"Living in the Future: The Calit2 Experience

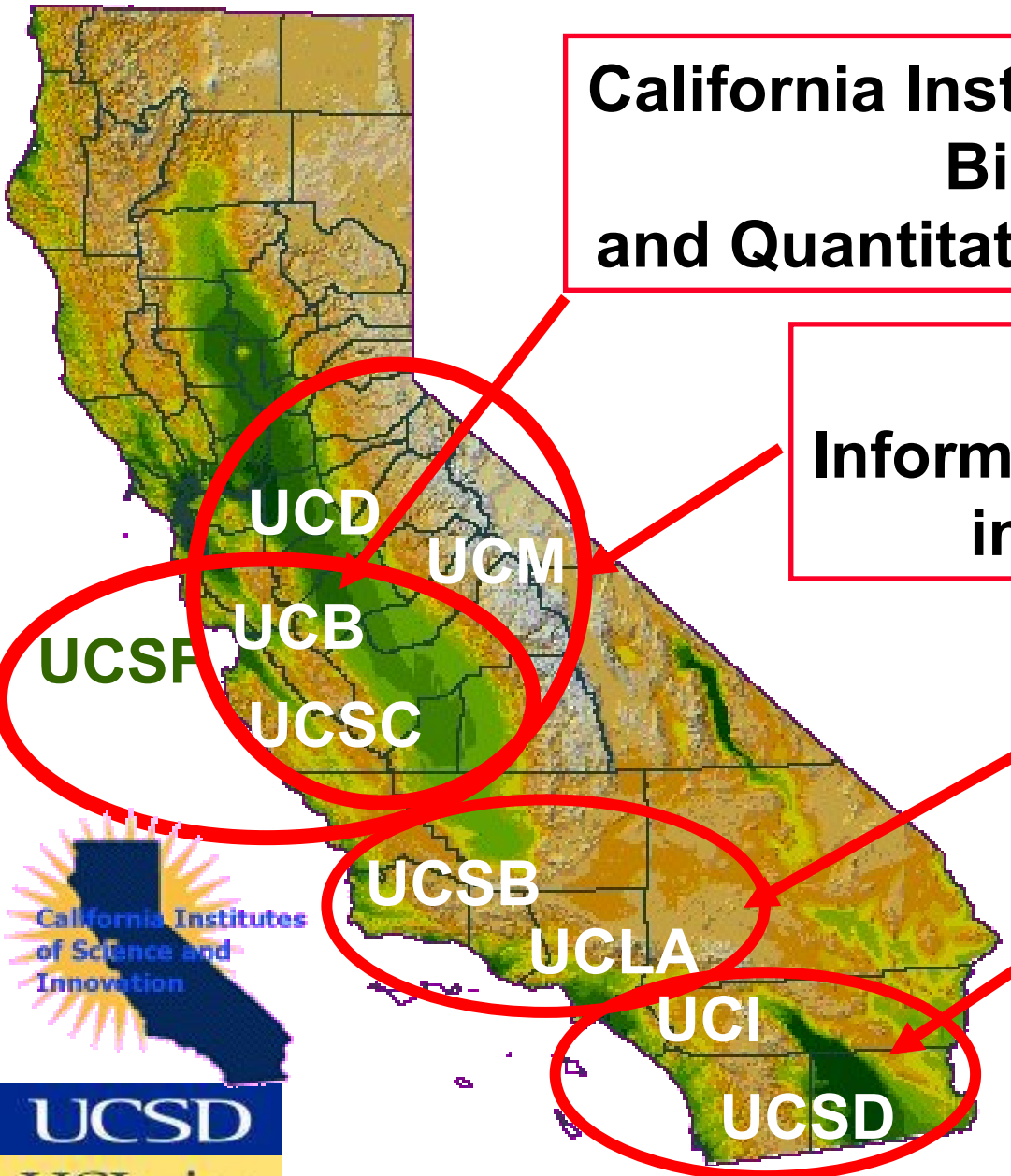
Invited Talk
U.S. – India Summit on Education, Research, and Technology
Science & Technology in 10, 20, & 50 Years
Calit2@UCSD
May 31, 2006

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

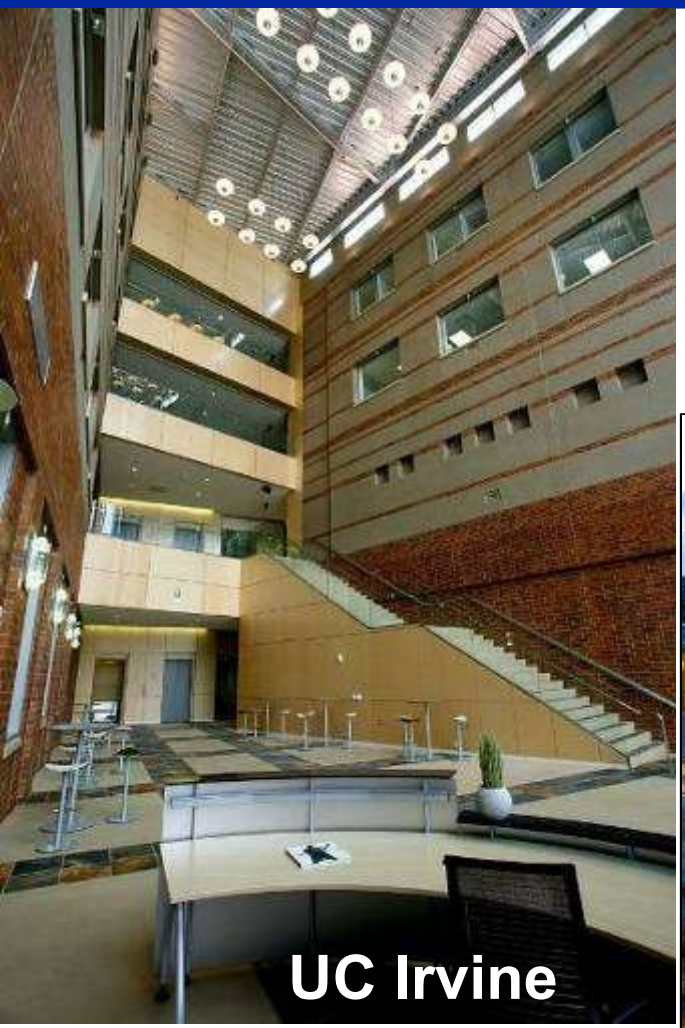
California Institute for Telecommunications and Information Technology

