CALIT2@UCSD

University of California, San Diego Division of the
California Institute for Telecommunications and Information Technology

In October 2005, the California Institute for Telecommunications and Information Technology (Calit2) dedicated the building that houses its headquarters and its UCSD division. The 215,000-square-foot building is home to a wide range of projects at the intersection of science, engineering, and the arts.

Consider these pages a floor-by-floor guide to the UCSD Division of Calit2—not just to its state-of-the-art facilities but also to the people who inhabit its labs and offices, conference rooms and research neighborhoods. You will meet a few of the 900 faculty, staff, graduate and undergraduate researchers working in the building, and the hundreds more at Calit2-related facilities across campus.

You will learn about specific projects underway, the industry partners and funding agencies contributing to Calit2's research enterprise, and how to get involved in our multidisciplinary research mission. We invite you to join us to...

collaborate.
innovate.
create.

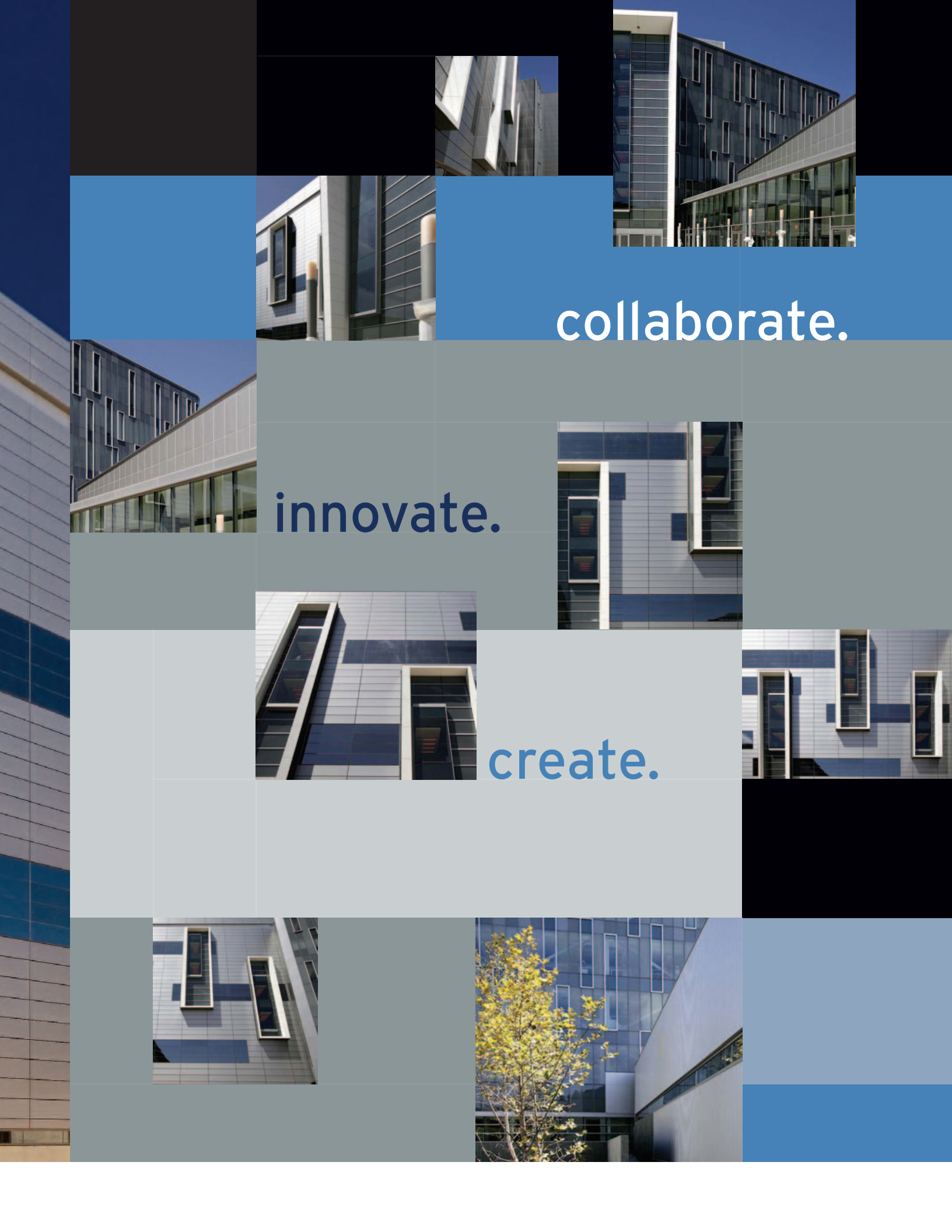

collaborate.
innovate.
create.

