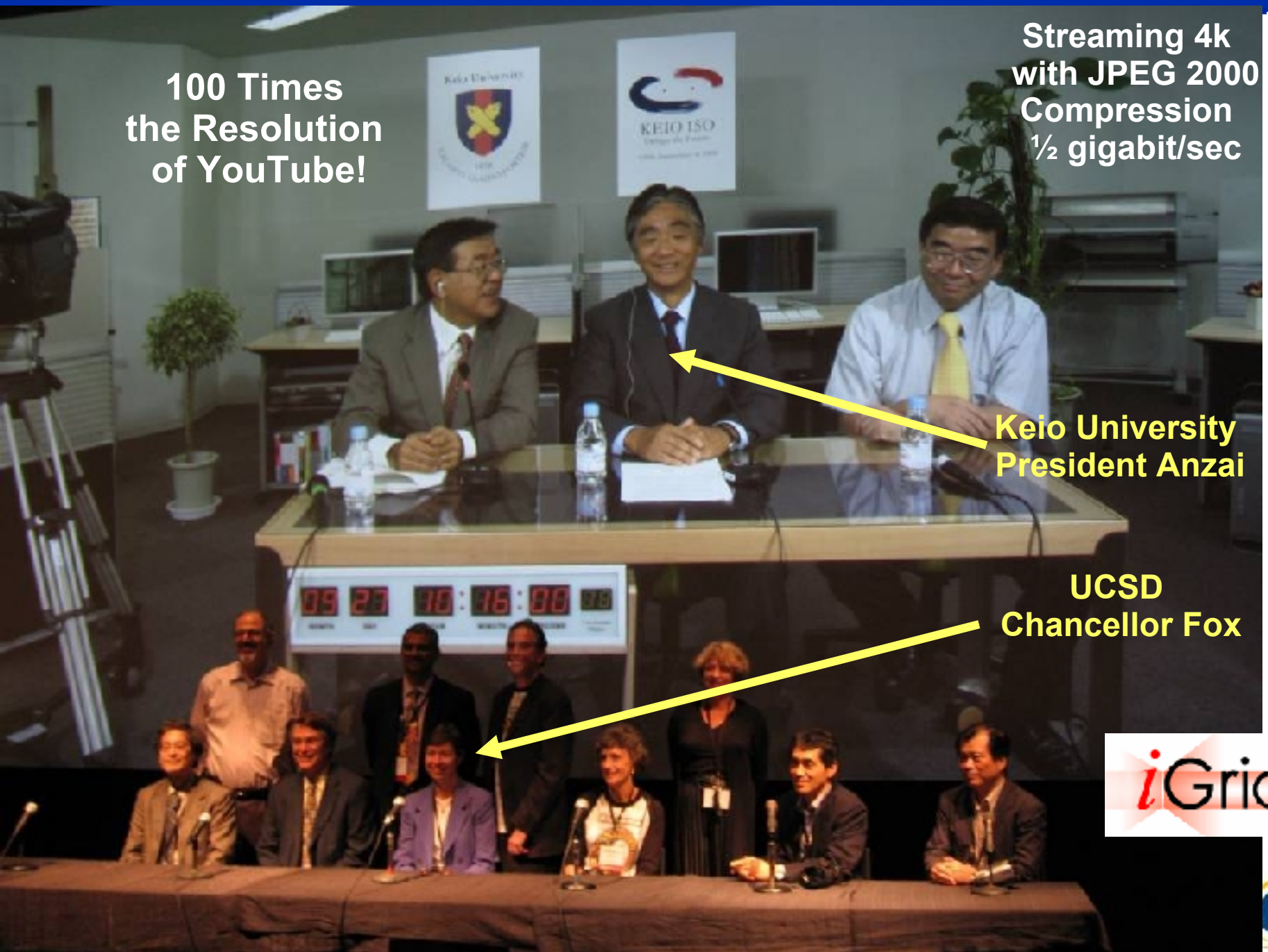
i ii I II III IV V Introduction

UCSD UCIrvine

http://cisa3.calit2.net/

it2

First Trans-Pacific Super High Definition Telepresence Meeting Using Digital Cinema 4k Streams



