“Calit2 as a Model for Collaborative Innovation”

Invited Talk

The Charter 100

San Diego, CA

April 12, 2018

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

http://lsmarr.calit2.net

I Have Spent Four Decades Developing Collaborative Institutes



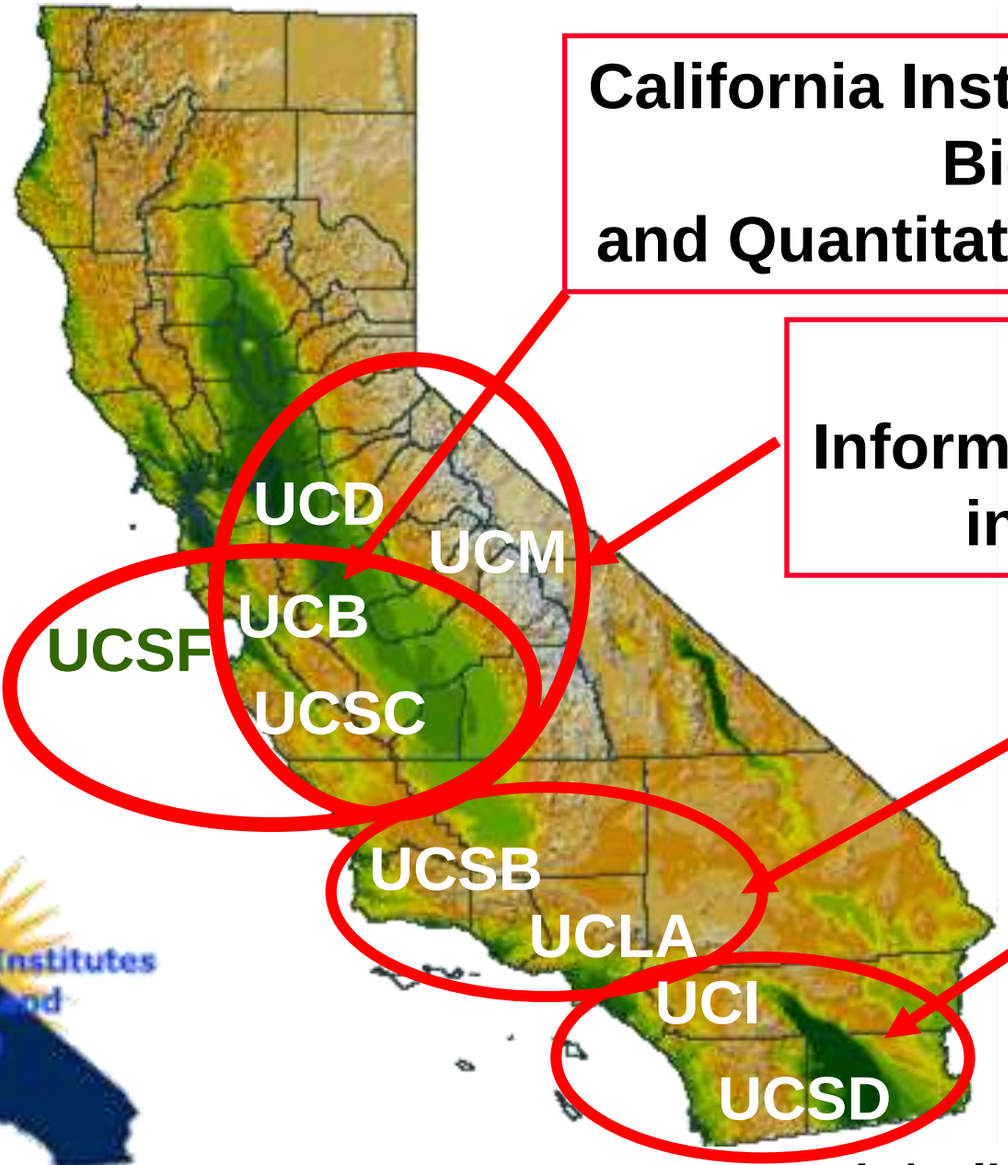
National Center for
Supercomputing Applications 1985



Beckman Institute for
Advanced Science and Technology 1989

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

2000



California Institute for Bioengineering, Biotechnology, and Quantitative Biomedical Research

Center for Information Technology Research in the Interest of Society

California NanoSystems Institute

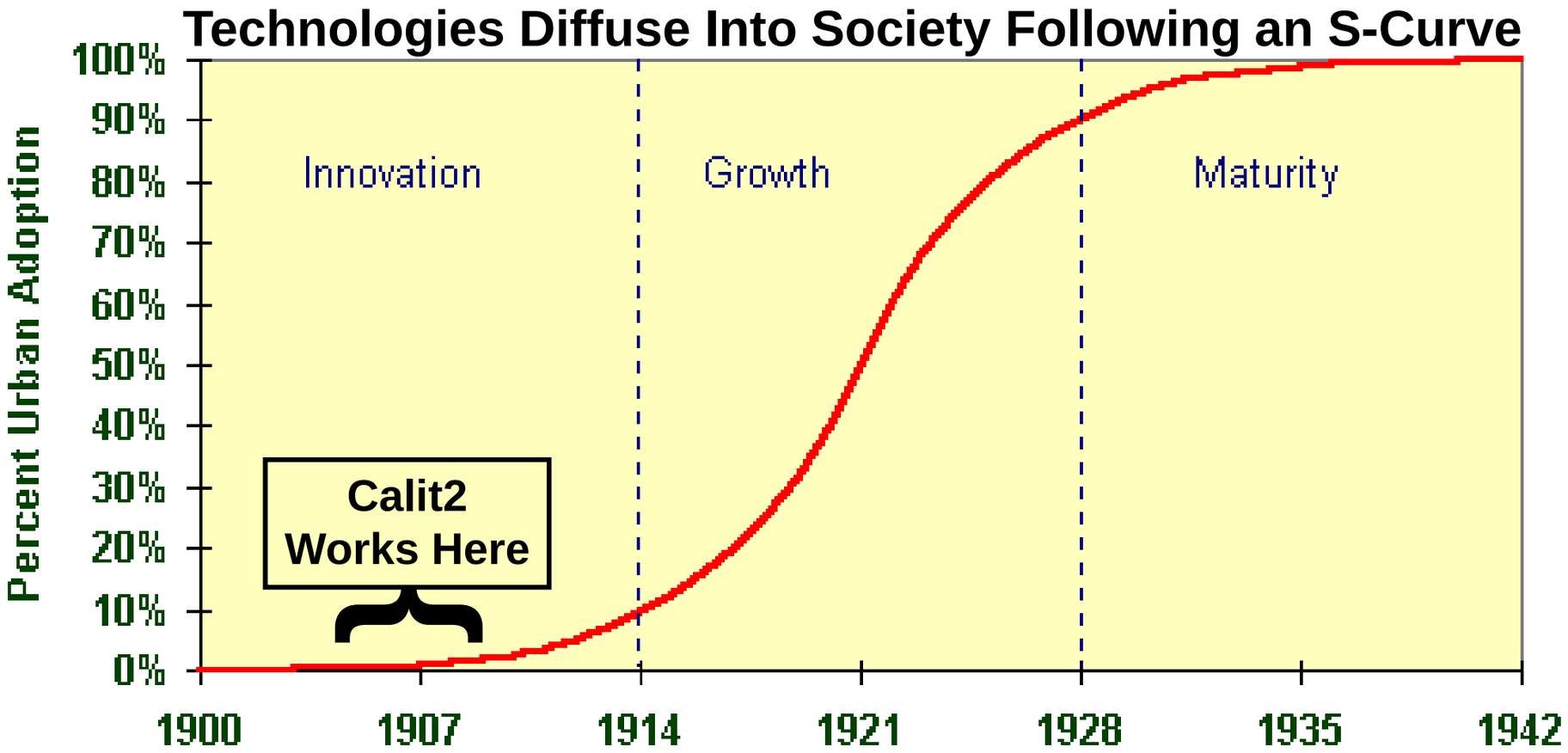
California Institute for Telecommunications and Information Technology