TABLE OF CONTENTS | CALIT2@UCSD

MESSAGE FROM THE DIRECTOR

In the new engineering courtyard, UCSD Division Director Ramesh Rao (right) and Associate Directors Leslie Lenert (left) and William Hodgkiss surround 370,000-pound "Bear" sculpture by artist Tim Hawkinson. Lenert is a professor in the School of Medicine and Hodgkiss in the Scripps Institution of Oceanography and Jacobs School of Engineering.

"Calit2 must always bring new value."

- Ramesh Rao

The UCSD Division of the California Institute for Telecommunications and Information Technology is investing intellectually and financially in multidisciplinary research that is relevant to society. We have done this first by partnering with virtually every department on campus to leverage the extraordinary talent UCSD has nurtured over the years, and then by acting as an 'enabler'—driving research and innovation in technologies that otherwise might not emerge from the strict confines of individual university departments.

Our new building is a physical manifestation of that multidisciplinary agenda. We have invested heavily in creating shared facilities, including clean rooms for nanofabrication, digital theaters for new media arts and scientific visualization, test and measurement labs for circuit design, smart spaces for experiments in augmented reality, transmission and networking testbeds for wireless and optical communications, and labs for designing systems on a chip.

We have also taken the road less traveled—juxtaposing people and programs in uncommon proximity to maximize the opportunity for experts from different disciplines to work together. Bioengineers work alongside computer scientists, visual artists next door to neuroscientists, electrical engineers down the hall from cognitive scientists, and so on.

Our professional researchers, program and project managers, and administrative staff complement our physical facilities. They help create and maintain this new infrastructure to support research, interface with industry partners, and connect with community organizations on dozens of projects. The layout of the open space and the matrix organizational structure are designed to present our partners with many interfaces for engagement and sustained explorations. Our goal is to encourage researchers to engage with colleagues inside the building, across campus, and around the world. We want the best to join us.

"Calit2 has set the gold standard for collaboration."
–Marye Anne Fox

With only a small number of permanent inhabitants, our building will accommodate a dynamic mix of projects in various stages ranging from startup to completion. As a project runs its course, teams make way for the next project—and possibly a whole new group of Calit2 researchers. This best-of-class breeding ground for new technologies is a fluid environment where teams can quickly re-form (or disband) in light of changing research imperatives.

We are only as good as the community that chooses to work with us. So Calit2 must always bring new value—whether providing opportunities for graduate and undergraduate students to work on novel research projects, or forging new links between industry partners and the campus community. Our facilities are open to the campus and we go where we think Calit2's depth of expertise can provide the most value within the larger context of harnessing information technologies and telecommunications to improve the competitiveness of the California economy and to benefit society.

- Ramesh Rao
Director, UCSD Division, Calit2
Prof, Electrical and Computer Engineering
Jacobs School of Engineering
QUALCOMM Endowed Chair in
Telecommunications and
Information Technologies

MESSAGE FROM THE CHANCELLOR

It has been thrilling for me to see the Calit2 building take shape on this campus. Perhaps more than any other academic endeavor, Calit2 boldly exemplifies UCSD's three pillars of strength: innovation, interdisciplinary scholarship, and international collaboration. As a scientist who has spent her career in higher education, I believe our research mission is a public trust that we fulfill best by collaborating across disciplines and sectors.

By teaming some of the nation's top scholars and researchers in telecommunications and information technology with leading California high-tech companies, Calit2 has set the gold standard for collaboration. The institute's facility at UCSD rallies faculty, researchers, staff and students from diverse disciplines around Calit2's vital mission: to ensure that California maintain its leadership in telecom, information technology, and the myriad sectors of the California economy—from engineering to medicine—that rely increasingly on the success of these technologies.