UCSD
UCIrvine

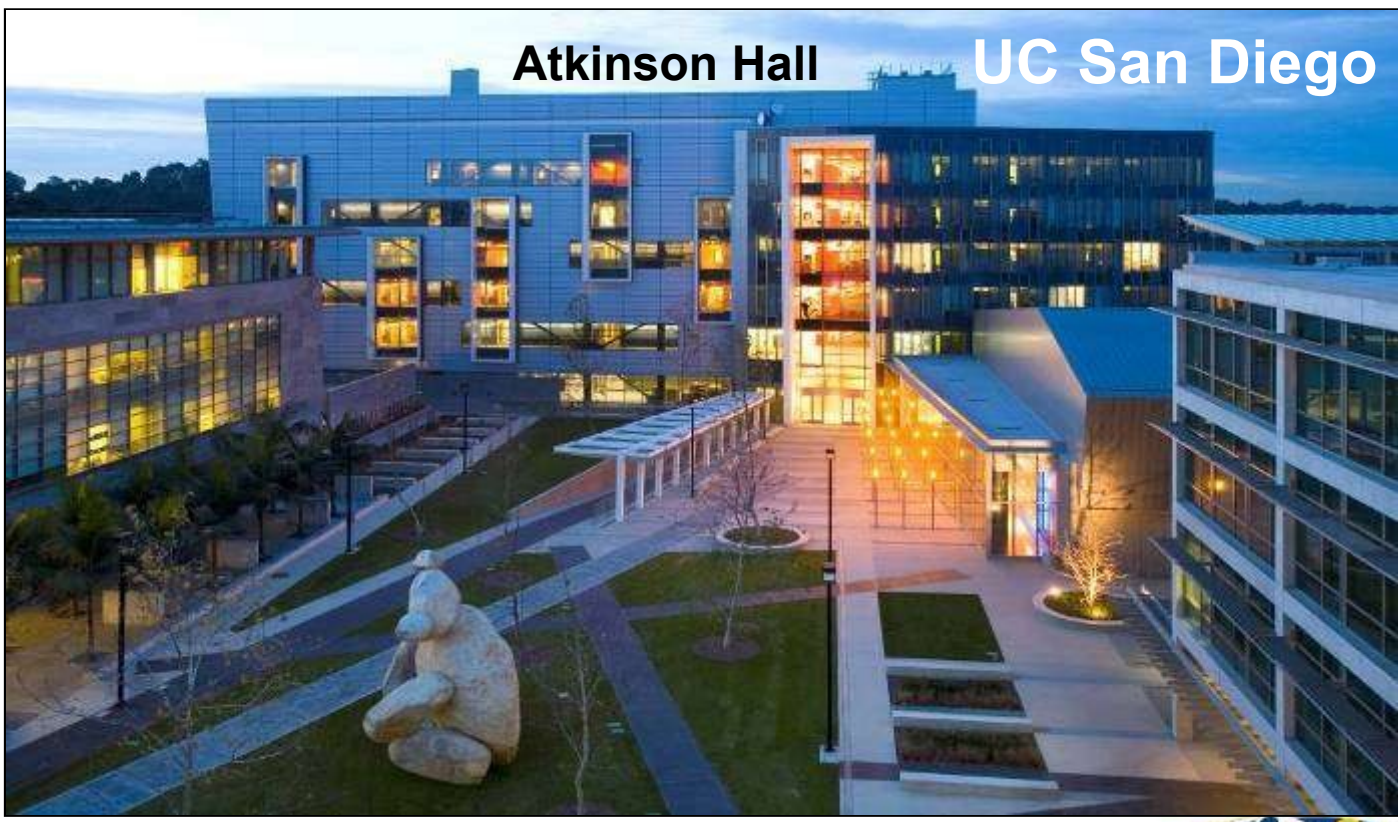
www.ucop.edu/california-institutes

it²

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



- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks
  - International Conferences and Testbeds
- New Laboratories
  - Nanotechnology
  - Virtual Reality, Digital Cinema



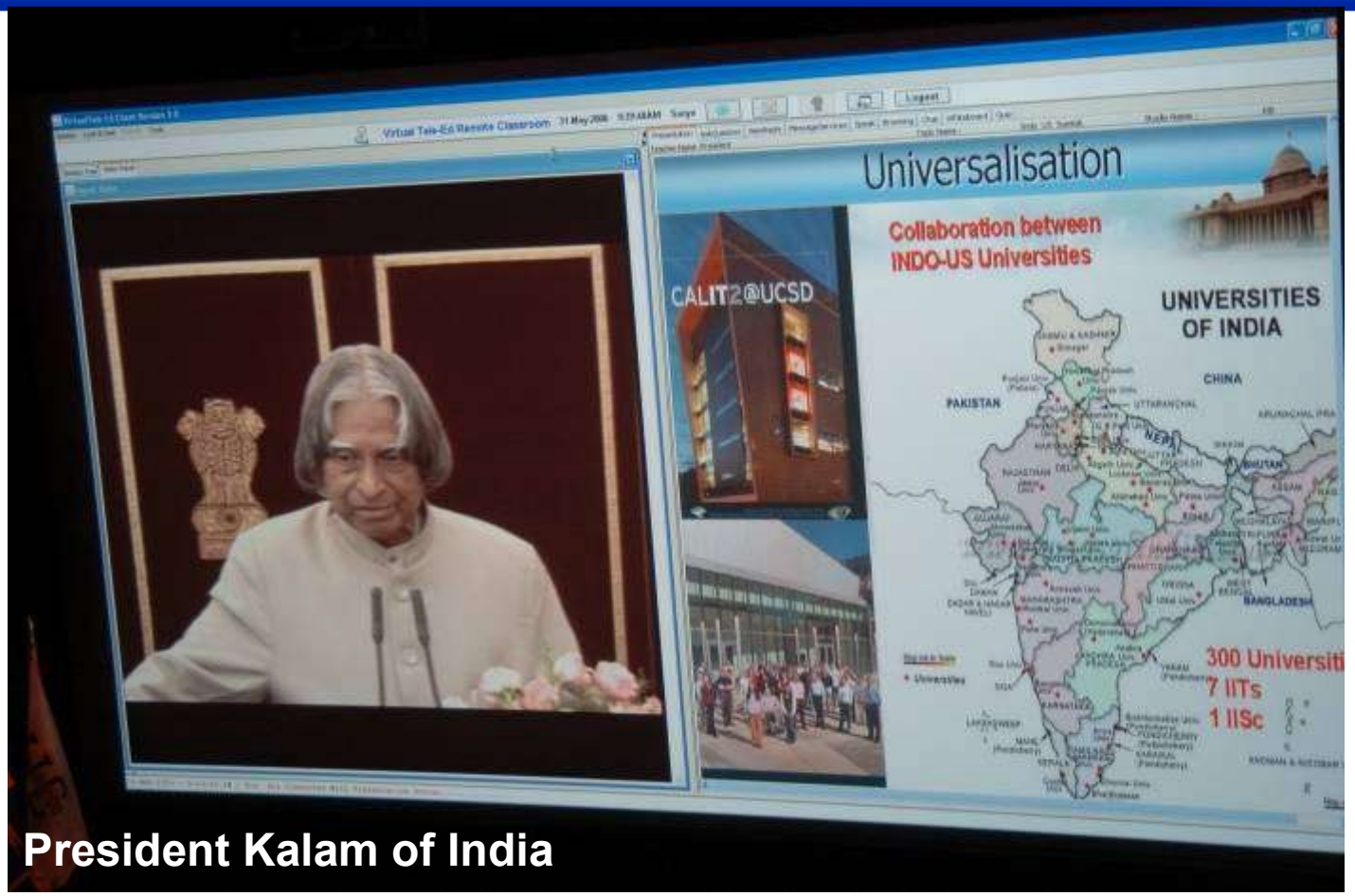
www.calit2.net

UCSD
UCIrvine

Preparing for a World in Which Distance is Eliminated…

it2

We Saw Today the Beginning of Eliminating Distance Between U.S. and India



President Kalam of India

- Video Was 720x480 = 1/3 MegaPixels
- Reliance Measured Bandwidth Today:
  - 6 Mbps India to San Diego

UCSD
UCIrvine

Photo: Barbara Haynor, Calit2

it2

From Megabits to Gigabits: First Trans-Pacific Super High Definition Telepresence Meeting

Telepresence Using
1000 Mbps Bandwidth
3840x2160 Pixels = 8.3 MPixels
Compressed SHDTV Streaming



Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

iGrid 2005

it²

Toward Borderless Collaboration Between Global University Research Centers at 10Gbps