California Institutes of Science and Innovation

www.ucop.edu/california-institutes

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

Co-Evolution of Personal Automobile and Highway/Petroleum Infrastructure



Source: Harry Dent, The Great Boom Ahead

Complex Problems Require a New Research and Education Framework

220 UCSD & UCI Faculty
Working in Multidisciplinary Teams
With Students, Industry, and the Community



The State Provides $100 M
For New Buildings and Equipment

www.calit2.net

LS Slide 2001

The UCSD Cal-(IT)^2 Building Will Be Occupied in January 2005

200 Single Offices
Hundreds
of Collaborative Seats

Virtual Reality
Cube

Digital Cinema
Auditorium



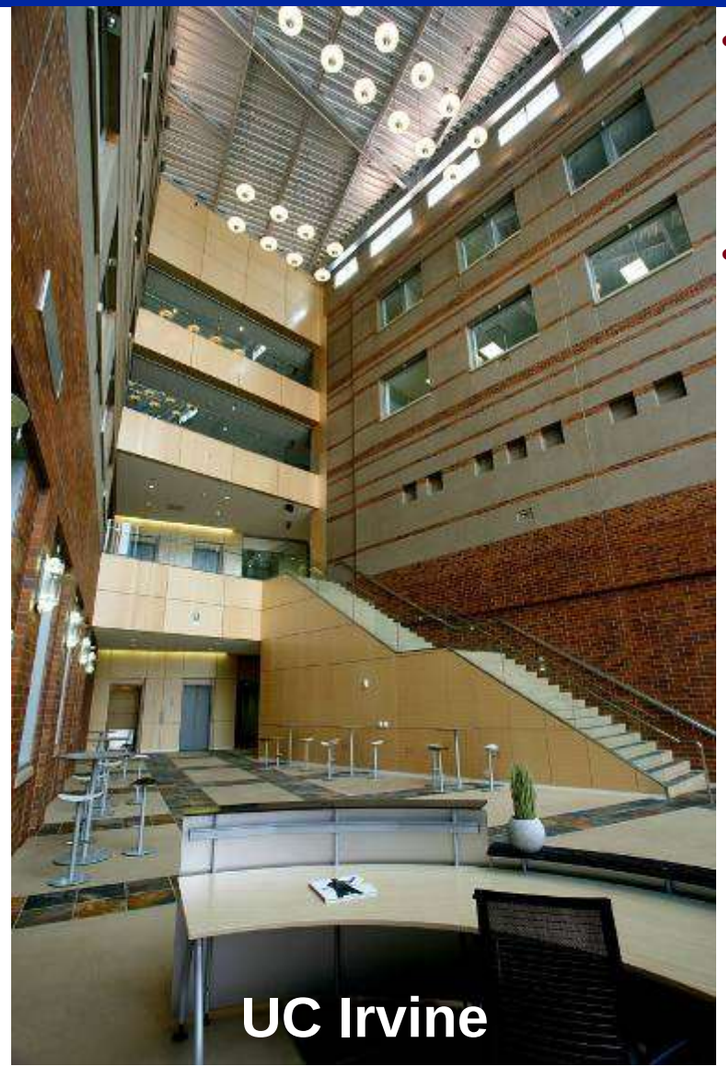
Nanotech
Clean Rooms

RF and Optical
Circuit Labs

Watch us Grow! [www.calit2.net]

Two New Calit2 Buildings Provide New Laboratories for “Living in the Future”

2005



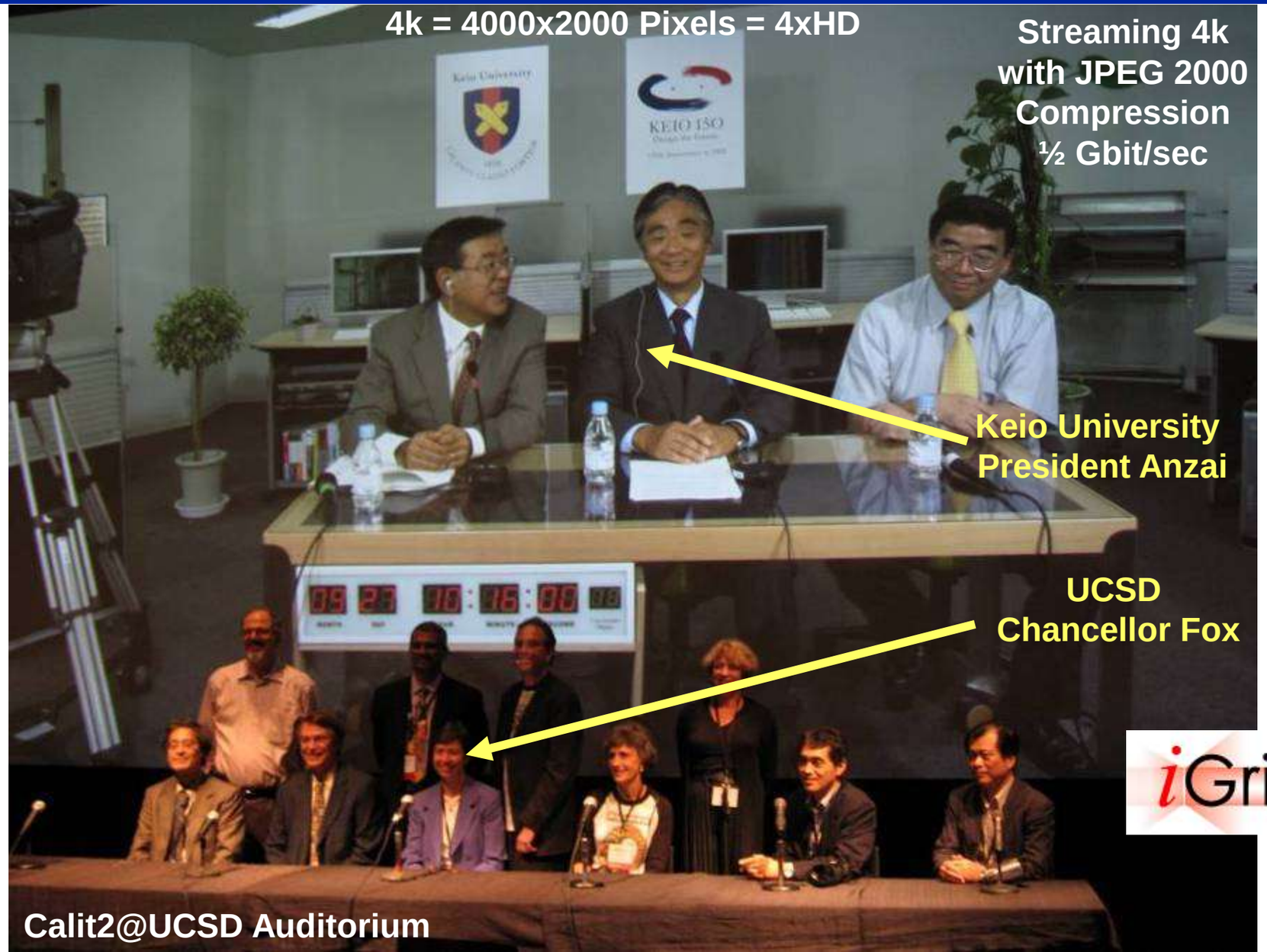
- New Laboratory Facilities
  - Nanotech, BioMEMS, Chips, Radio, Photonics, Grid, Data, Applications
  - Virtual Reality, Digital Cinema, HDTV, Synthesis
- Over 1000 Researchers in Two Buildings
  - Linked via Dedicated Optical Networks
  - International Conferences and Testbeds

Richard C. Atkinson Hall Dedication Oct. 28, 2005



International Impact: Calit2 First Event-First Trans-Pacific Telepresence Meeting Using Digital Cinema 4k Streams

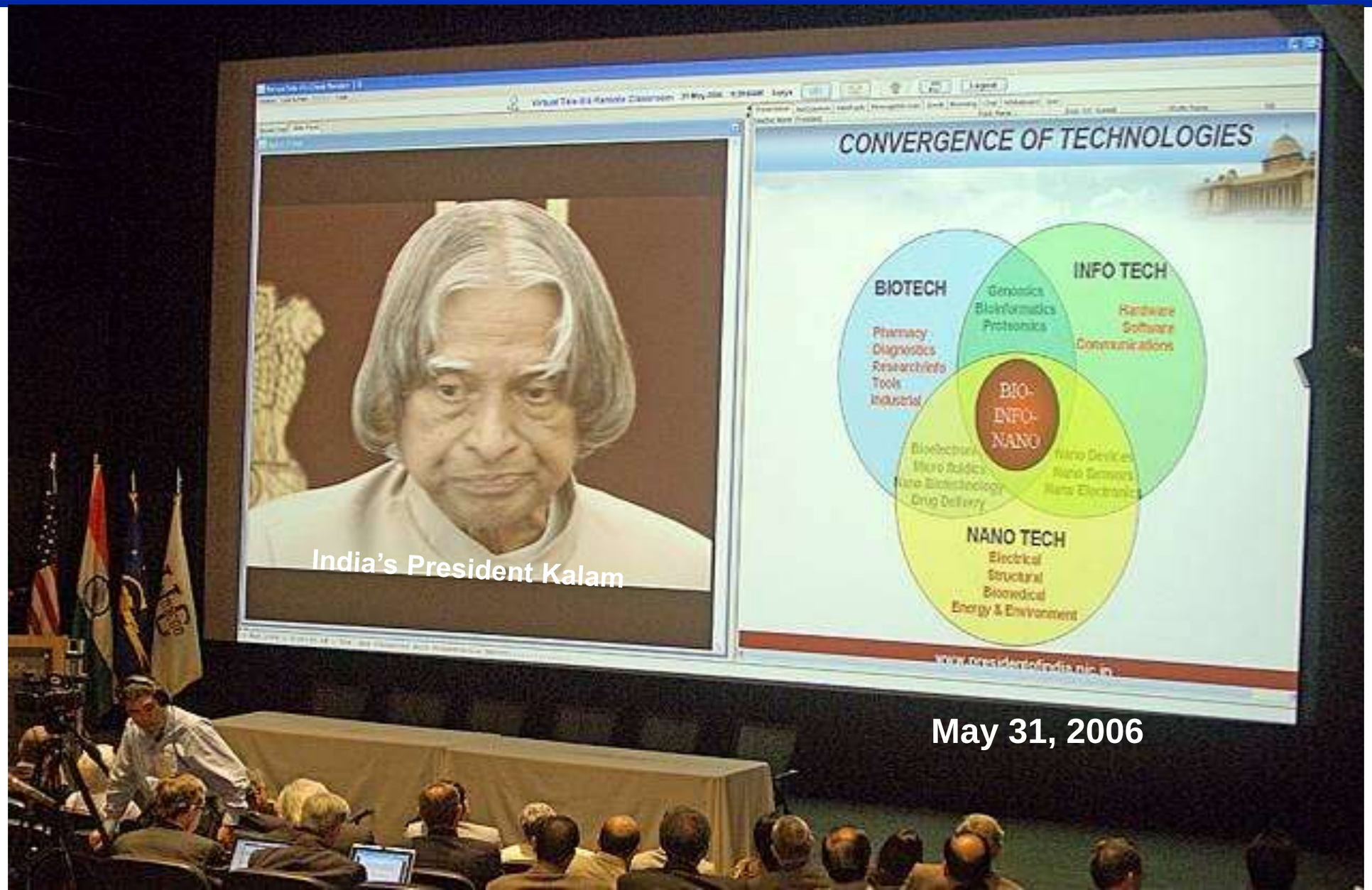
September 2005



Lays Technical Basis for Global Digital Cinema

Sony
NTT
SGI

Building a Global Collaboratorium: India's President Kalam Gives Lecture to Calit2