- Marye Anne Fox
Chancellor
University of California, San Diego

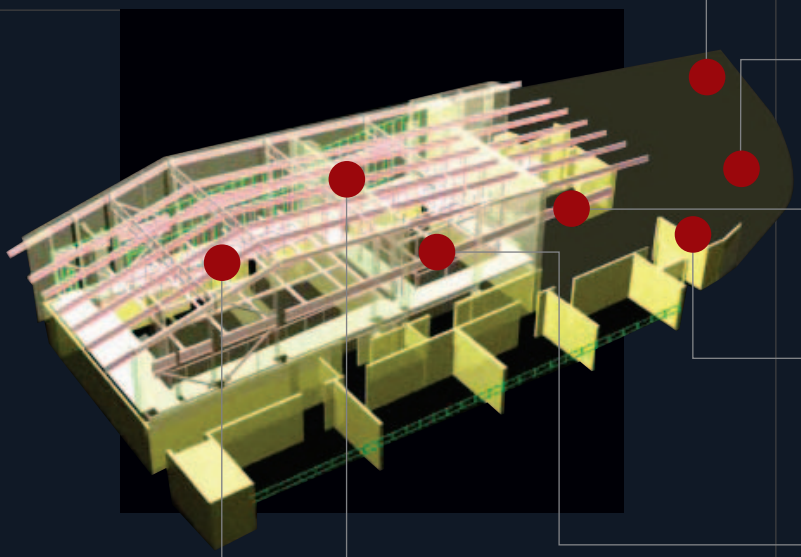
UCSD Chancellor Marye Anne Fox tours a networking and visualization demo at iGrid 2005, the first major workshop to be held in Calit2's new building in San Diego. At right: Calit2 Director Larry Smarr, who co-hosted iGrid with UCSD Division Director Ramesh Rao.

1

NEW MEDIA | EXPERIMENTAL GAME LAB

1ST FLOOR
ARTS WING

The technology and aesthetics of computer games are driving the development of computer graphics, visual communications, information infrastructures and much more. An entire wing of the new Calit2 building provides state-of-the-art facilities for audio, video and interactive arts research, including a motion-capture studio, audio spatialization lab, and virtual-reality space to prototype technologies for gaming in a 360-degree, total-immersion environment.



Center for Research in Computing & the Arts
Offices, guest studios and research neighborhood for CRCA and Calit2's New Media Arts activities. Nearby 3D Fabrication Lab.

Audio Spatialization Lab
Dedicated space for development of real-time computer music tools for performance and composition.

Immersive Visualization Lab
Multi-screen, multi-user virtual reality environment with access to large database visualization servers.

Performative Computing Lab
Studio for integrating the human body into digital media with telepresence, computer vision, motion capture and experimental human-computer interfaces.

'Black Box'
2-story, reconfigurable performance space for experiments with an audience's relationship to the physical environment and mediated elements.