CineGrid

Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

iGrid 2005

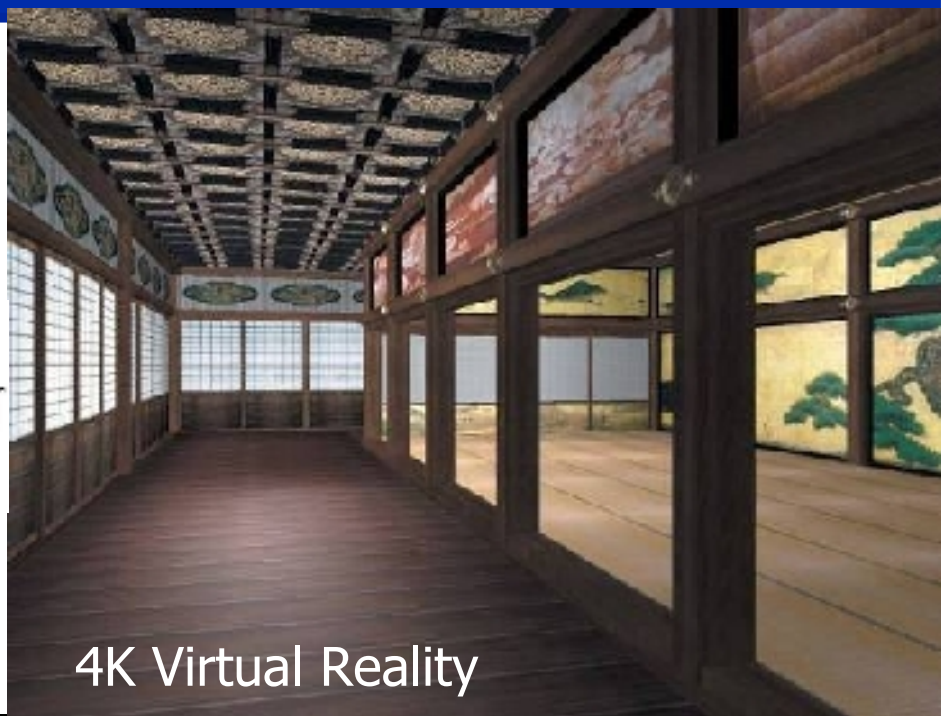
it²

CineGrid @ iGrid2005:
Six Hours of 4K Projected in Calit2 Auditorium

4K Distance Learning

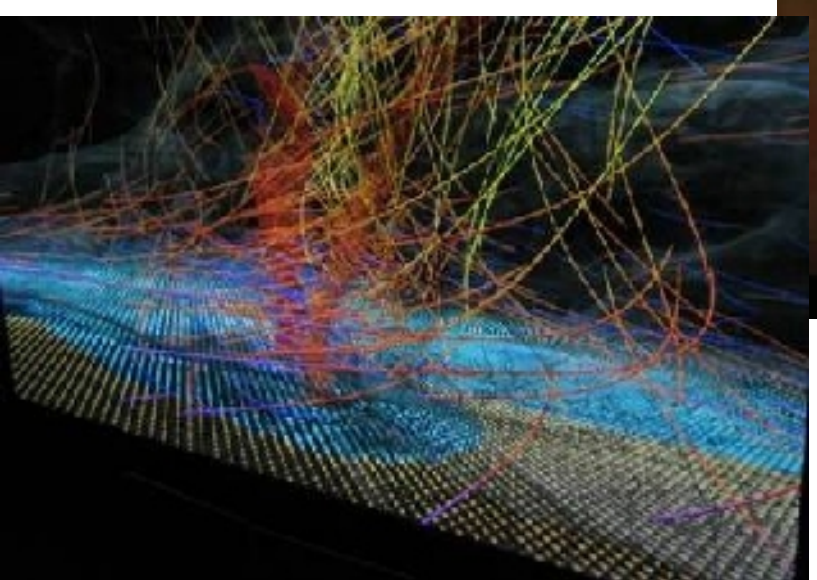


CineGrid



4K Virtual Reality

4K Scientific Visualization