Victoria Premier and Australian Deputy Prime Minister Asking Questions to Calit2 Australian-American Leadership Dialogue



January 15, 2008

www.calit2.net/newsroom/release.php?id=1219

Calit2 Materials and Devices Laboratory: "Nano3"–NanoScience, NanoEngineering, NanoMedicine

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

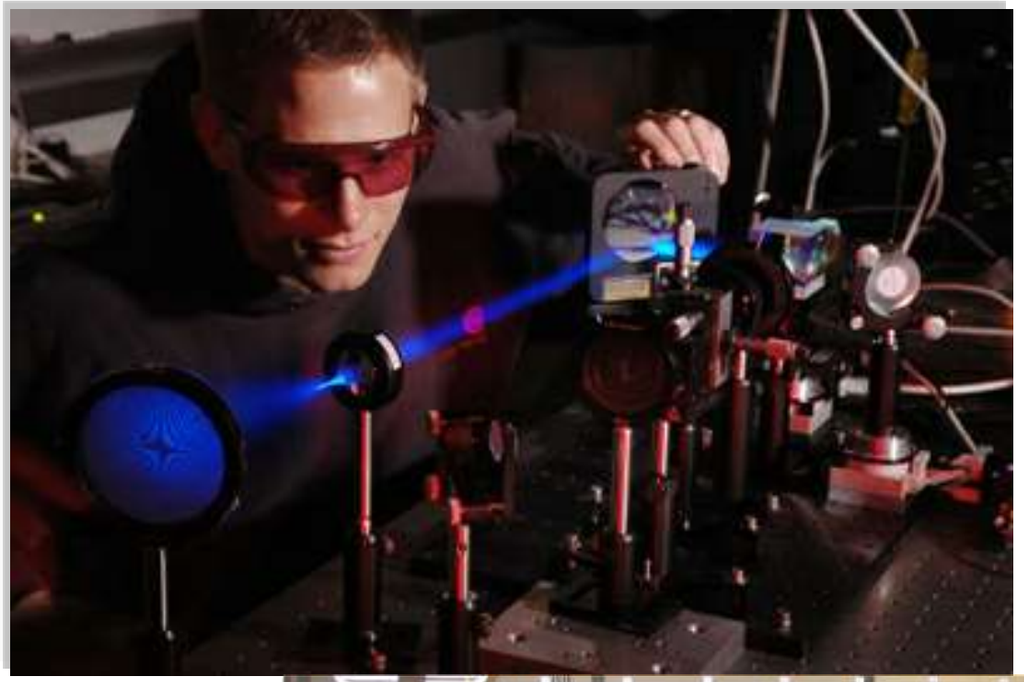


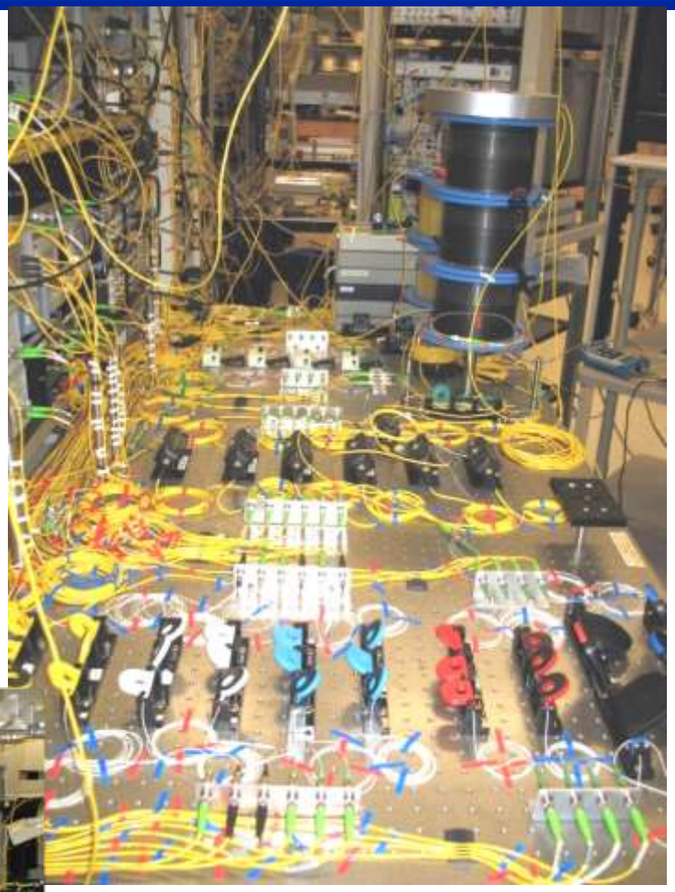
Similar Clean Rooms at UCI

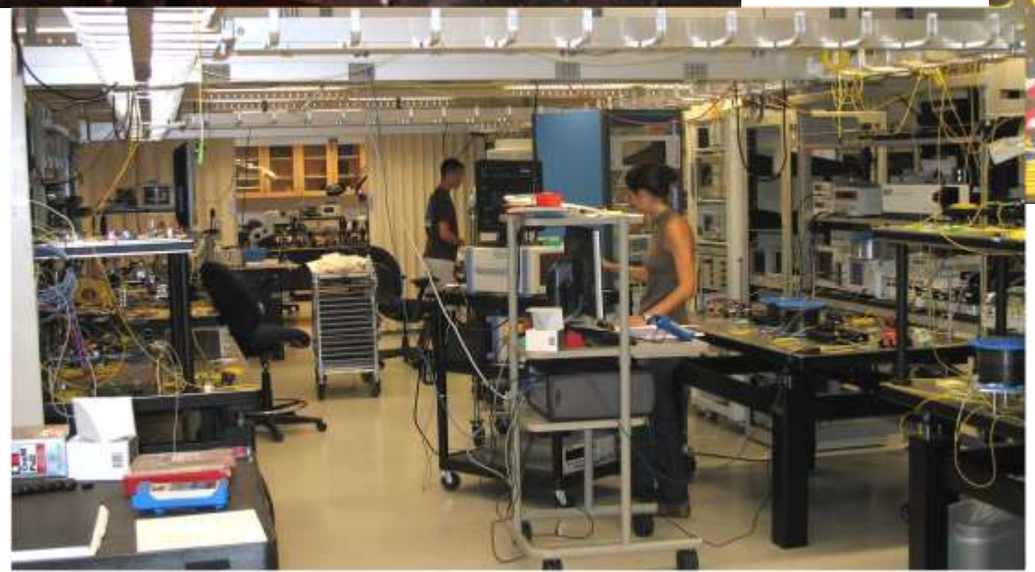
Provided Access to 150 Companies via Recharge

Source: Bernd Fruhberger, Calit2

One of the Most Advanced Photonics Systems Labs in the World







Calit2 and UCSD Are Designing and Building Robots in the Real World Working with Humans

CONTEXTUAL ROBOTICS INSTITUTE

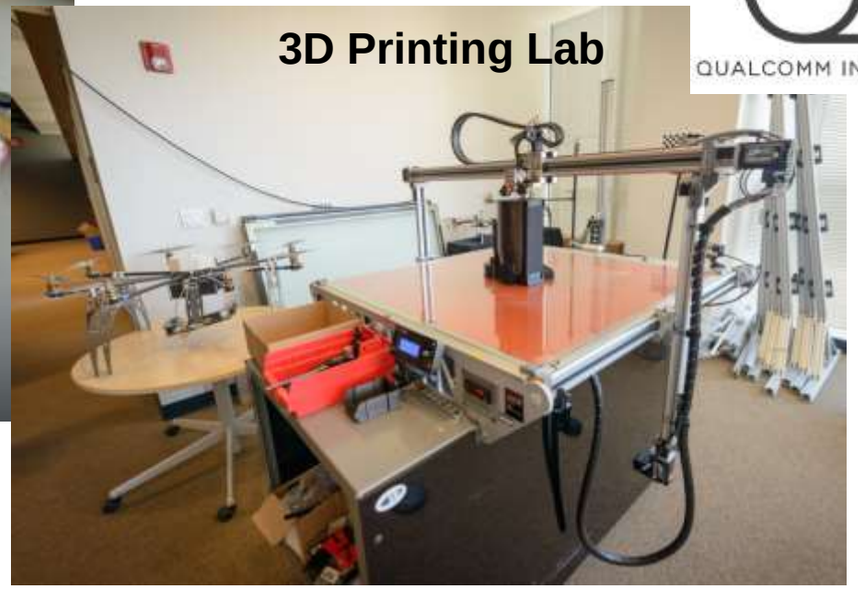
CONTEXTUAL ROBOTICS FORUM 2017
INTELLIGENT VEHICLES 2025
October 27, 2017 at UC San Diego