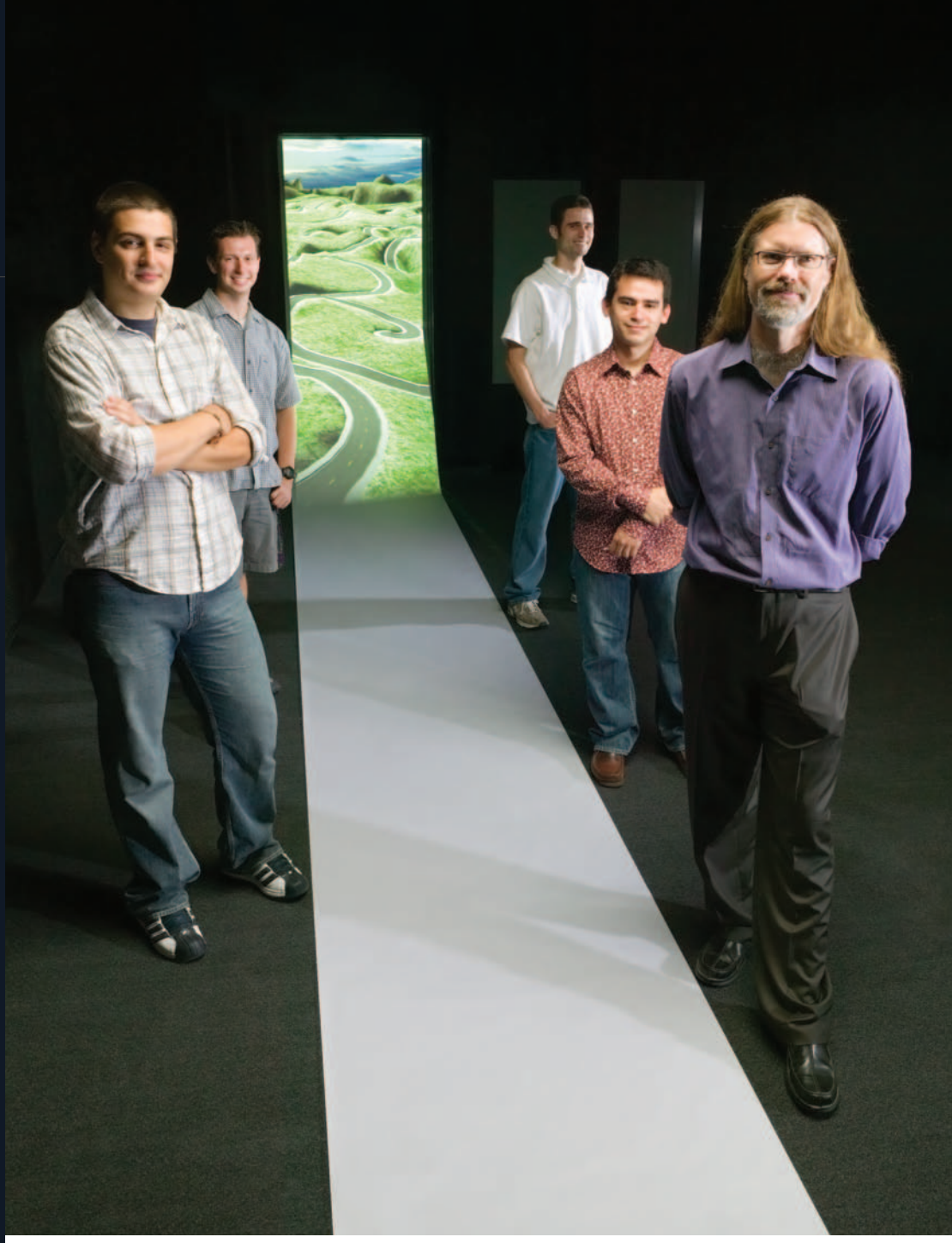
Art Gallery
~1,000-square-foot networked exhibition space to showcase world-class experimental art and prototype technology.

Digital Cinema
200-seat theater with ultra-high resolution video, 3D sound, stereo imaging and telepresence conferencing.

Visual artists and computer scientists in the Experimental Game Lab see games as tools for new forms of art. Lab researchers are working on next-generation game technologies and creating persistent and evolving multi-player online worlds built from procedurally defined assets.

The lab is developing new types of expressive forms for gaming, each as innovative as the next. To facilitate the creation of interactive artworks such as *Scalable City*, *Social Engines* and *Havoc*, the lab also builds custom software tools such as *ersatz* and *squint* that enable rapid development of content. Combining computer vision with computer modeling, researchers are inventing new approaches for the creation of the 3D graphic data for future game art forms.

Sponsors include **High Moon Studios**, **NDL, Inc.**, **Red Bull**, and **Criterion Software**.



Pictured (l-r): Experimental Game Lab staff researcher Alex Dragulescu; Calit2 Graduate Fellows Joey Hammer and Erik Hill; Visual Arts grad student Mike Caloud; and CRCA director Sheldon Brown.

"Culture at any time needs to have an effective, deeply engaging medium. Computer games may be the defining cultural form for the 21st Century."

- Sheldon Brown
Calit2 New Media Arts leader, and Director
UCSD Center for Research in Computing & the Arts (CRCA)

Pictured in 'bunny suits' (l-r): Integrated Nanosensors Lab director Ivan Schuller; undergraduate Casey Chiang; staff scientists and senior engineers Bernd Fruhberger and Maribel Montero; and Calit2 Undergraduate Scholar David Martin.