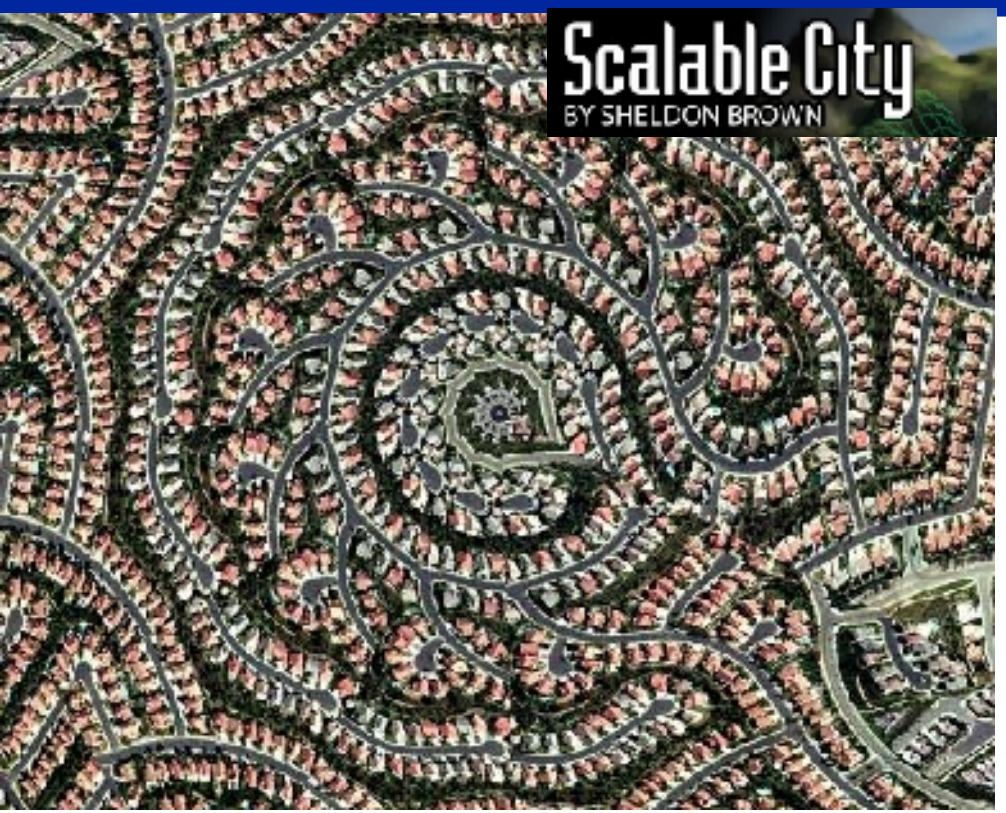
4K Digital Cinema

4K *Anime*



Source: Laurin Herr

Calit2 Has Facilitated Deep Interactions With the Digital Arts on Both Campuses



Bill Tomlinson, Lynn Carpenter UCI "EcoRaft"



"Researchers Look to Create a Synthesis of Art and Science for the 21st Century"