Prof. Tajana Rosing



3D Printing Lab

QUALCOMM INSTITUTE



Training a New Generation of Computer Scientists to Program in Virtual Reality





Lab Contains 24 Oculus Rift and a HIVE Head-Mounted VR Units

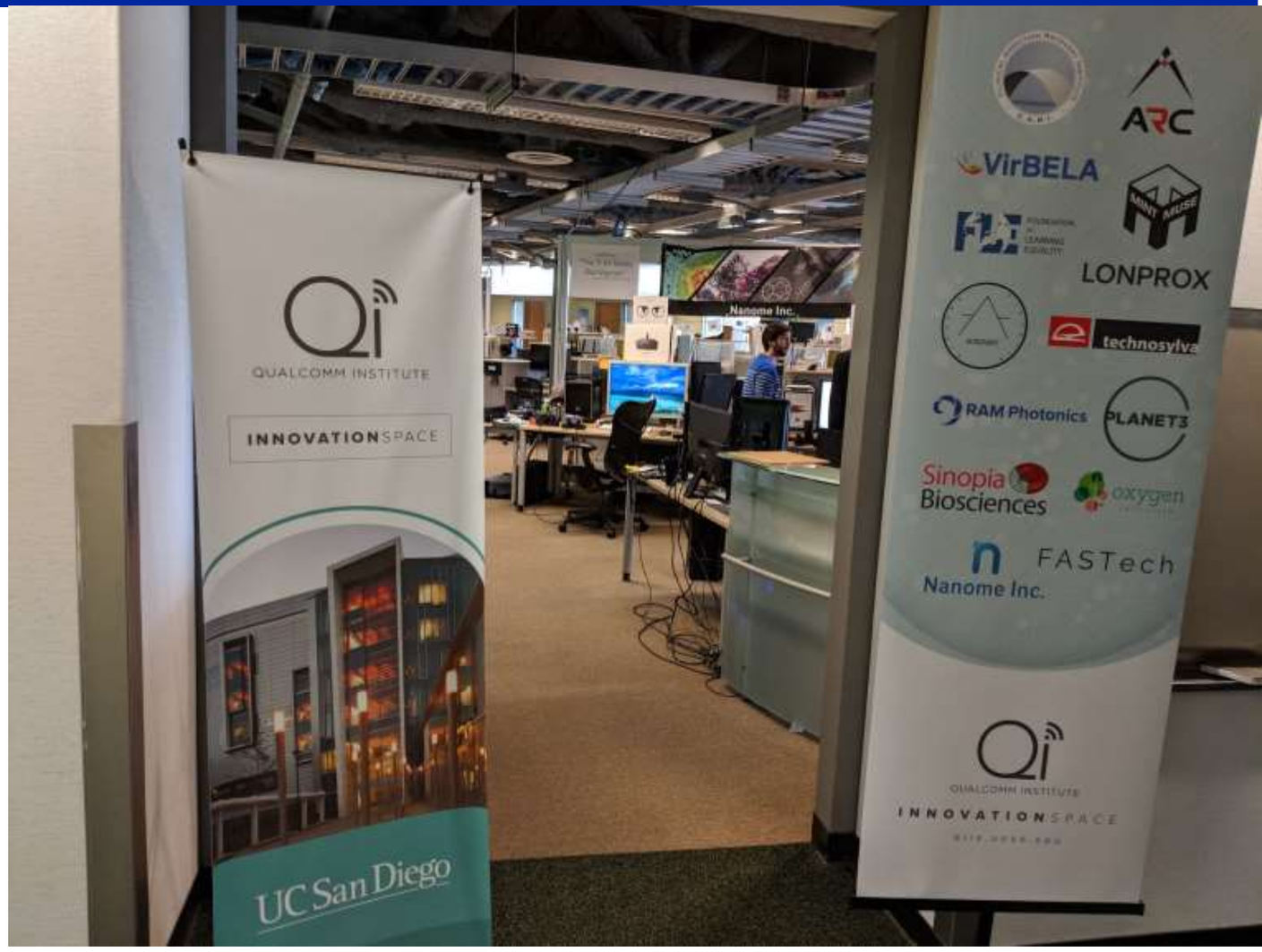
New VR Lab in UCSD CSE Building Developed by Calit2's Jurgen Schulze



Goal to Set Up a Similar Lab in UCSD Health Sciences

Calit2's Qualcomm Institute Innovation Space (QIIS) Launched in Late 2015

- **Currently 17 Startups in QIIS**
- **Generates Economic Value:**
  - **Attracted Over $50M in Investments & Grants**
  - **Booked Over $6M in Revenues**
  - **Funded Over $2M Of QI Services + $100K in Rents**
- **Employs Students as Interns and Eventually Employees**
  - **Nearly 200 Student Interns Since 2015**
  - **Over 25 Interns Later Hired into Full-Time Jobs at QIIS Companies**