NANO | INTEGRATED NANOSENSORS

The Integrated Nanosensors project is an interdisciplinary effort that closely reflects the interests and philosophy of Calit2. Physicists, chemists, biologists, engineers, as well as material and computer scientists are working together on basic research. They aim to put as many as millions of nanoscaled sensors on a single chip, including power sources and limited computational capabilities. Researchers operate cooperatively in addressing all aspects of the problem, and if they are successful, this basic research could have a lasting impact on a variety of areas including artificial intelligence, national security, medicine, and environmental monitoring.

Novel materials, new device geometries, fabrication of devices using nanolithography, new software development, and powering are just some of the central issues that scientists and engineers are tackling. To do so, they need access to state-of-the-art facilities that are generally not available to a single investigator's lab. The clean-room wing of Calit2's building at UCSD serves as a focal point for this research. The Nanoscience lab, in particular, enables the fabrication of devices structured at the nanoscale. This combination of top-flight facilities and multidisciplinary science and engineering also serves as a training ground for a new generation of scientists and technologists.

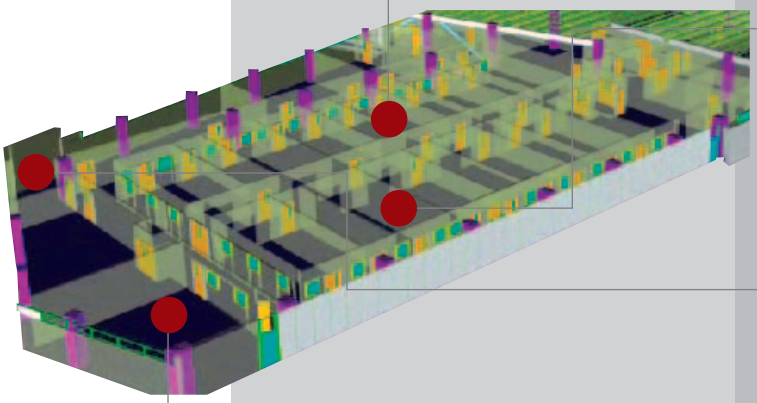
Sponsors include the **Air Force Office of Scientific Research** and **Department of Defense Multidisciplinary University Research Initiative.**

"This project is imitating nature in trying to develop something akin to skin or a nose in which millions of sensors, of a few different types, cooperatively detect several physical and chemical stimuli."

- Ivan Schuller
Professor, Physics
PI, MURI Integrated Nanosensors Project

1

1ST FLOOR
CLEAN ROOM WING



Class 100 Clean Room Modules: Nano/microlithography
Areas with no more than 100 particles larger than 0.5 microns per cubic foot of air. Facilities include e-beam lithography and photolithography modules.

Class 1000 Clean Room Modules: Nano/microfabrication
No more than 1,000 particles larger than 0.5 microns per cubic foot of air. Areas include metallization/thin film deposition, advanced dry etching, metrology, thermal and back-end processes.

Advanced Structural Characterization
Techniques include scanning electron microscopy (using electrons rather than light to form an image) and scanning probe microscopy. Ultrahigh vacuum surface analysis. Optical characterization.

OTHER FACILITIES INCLUDE:

Metal-Organic Chemical Vapor Deposition Facility
MOCVD technique used for thin film growth in advanced, compound semiconductors and nanostructures.

ARTIFICIAL INTELLIGENCE

MACHINE PERCEPTION LABORATORY (MPLab)

RUBI is a three-foot-tall girl robot. The acronym stands for Robot Using Bayesian Inference, a form of artificial intelligence that emphasizes probabilistic methods for learning and handling uncertainty in a principled manner. RUBI can detect the six basic facial expressions, and even distinguish voices by combining spatial and temporal processing. In an effort to learn more about real-time, robot-human interaction in everyday environments, MPLab researchers take 'her' to UCSD's Early Childhood Education Center, where they observe how pre-schoolers interact with and learn from her. And while the immediate focus of the project is on using robotics to enrich educational experiences, what researchers are learning could be critical to the development of a new generation of robots tailored to interact with humans.