By John Markoff
NYTimes November 5, 2005

SPECFLIC 1.0 – A Speculative Distributed Social Cinema by Adrienne Jenik



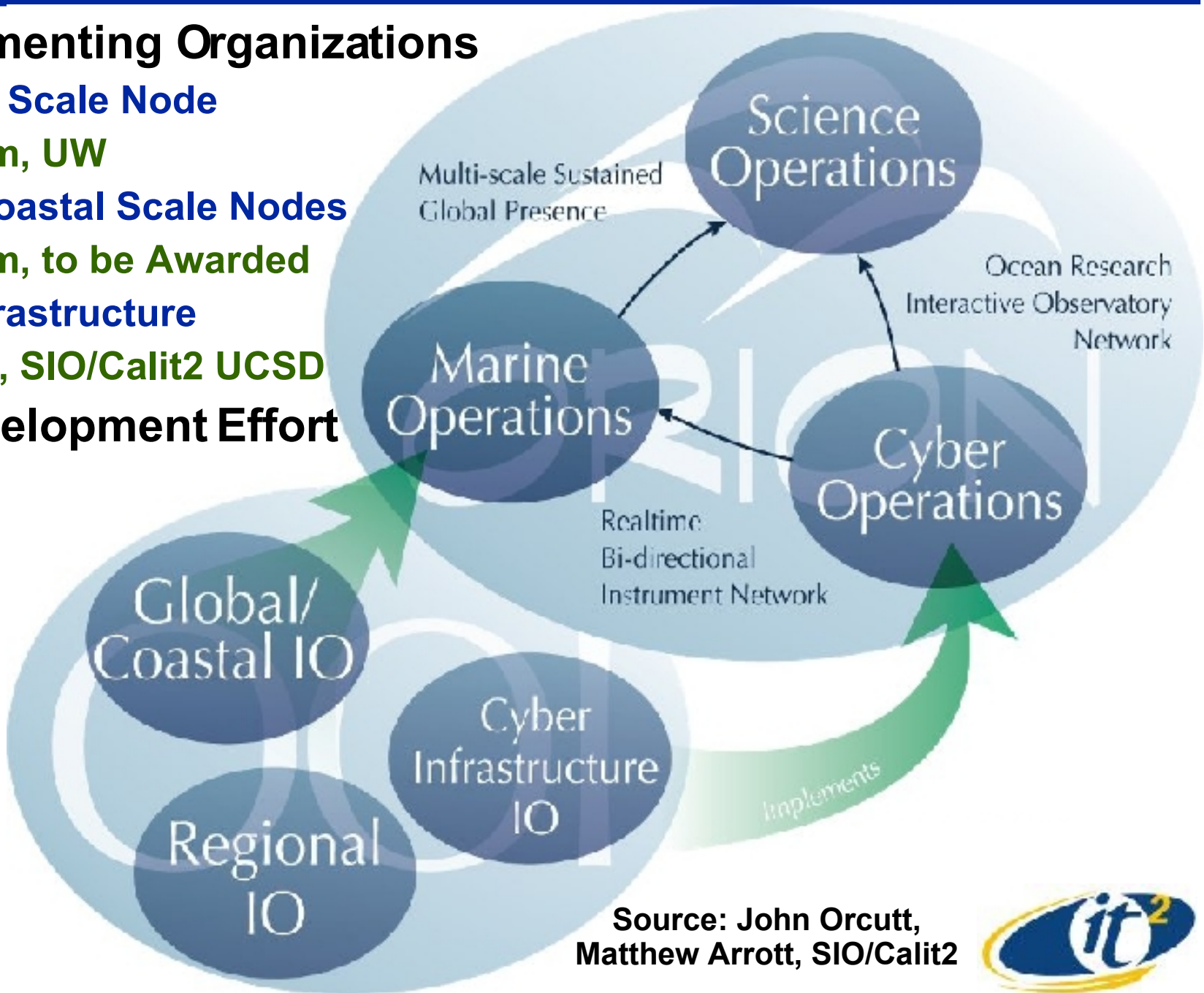
Calit2, SDSC, EVL, and SIO are Creating Environmental Observatory Control Rooms



UCSD UCIrvine evl electronic visualization laboratory SDSC SAN DIEGO SUPERCOMPUTER CENTER SCRIPPS INSTITUTION OF OCEANOGRAPHY it²