Maxine Brown, Tom DeFanti, Co-Chairs

iGrid 2005

THE GLOBAL LAMBDA INTEGRATED FACILITY

www.igrid2005.org



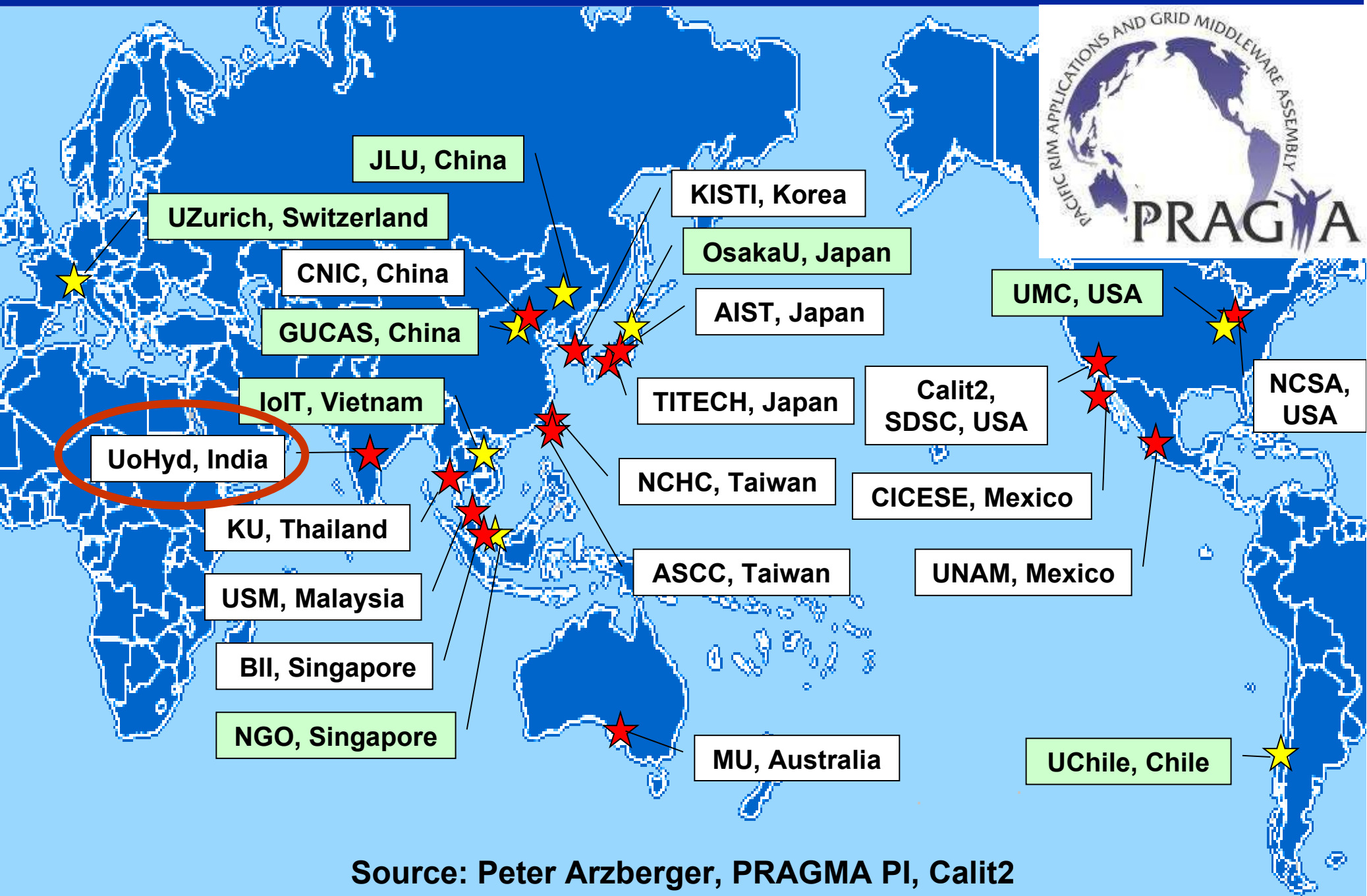
the UC Discovery Grant

September 26-30, 2005
Calit2 @ University of California, San Diego
California Institute for Telecommunications and Information Technology



450 Attendees, 130 Participating Organizations
20 Countries Driving 49 Demonstrations
1- or 10- Gbps Per Demo

International Grid Testbed
Pacific Rim Applications and Grid Middleware Assembly



Source: Peter Arzberger, PRAGMA PI, Calit2

PRAGMA 9

PACIFIC RIM APPLICATIONS AND GRID MIDDLEWARE ASSEMBLY



www.uohyd.ernet.in/pragma9

www.prama-grid.net

Collaboration Goals from President Kalam of India

- Interactive Knowledge System
- Convergence of Info- Nano - Bio
- Make the Bandwidth Available with No Limits
- PURA--Societal Grid With Electronic Connection of a Billion People