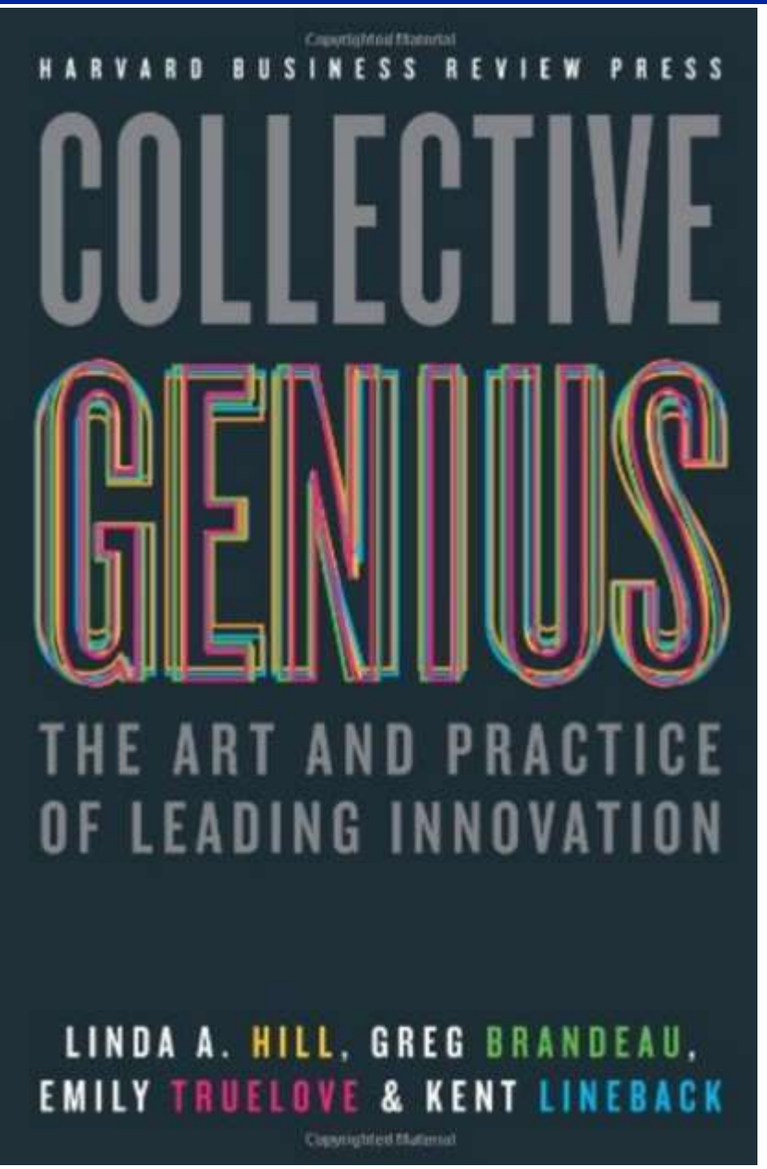


UC San Diego

QUALCOMM INSTITUTE

it²

Independent Analysis of Calit2:
Harvard Business School's Case Study on Calit2



HARVARD | BUSINESS | SCHOOL

9-411-105

JUNE 8, 2011

LINDA A. HILL

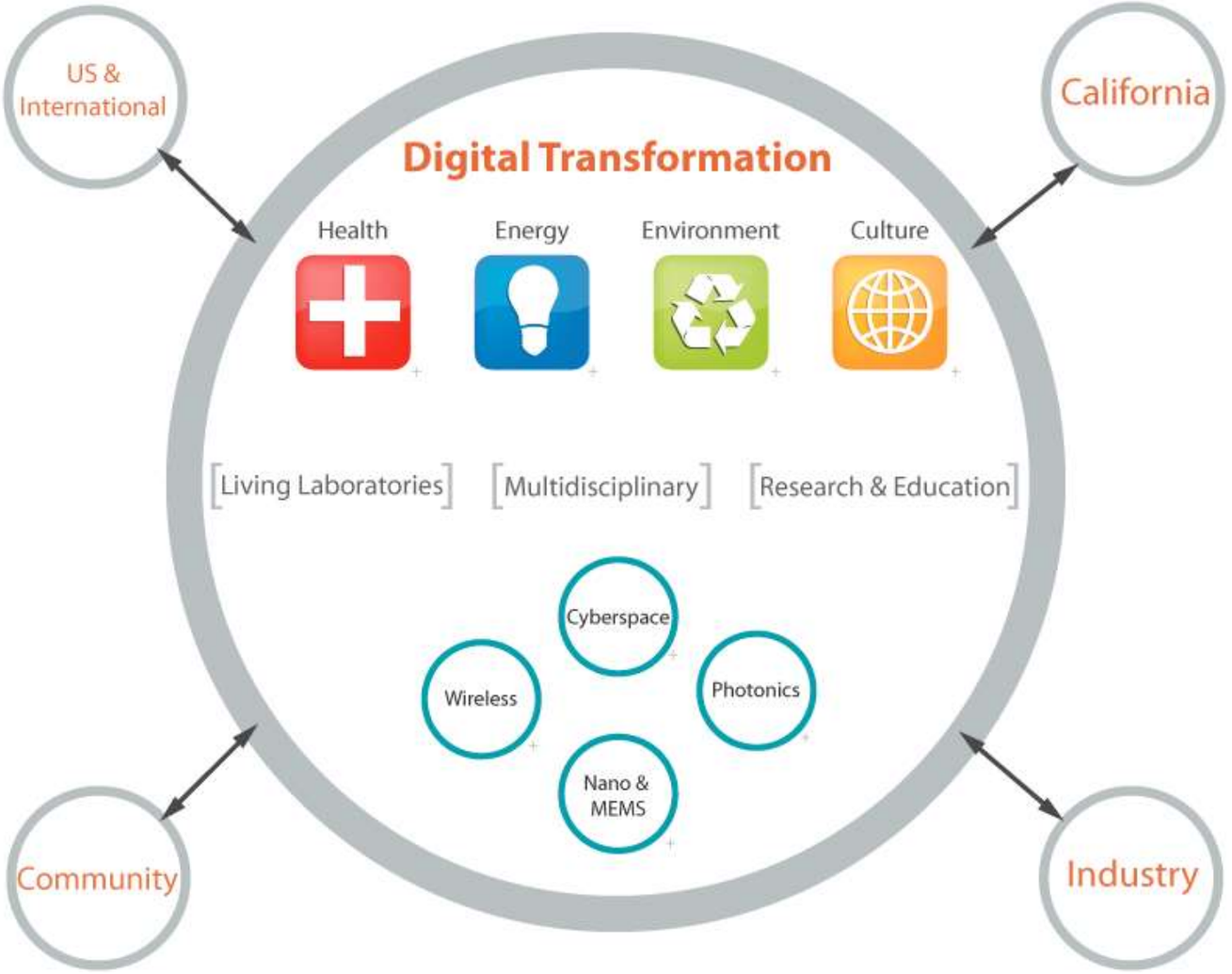
ALISON BERKLEY WAGONFELD

Calit2: A UC San Diego, UC Irvine Partnership

June 10, 2014

Re-Branding: Calit2 is a Framework for “Living in the Future” of the Digital Transformation of Society

2010



Calit2@UCI Public-Private Partnership in Measuring and Increasing House Appliance Energy Efficiency



















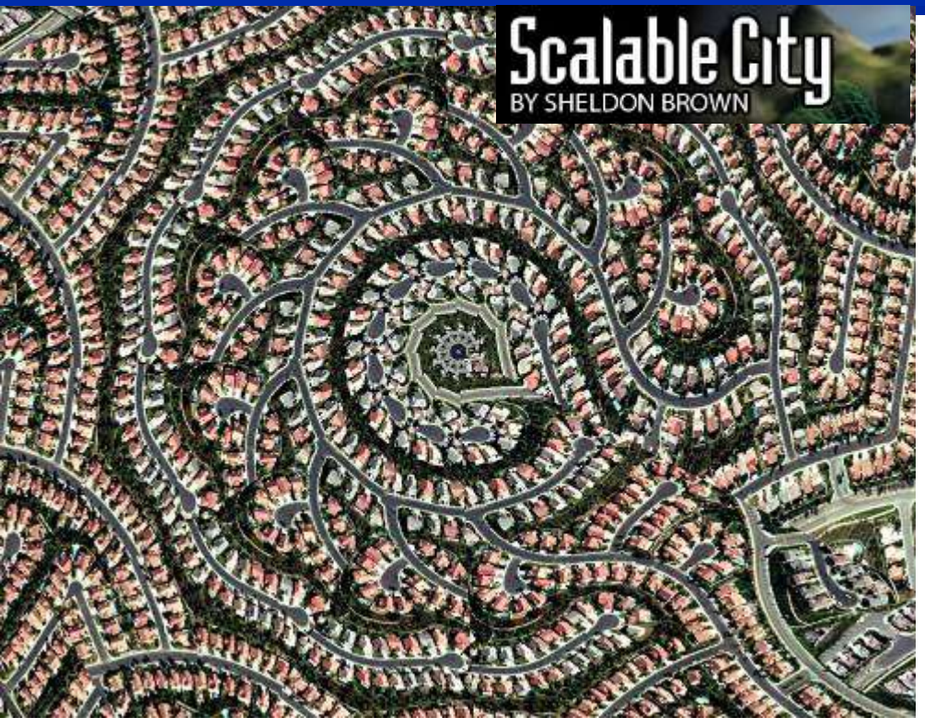








Calit2 Has Facilitated Deep Interactions With the Digital Arts on Both Campuses



The New York Times

Business Day

Technology

WORLD | U.S. | N.Y. / REGION | BUSINESS | TECHNOLOGY | SCIENCE | HEALTH | SPORTS | OPINIO

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

By JOHN MARKOFF
Published: November 5, 2005

SPECFLIC 1.0 – A Speculative Distributed Social Cinema by Adrienne Jenik



Bill Tomlinson, Lynn Carpenter UCI "EcoRaft"









Calit2 Qualcomm Institute Auditorium Aug. 11, 2014

SoCal's Santa Anna Wildfires: View From NASA's Aqua Satellite's MODIS Instrument

Calit2, SDSU, and NASA Goddard Used NASA Prioritization and OptIPuter Links to Cut time to Receive Images from 24 to 3 Hours



Moderate Resolution Imaging Spectroradiometer (MODIS)

NASA/MODIS Rapid Response

www.nasa.gov/vision/earth/lookingatearth/socal_wildfires_oct07.html

Project FireSight: San Diego County Board of Supervisors Funds Installation of 16 cameras on Mount Woodson and Red Mountain

October 26, 2010

Ron Roberts, San Diego County Supervisor



Digital San Diego County Developed by Jessica Block, QI; TourCAVE at Calit2's Qualcomm Institute



Howard Windsor, San Diego CalFIRE Chief

Using Calit2's Qualcomm Institute NexCAVE for CAL FIRE Research and Planning



Source: Jessica Block, Calit2

WIFIRE Prediction in Lilac Fire Dec 2018 in Collaboration with San Diego Airborne Intelligence Reconnaissance System (SDAIRS)