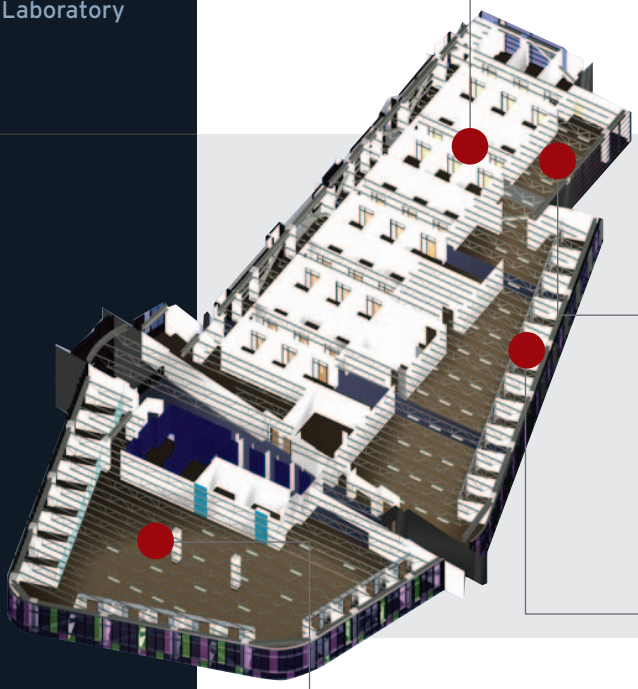
MPLab scientists at Calit2 hope to gain insights into how the brain works by developing embodied systems that solve problems similar to those encountered by the brain. The lab focuses on systems that perceive and interact with humans in real time, using natural—visual, auditory and tactile—communication channels. Developing such systems requires a multidisciplinary approach that combines mathematical modeling, machine learning techniques, computational modeling of brain function, and behavioral experiments.

Sponsors include **Sony Intelligence Dynamics Laboratory**, **UC Discovery Grant/IUCRP**, **NSF**, and **Department of Homeland Security**.

2ND FLOOR

"Computers are already powerful enough to sustain useful robots that interact and assist humans in everyday life. Now progress requires a scientific shakedown in goals and methods not unlike the cognitive revolution that occurred 40 years ago."

- Javier Movellan
Director
Machine Perception Laboratory



San Diego Supercomputer Center
Temporary offices for SDSC staff and researchers including the National Laboratory for Advanced Data Research (a partnership between SDSC and the National Center for Supercomputing Applications); Geographic Information Systems group; and NSF-funded Network for Earthquake Engineering Simulation's Cyberinfrastructure group.

Machine Perception Laboratory
MPLab's cross-disciplinary team of experts are based in the Department of Cognitive Science, Institute for Neural Computation, and Computational Neurobiology Laboratory.

SDSC/Calit2 Synthesis Center Administration
Office space for managers and staff of visualization and collaboration facility located on first floor of the Calit2 tower.

Visual Arts
Two Calit2-funded Visual Arts faculty work closely with engineers and scientists throughout the building. Natalie Jeremijenko is an acclaimed new media artist, and Ricardo Dominguez a self-professed 'artist and electronic civil disobedience pioneer'.

MPLab members (l-r): Cognitive Science undergrad Micah Rye and grad student Ian Fasel; founder and co-director Javier Movellan; co-director Gwen Ford Littlewort; research robot RUBI; associate research engineer Jacob Whitehill; and co-director Marian Stewart Bartlett.