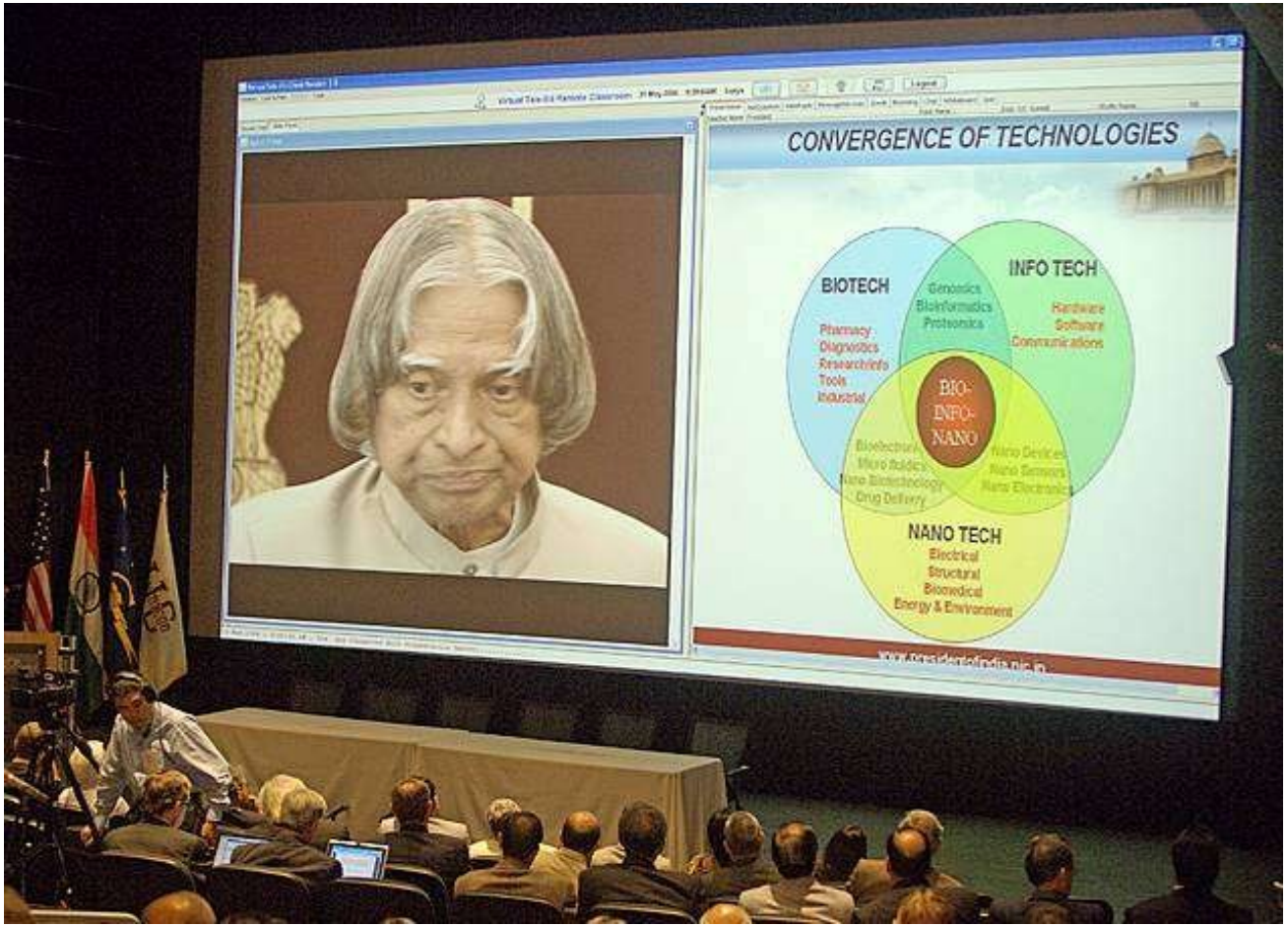
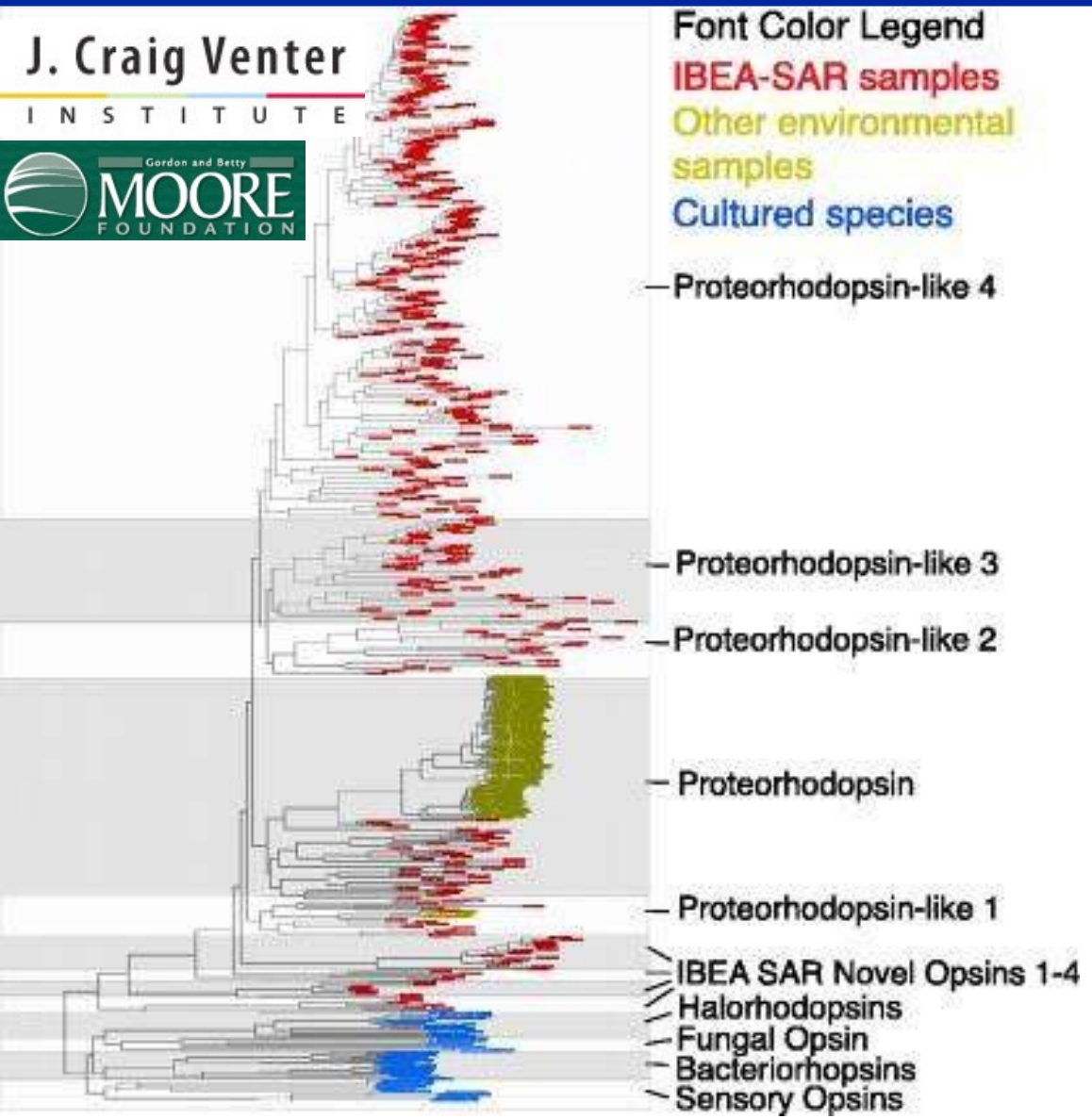


Photo: Alan Decker, UCSD

UCSD
UCIrvine

The Sargasso Sea Experiment: Convergence of Bio and IT



- **Analyzed Ocean Water for Gene Content & Biodiversity**
- **Sequences from at Least 1800 Genomic Species, 148 Previously Unknown**
- **Identified over 1.2 Million Unknown Genes**

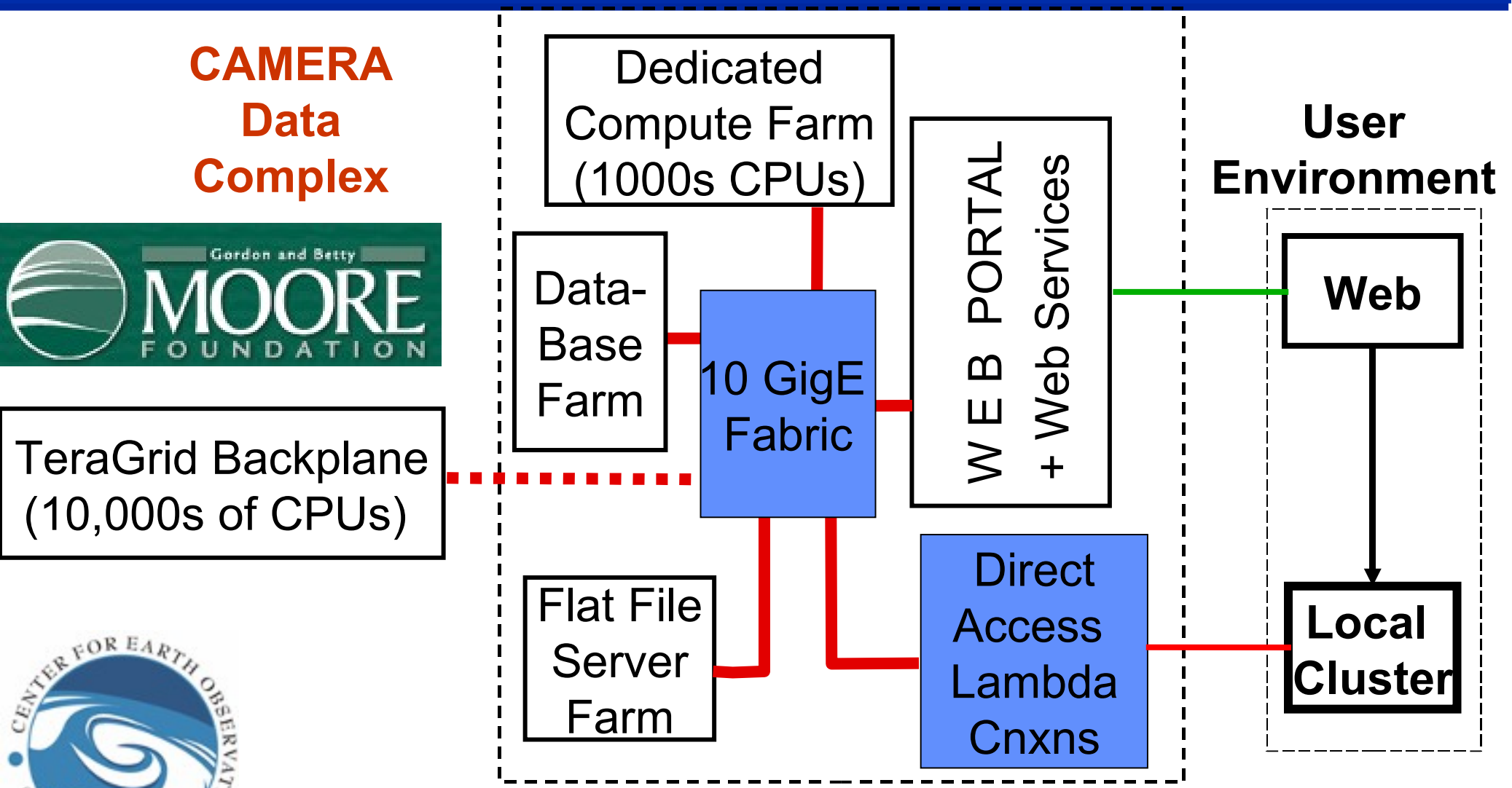
- **New Applications:**
  - **Solar Energy**
  - **Alternate Fuels**
  - **Agriculture**
  - **Bioremediation**
  - **Medicine**