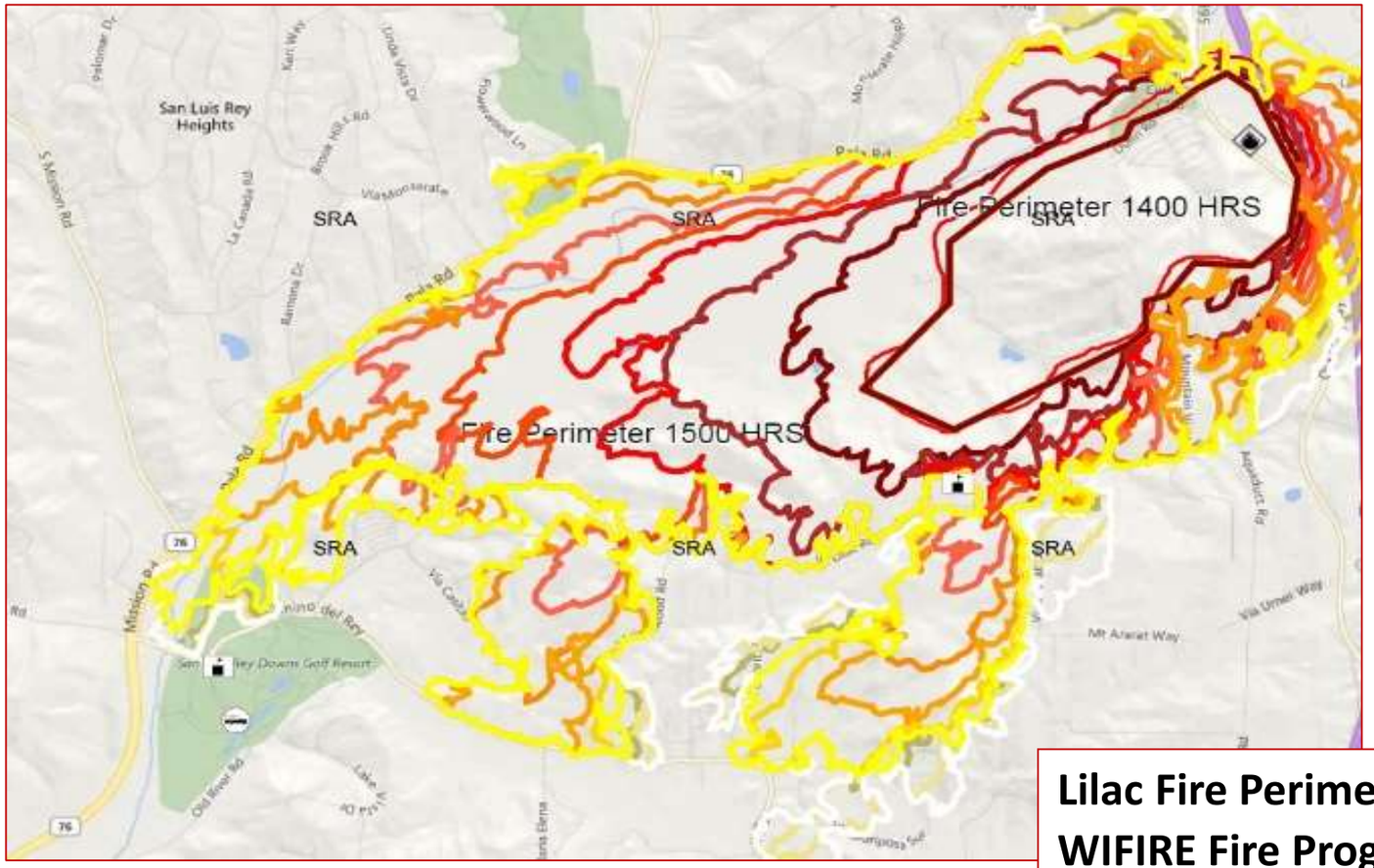
GENERAL ATOMICS AERONAUTICAL

SCOUT SITUATION AWARENESS & COLLABORATION TOOL

CITY of SAN DIEGO FIRE-RESCUE

WIFIRE

UNIVERSITY OF CALIFORNIA SAN DIEGO



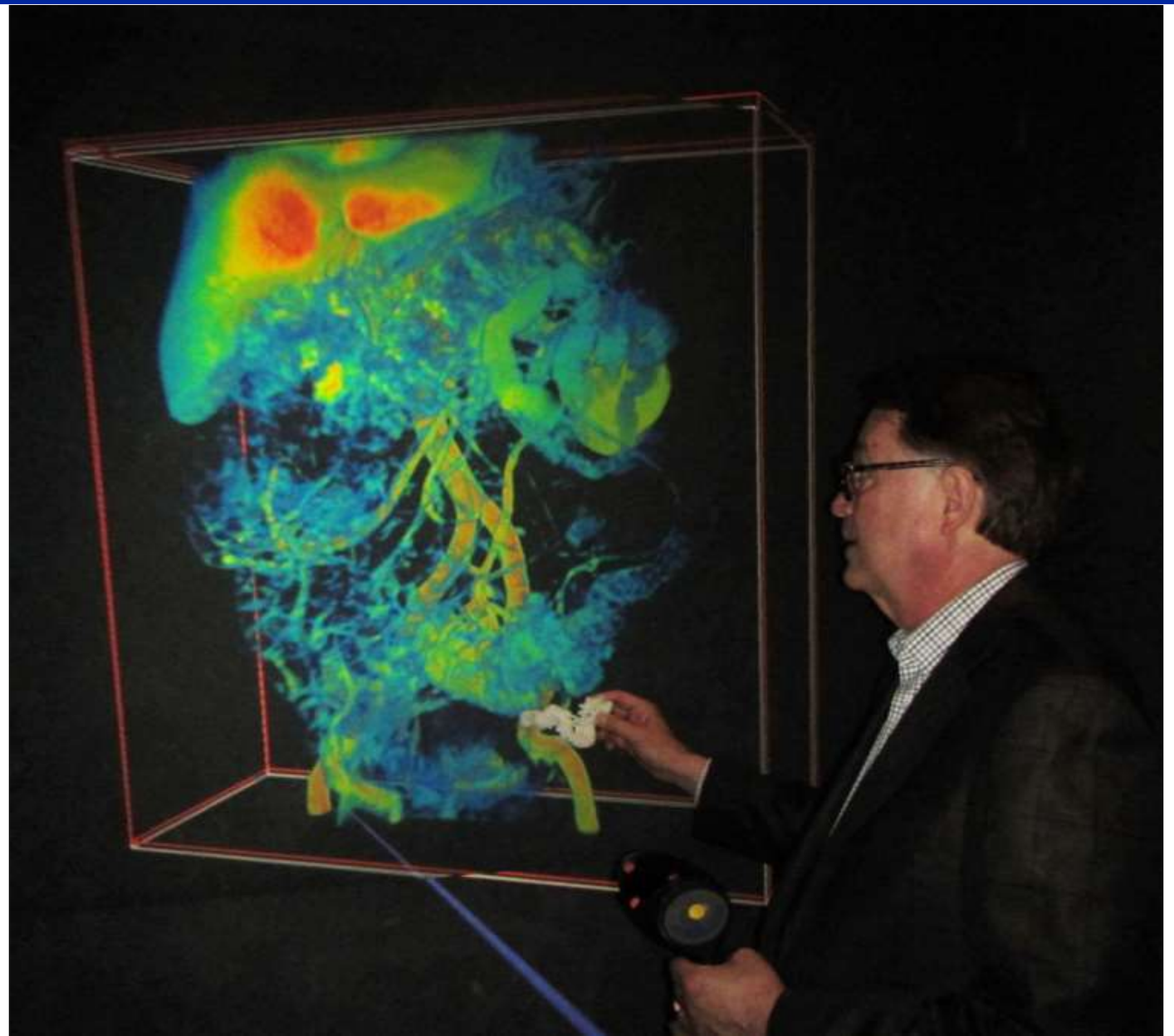
Lilac Fire Perimeter and WIFIRE Fire Progression Model in SCOUT



Source: Ilkay Altintas, SDSC; PI WIFIRE

3D Volumetric Visualization From MRI In Calit2 Virtual Reality StarCAVE

3D Volumetric Visualization Created by Calit2's Jurgen Schulze from January 2012 MRI



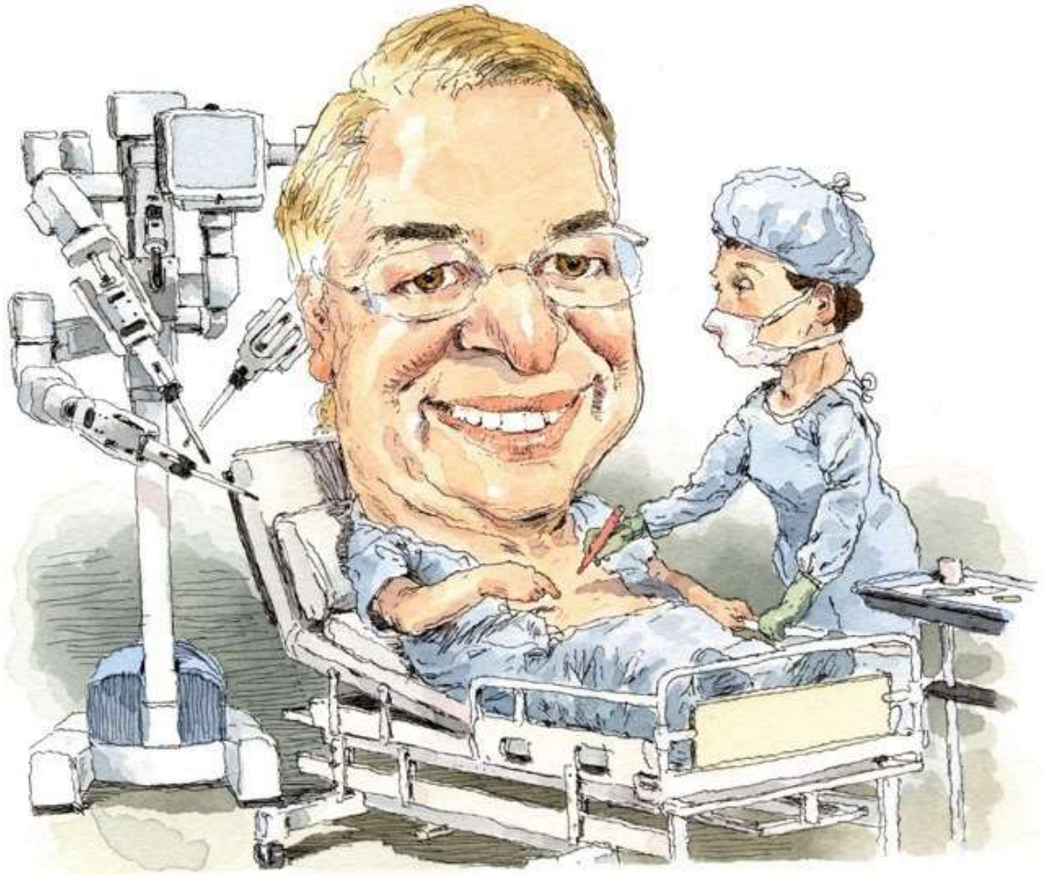
The Ability to See Inside Myself Eventually Led to My Co-Planning My Own Surgery