Ocean Observatory Initiative -- Initial Stages

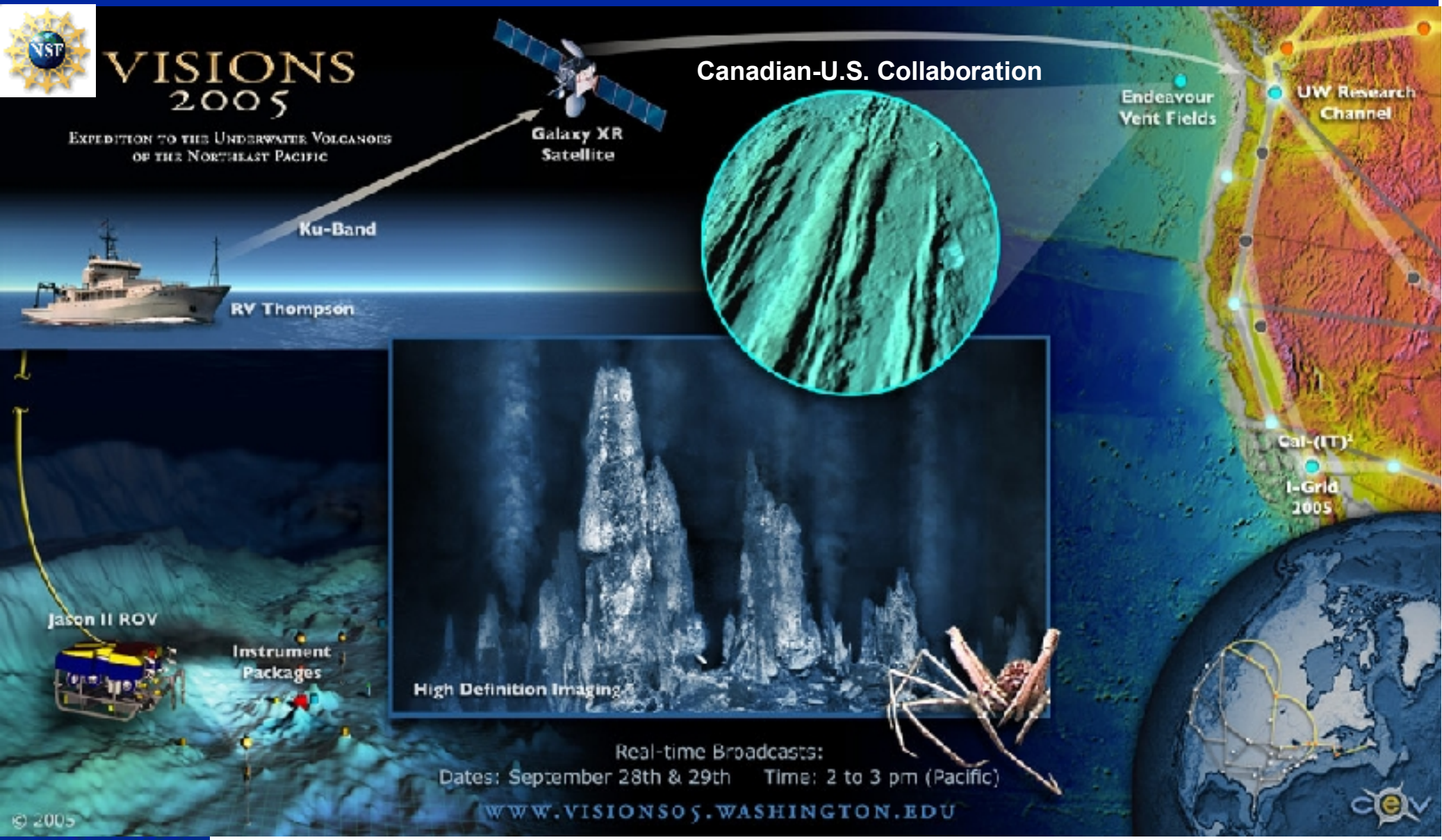
- **OOI Implementing Organizations**
  - **Regional Scale Node**
    - **$150m, UW**
  - **Global/Coastal Scale Nodes**
    - **$120m, to be Awarded**
  - **Cyberinfrastructure**
    - **$30m, SIO/Calit2 UCSD**
- **6 Year Development Effort**



Source: John Orcutt, Matthew Arrott, SIO/Calit2

UCSD UCIrvine

Remote Interactive High Definition Video of Deep Sea Hydrothermal Vents



UCSD
UCIrvine

Source John Delaney & Deborah Kelley, UWash