UCSD
UCIrvine

J. Craig Venter, et al. *Science*
2 April 2004: Vol. 304. pp. 66 - 74

it²

Community Cyberinfrastructure for Advanced Marine Microbial Ecology Research and Analysis



Source: Phil Papadopoulos, SDSC, Calit2

Global Ocean Sampling Project
Measuring the Genetic Diversity of Marine Microbes

Collaborate with India to Add Microbe Ecologies From Rivers and Coastal Oceans



MARINE MICROBIOLOGY INITIATIVE

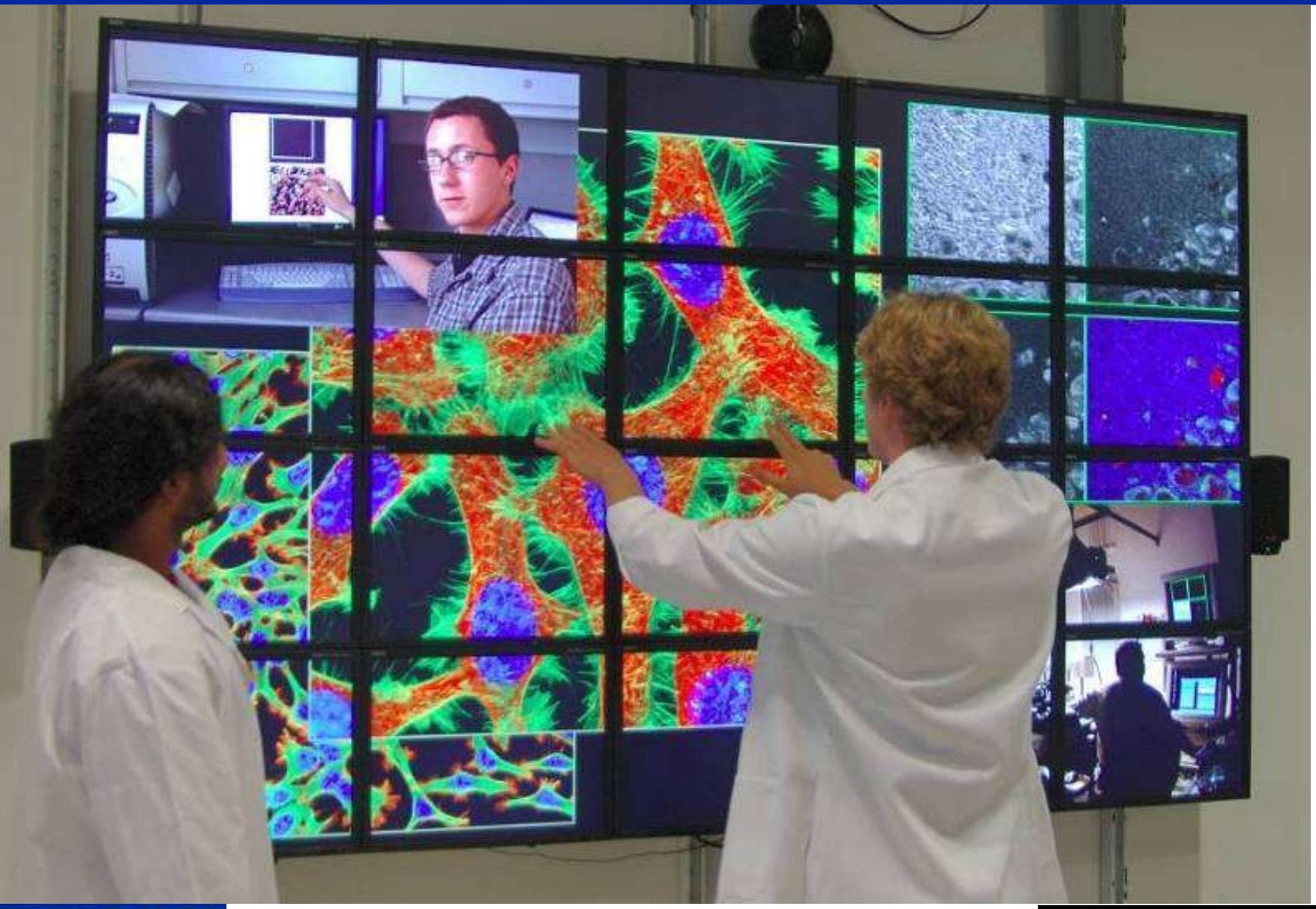
Gordon and Betty MOORE FOUNDATION

UCSD
UCIrvine

J. Craig Venter INSTITUTE

it²

Integration of High Definition Video Streams with Large Scale Image Display Walls – OptIPuter Project



Scalable Adaptive Graphics Environment Jason Leigh, EVL, UIC

UCSD UCIrvine

evl electronic visualization laboratory

Source: David Lee, Mark Ellisman NCMIR, UCSD

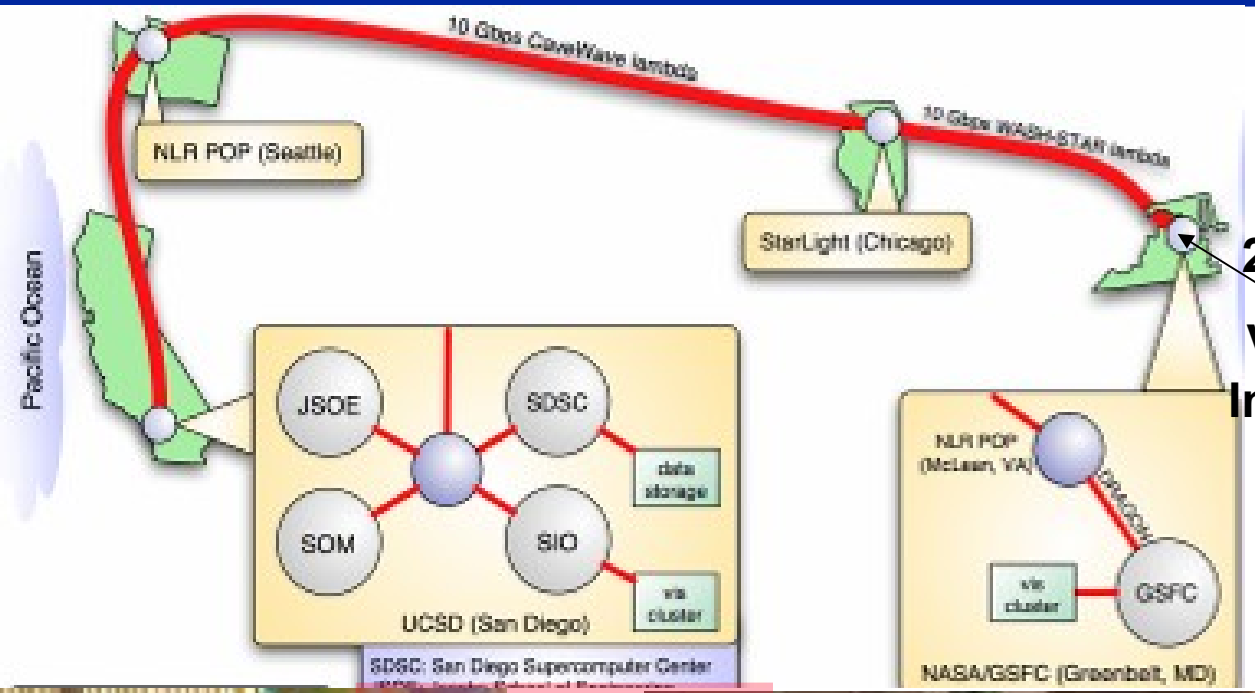
NCMIR NATIONAL CENTER for MICROSCOPY and IMAGING RESEARCH at San Diego, an NIH supported resource center