The Atlantic

The Man Who Saw Inside Himself

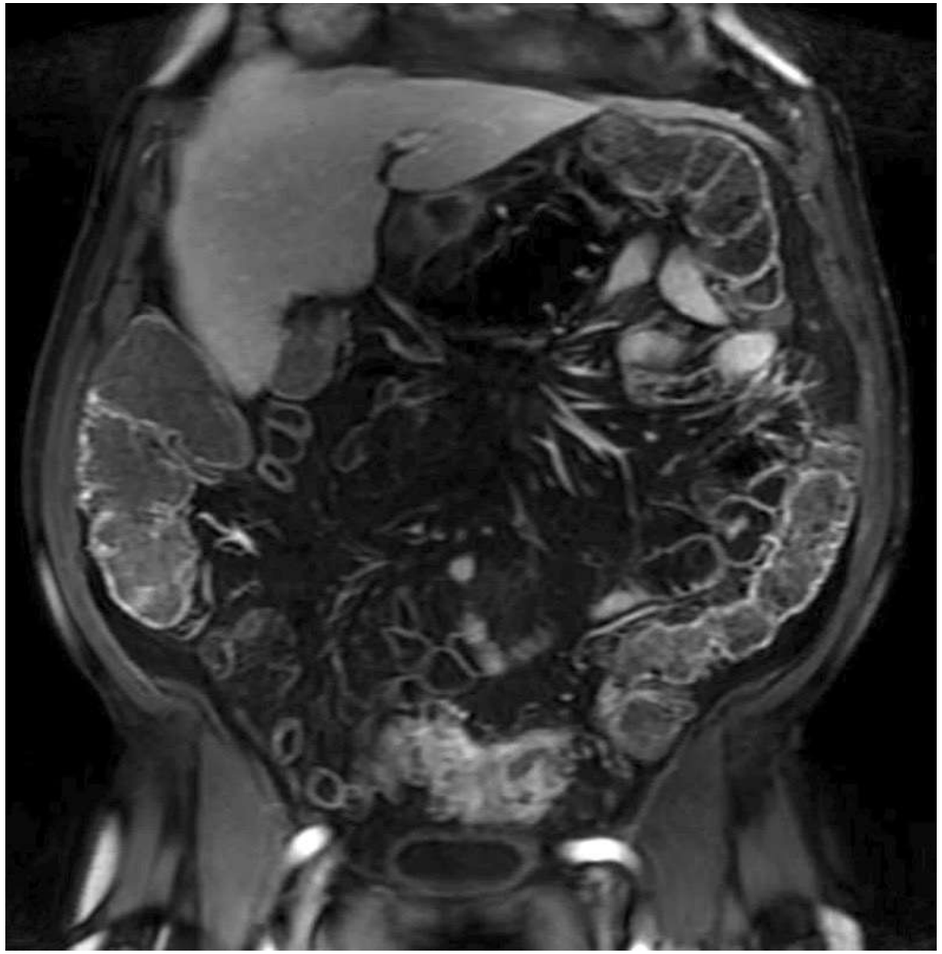
For years, Larry Smarr has used a supercomputer to monitor his health and peer at his organs. Recently, he used his knowledge to help direct his own surgery.

MARK BOWDEN | MARCH 2018 ISSUE | HEALTH

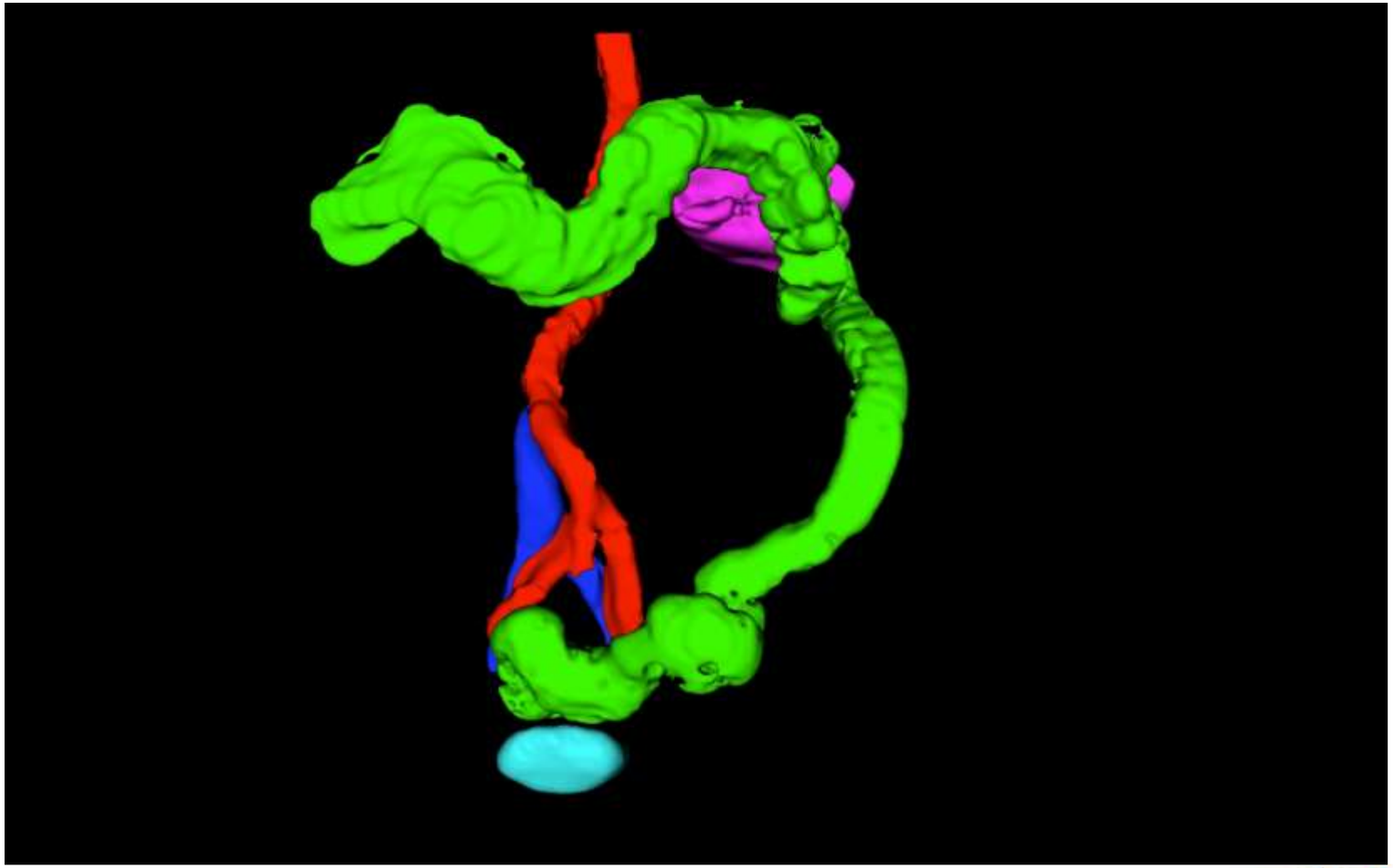


From Quantified Self to Quantified Surgery: Converting MRI Slices to 3D Organ Segmentation for Surgical Pre-Planning

Images of Dr. Smarr's Abdomen
To Support Sigmoid Colon Resection Surgery



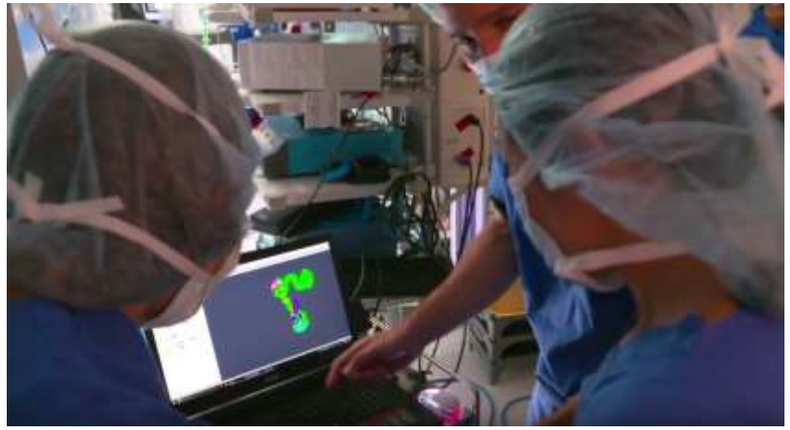
MRI Slice from Dr. Cynthia Santillan



3D Organ Segmentation Made by Dr. Jurgen Schulze from Dr. Santillan's 150-Slice MRI

Using QI Organ Segmentation in UCSD Operating Room on Tuesday November 29, 2016

Dr. Schulze Rotating 3D Organs To Match Up With da Vinci Arms and Internal Camera



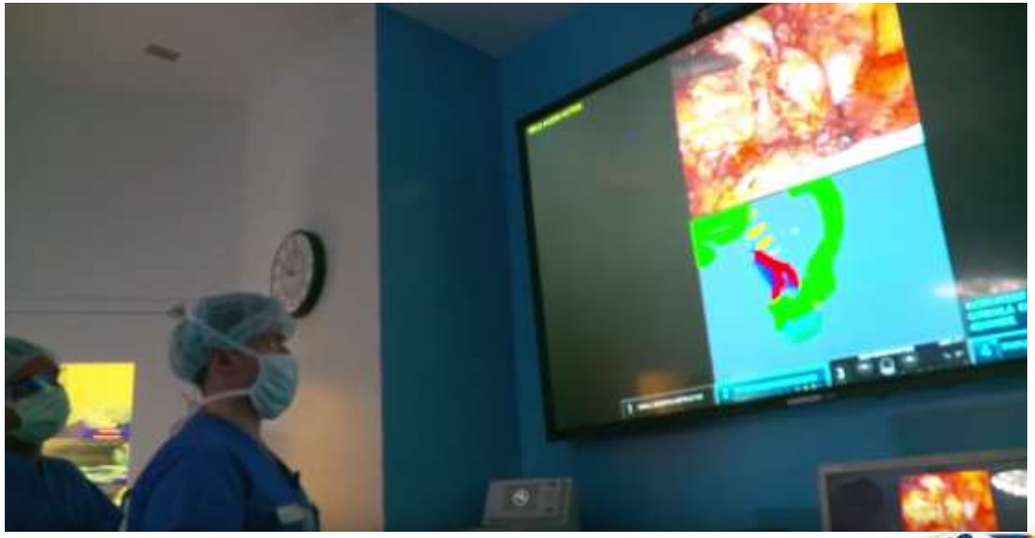


Patient Smarr With da Vinci Robot Arms Inside Him





Dr. Ramamoorthy Operating Da Vinci Xi Robot During Surgery



OR Team Using Large Screens To Watch Dr. Schulze's da Vinci Images

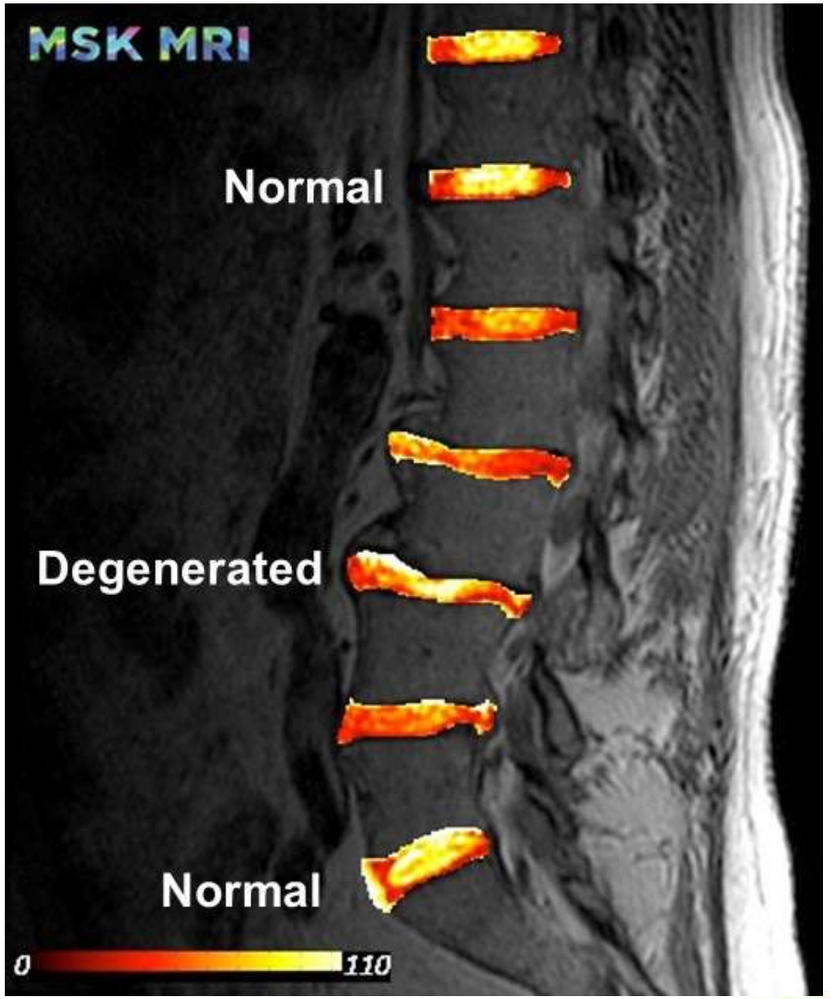
Collaboration With Christine Chung, M.D. on Advanced MRI: Adjusting T1/T2 to Bring Out Regions of Interest

T1 has contrast with fat bright (shows bone and alignment well)



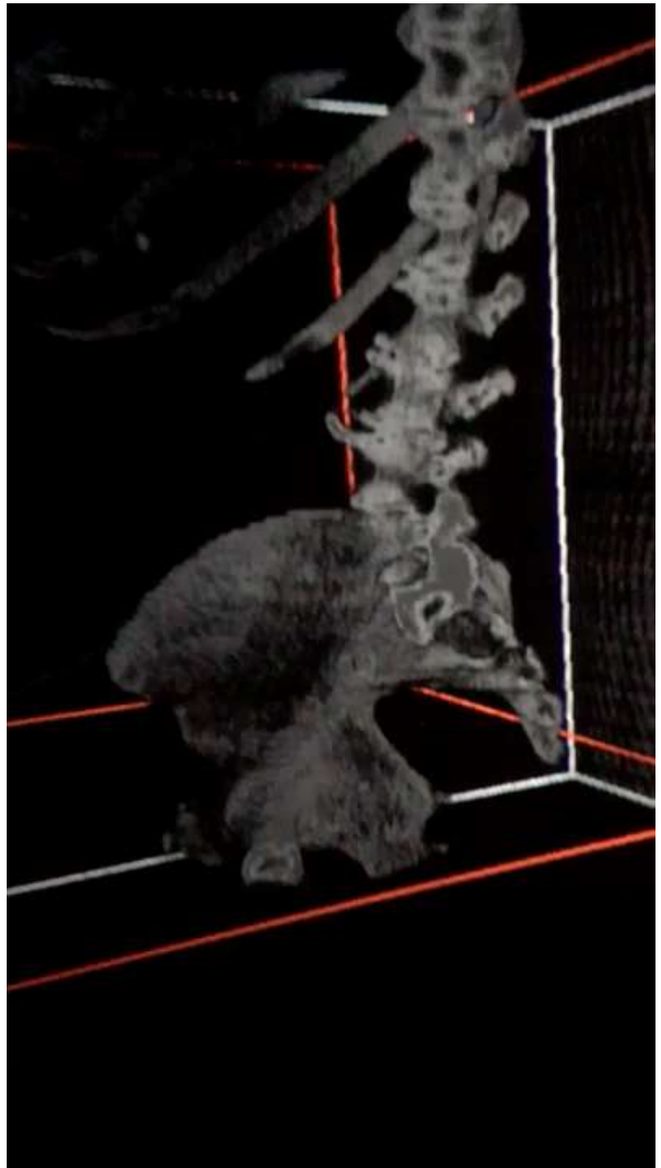
T2 with fat suppression: makes fat dark and fluid bright (emphasizes disc and fluid around spinal cord/roots)

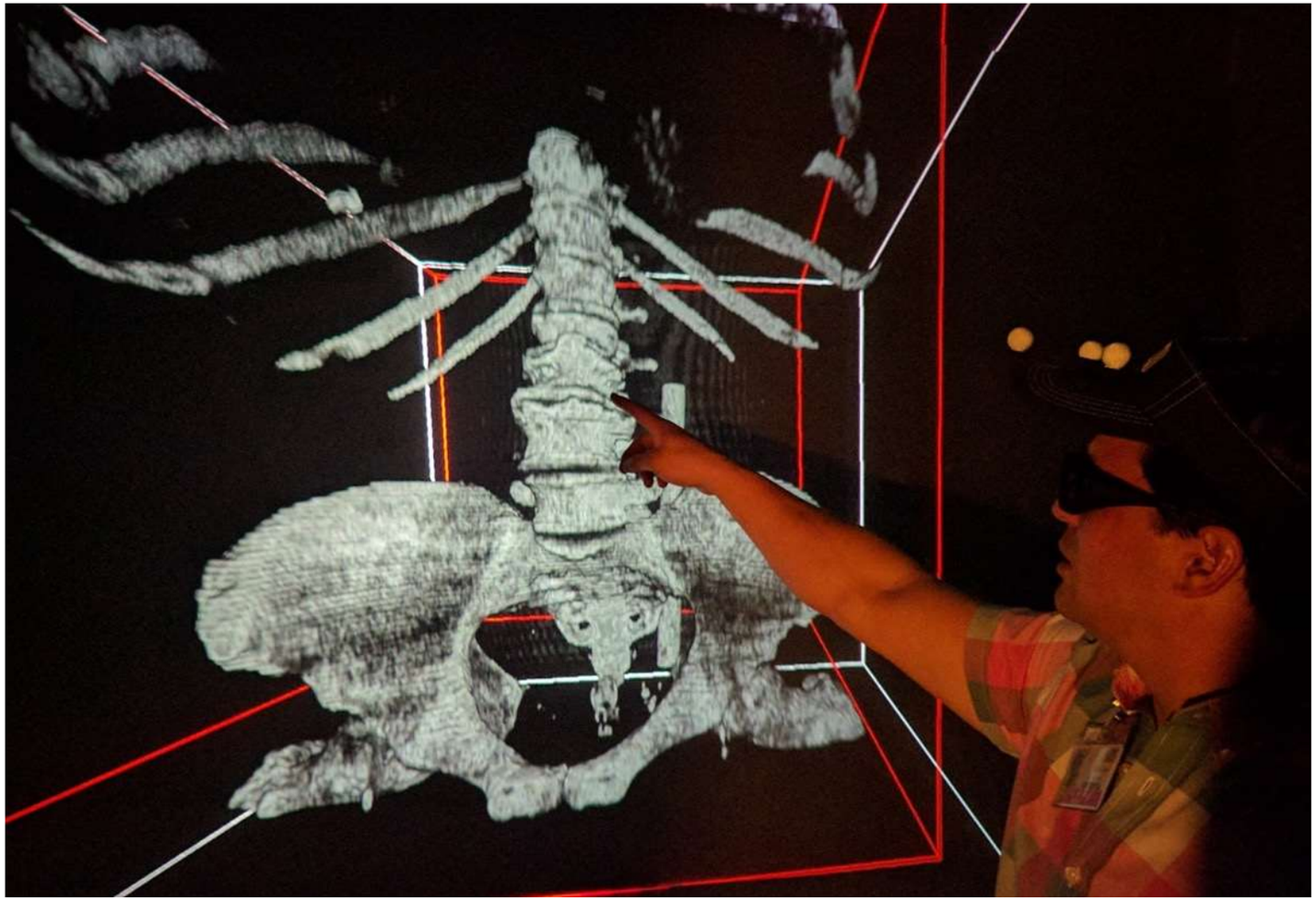




Images courtesy of Christine Chung MD, UCSD MSK Imaging Research Lab (www.MSKMRI.com)

Mike Kurisu Examining Larry Smarr's Spine in the Calit2 Virtual Reality CAVE





Visualizations from MRI by Jurgen Schulze, Calit2, UCSD

From Digitally-Enabled Future Patient to Digitally-Enabled Future Doctor