it2

Calit2 and the Venter Institute Will Combine Telepresence with Remote Interactive Analysis

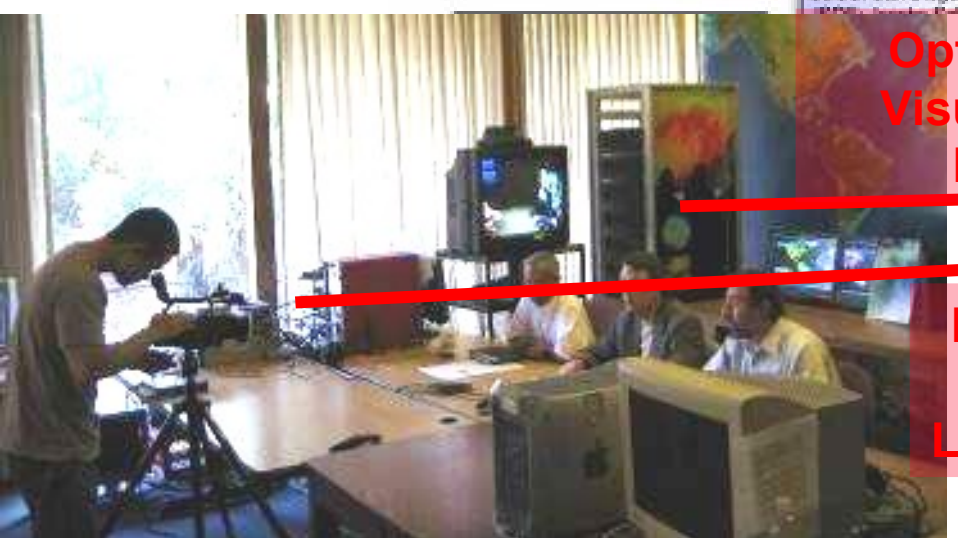
Live Demonstration of 21st Century

National-Scale Team Science



25 Miles

Venter Institute



OptIPuter Visualized Data

HDTV Over Lambda

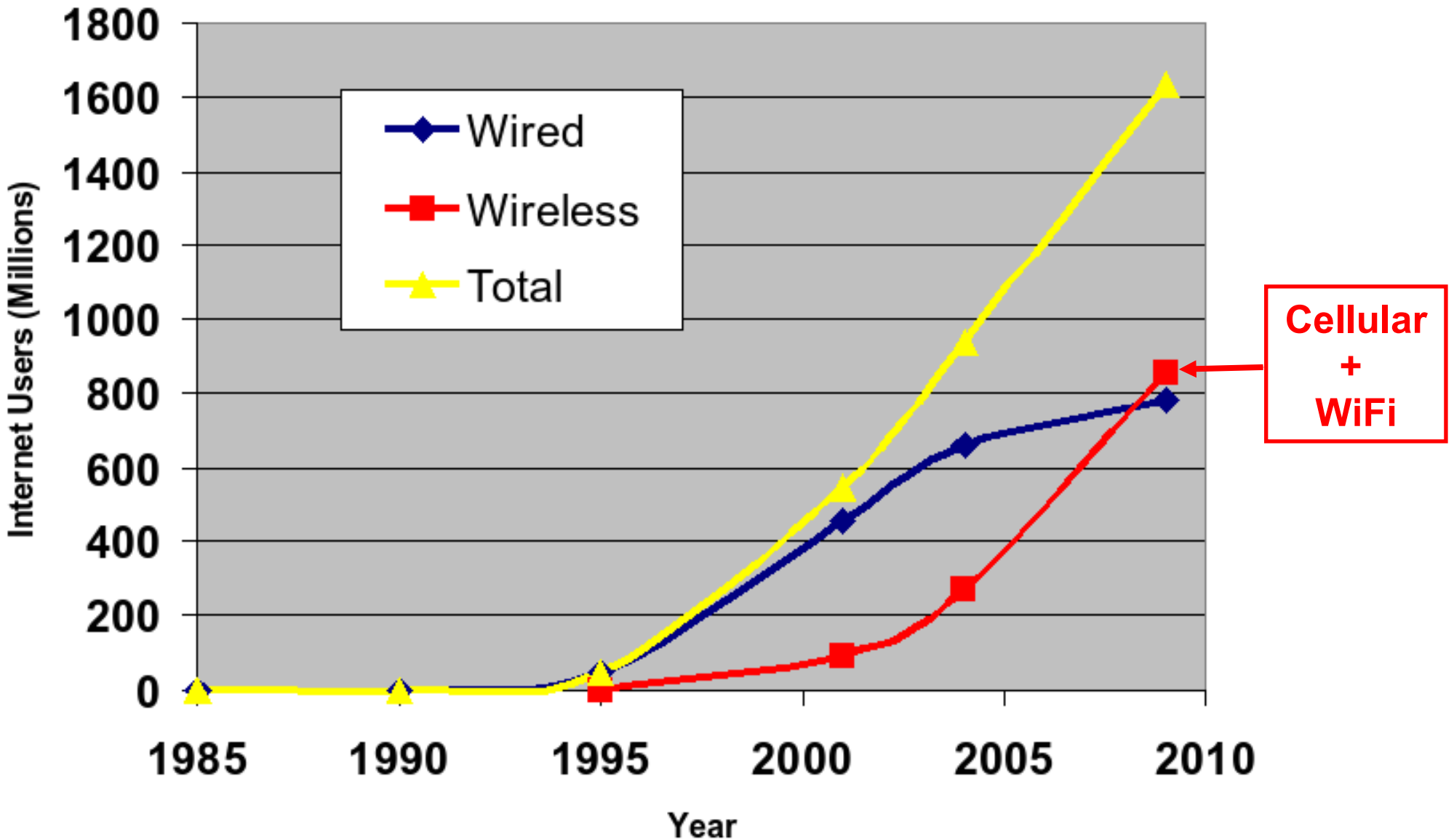


UCSD

UCIrvine

Link India over Gigabit Links in 2007?

The Wired Internet is Extending Throughout the Physical World via an "Always-On" Mobile Internet



UCSD
UCIrvine

http://www.etforecasts.com/products/ES_intusersv2.htm

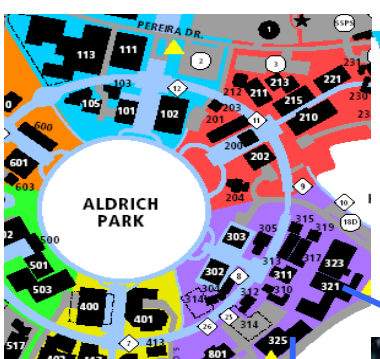
it²

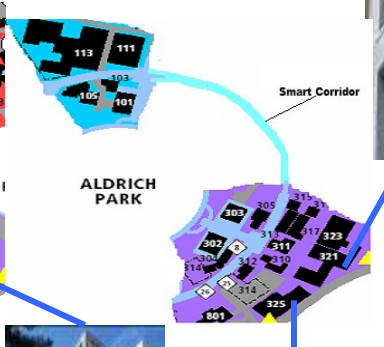
NSF-Funded ResponSphere Establishes Calit2 Project Rescue Testbeds in Irvine and in San Diego

- **Testbeds for Localized Site-Specific Disasters via Crisis Response Drills**
- ***Gaslamp Quarter*, San Diego/ UCSD**
  - **Ubiquitous Wireless Coverage in Downtown San Diego**
- ***Crisis Assessment, Mitigation, And Analysis* – UCI Campus**
  - **Field-Test & Refine Research on Information Collection, Analysis, Sharing, and Dissemination in Controlled yet Realistic Settings**















UCSD UCIrvine bren:school information and computer sciences

rescue

responsphere

PI: Magda El Zarki, ICS, UCI
www.responsphere.org

it²

NSF RESCUE Strongly Coupled with NIH WIISARD Grant

Wireless Internet Information System for Medical Response in Disasters

Calit2 is Working Closely with the First Responder Community



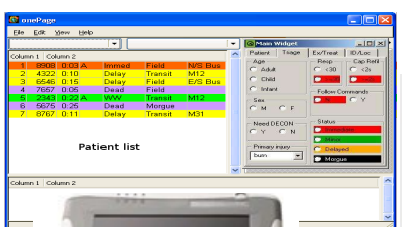




Triage

First Tier





Patient list



802.11 pulse ox







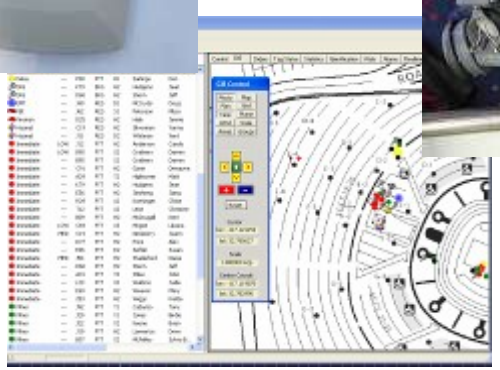
Reality Flythrough
Mobile Video



Mid Tier

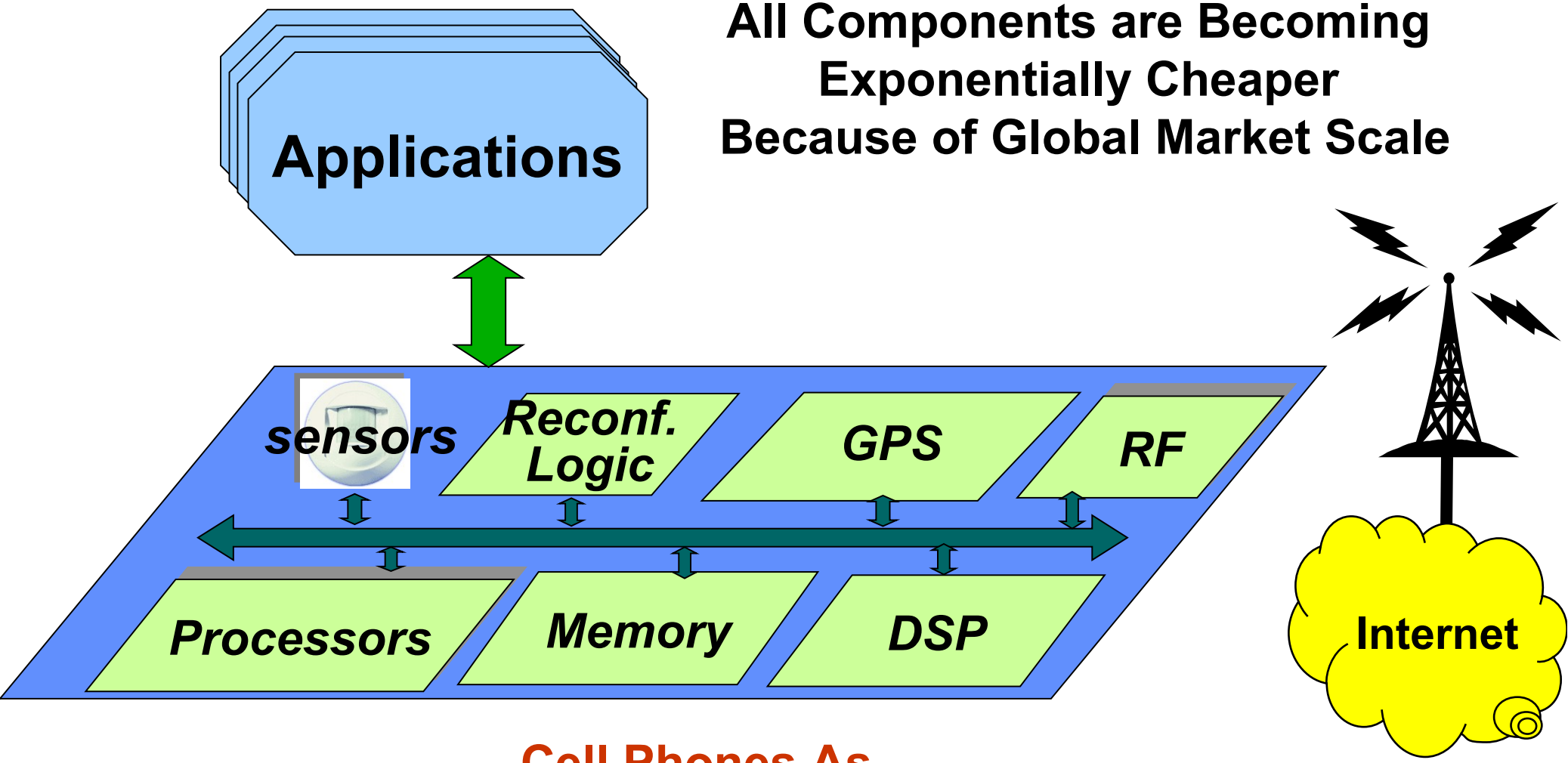


Wireless Networks



Command Center

Driving Costs Toward Zero to Enable Universal Internet Connectivity with Smart Endpoints



All Components are Becoming Exponentially Cheaper Because of Global Market Scale

Cell Phones As the New PCs

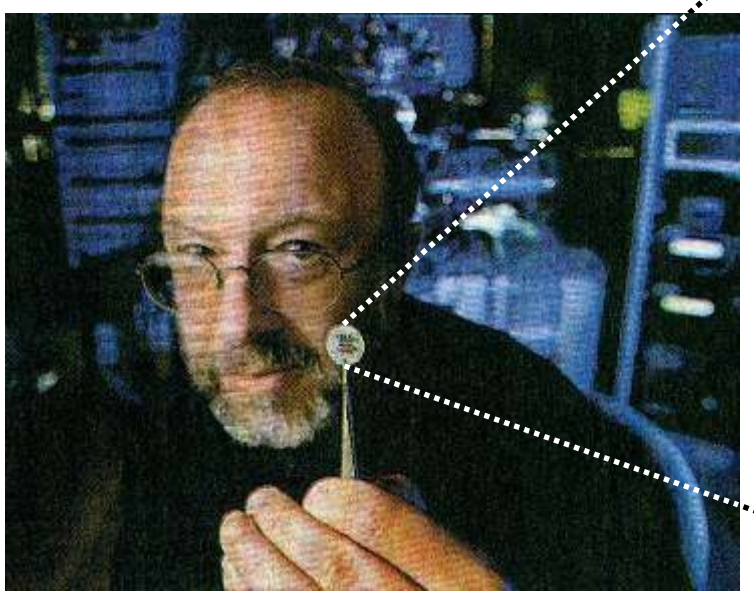
UCSD
UCIrvine

Source: Sujit Dey, UCSD ECE

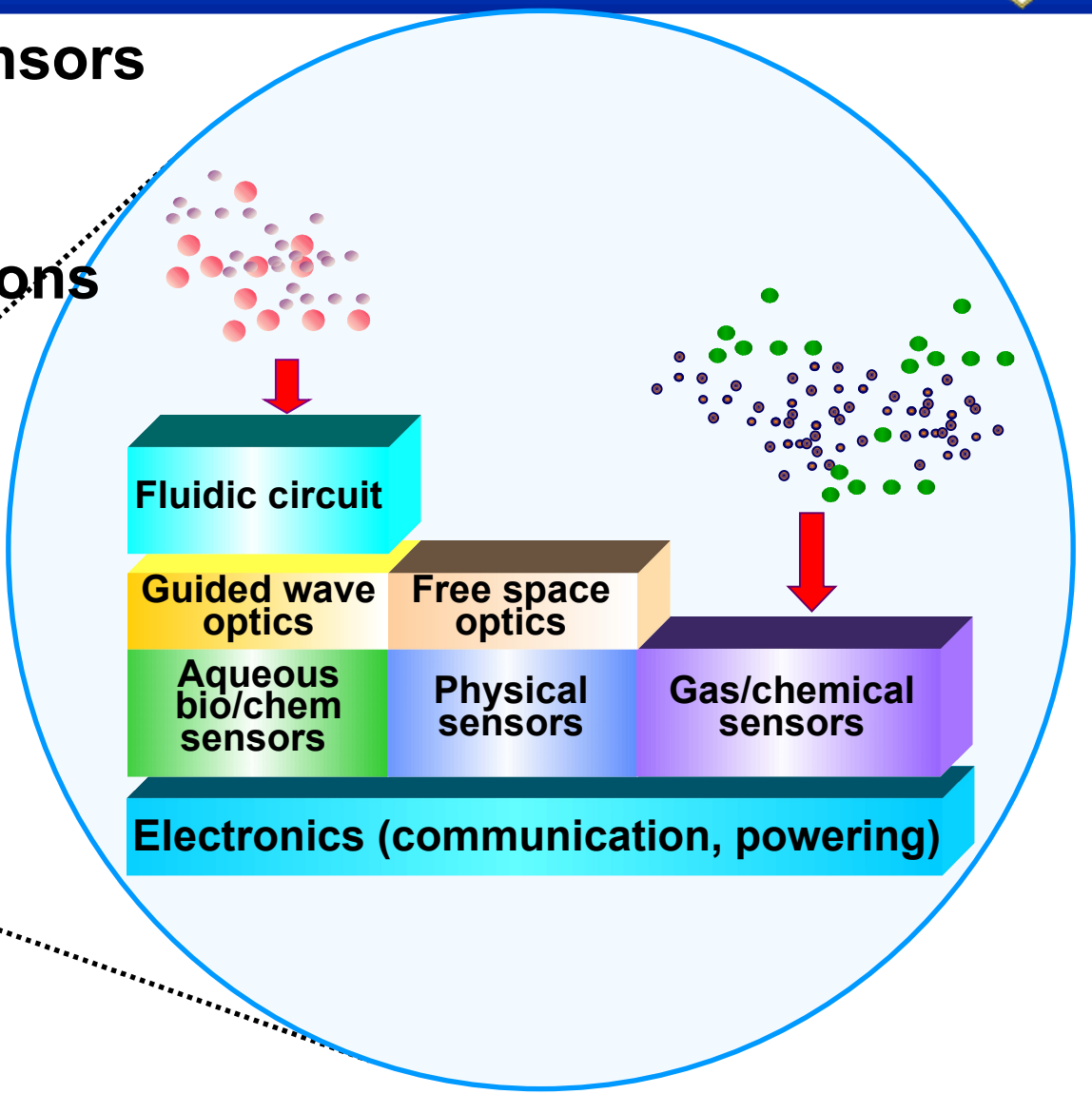
it²

A World of Distributed Sensors Starts with Integrated Nanosensors

Developing Multiple Nanosensors on a Single Chip, with Local Processing and Wireless Communications



I. K. Schuller holding the first prototype



UCSD
UCIrvine

I. K. Schuller, A. Kummel, M. Sailor, W. Trogler, Y-H Lo

Example: Project Atmospheric Brown Clouds (ABC) -- Combining Sensors, Networking, and Supercomputing

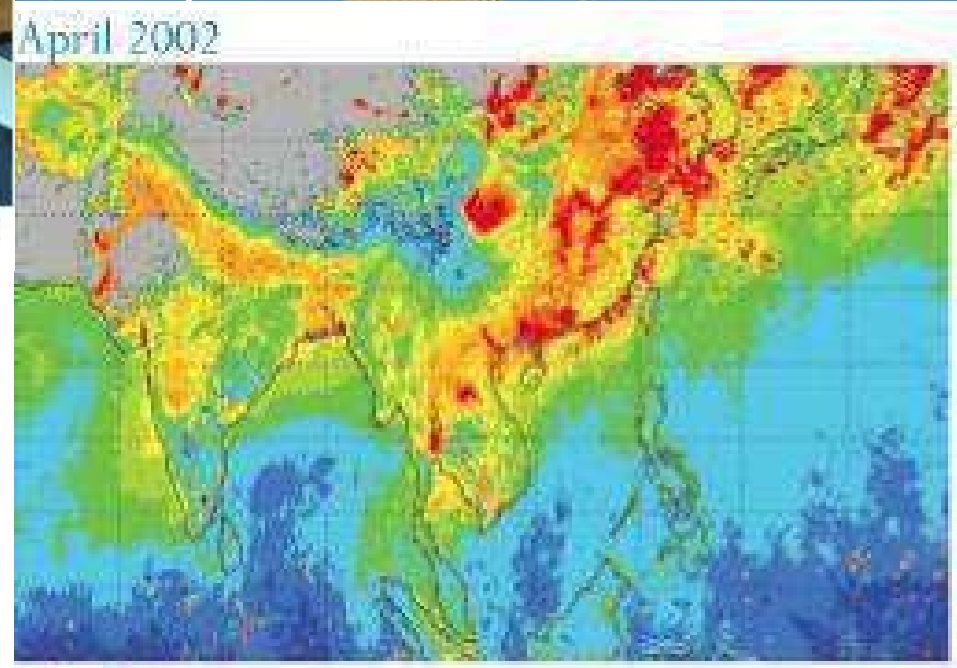
- A Collaboration to Predict the Flow of Aerosols within Asia and Across the Pacific
- Land, Ocean, Air, Space Sensors
- Remote Computing and Analysis Tools Running over National Lambda Rail will Enable Assimilation of the Project ABC Data



John Kosmatka with UAV (unmanned aerial vehicle) model.



Ground Stations Monitor Atmospheric Pollution



The Global Nature of Brown Clouds is Apparent in Analysis of NASA MODIS Data. Research by V. Ramanathan, C. Corrigan, and M. Ramana, SIO

UCSD
UCIrvine

http://www-abc-asia.ucsd.edu