LIFE SCIENCES | HAP WEBSERVER AND VISIBLE CELL

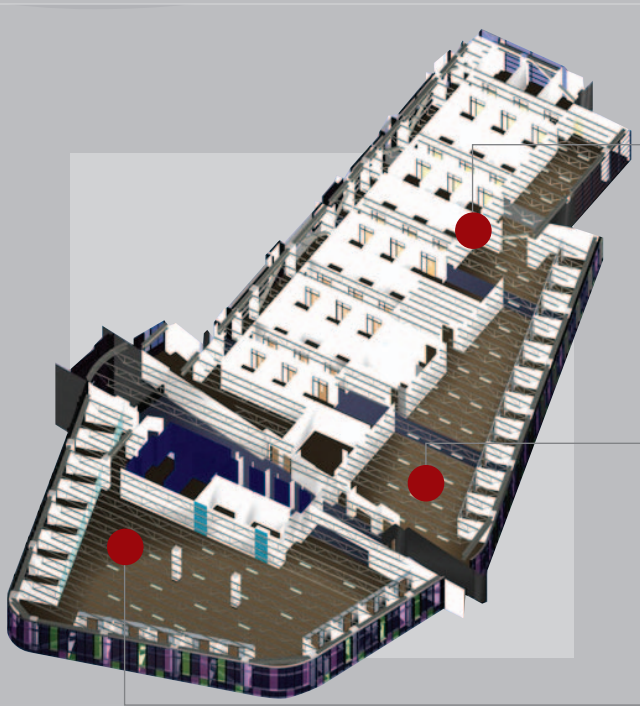
3

3RD FLOOR

Computer scientists, biologists, electrical engineers, chemists and others work side by side in Calit2 to apply novel information technology solutions to fundamental challenges in medicine and health.

More than a dozen projects are located on the third floor, including the HAP Webserver and related research. Calit2 hosts the Internet service, which simplifies a computational task to predict the human variation on each chromosome (as opposed to what is collected by scientists using high-throughput technology, which mixes the information on both chromosomes). Scientists from around the world can now collect genotypes and upload their data to the site. The HAP Webserver then computes the 'haplotype phasing' information and partitions the genotypes into blocks, or regions, of limited diversity.

The Visible Cell project will also become a valuable resource for scientists worldwide, by improving our understanding of extremely large cells—such as those of the nervous system and muscles—where there are gaps of knowledge through the cascading scales or uncharted territories in biological systems. Calit2 is teaming with the Center for Research in Biological Systems on the Visible Cell project to enable multi-scale study of these cells from their overall structures to



Bioinformatics, Computational and Systems Biology

Bioengineering professors Trey Ideker and Shankar Subramaniam as well as Computer Science and Engineering professor Eleazar Eskin team with colleagues from SDSC, Jacobs School of Engineering and Department of Chemistry and Biochemistry on emerging areas of research including the genetic basis of human disease and integrative network biology.

Center for Research in Biological Systems

The organized research unit encompasses a number of projects located wholly or in part at Calit2: Joint Center for Structural Genomics; National Biomedical Computation Resource; Biomedical Informatics Research Network; and the Visible Cell project of the National Center for Microscopy and Imaging Research.

San Diego Supercomputer Center

Two large research groups of SDSC will maintain temporary operations on Calit2's floor dedicated to the life sciences, including: Protein Data Bank, the single worldwide repository for the processing and distribution of 3D biological macromolecular structure data; and Bio/Biomed programs led by senior research scientist Lynn TenEyck.

their smallest, specialized components. The project pulls together researchers from nearly every domain of biology and biomedicine, along with experts in computing, the arts as well as computer scientists with expertise in databases, computing, networking, and graphics. Many participants work on other Calit2-affiliated projects, including the Biomedical Informatics Research Network, the flagship CRBS and Calit2 project funded by the National Institutes of Health.

Sponsors include **NIH, NSF, Department of Energy** and private foundations.

"The HAP Webserver is a great example of the revolution in computational biology and its potential benefits to society as we use it to study conditions thought to result from a complex interplay of multiple genetic and environmental factors."

- Eleazar Eskin
Asst Prof in Residence, Computer Science and Engineering

"The Visible Cell project constitutes the kind of grand challenge that Calit2 is well-designed to address: an inherently complex problem of direct and applicable significance to human life."

- Mark Ellisman
Professor, School of Medicine

Front (l-r): HAP Webserver principal investigator Eleazar Eskin and CRBS director Mark Ellisman. Back (l-r): National Center for Microscopy and Imaging Research and CRBS Executive Director Steve Peltier; bioinformatics Ph.D. candidate Juan Rodriguez; biology grad student and bioengineer Lisa Fong; computer science Ph.D. student Hyun Min Kang; postdoc computational biologist/applied mathematician Edgar Garduno; bioinformatics Ph.D. candidate Noah Zaitlen; and Grace Osborne, special projects coordinator and assistant to the CRBS director.

SOFTWARE

SERVICE-ORIENTED SOFTWARE AND SYSTEMS ENGINEERING LABORATORY (S3EL)

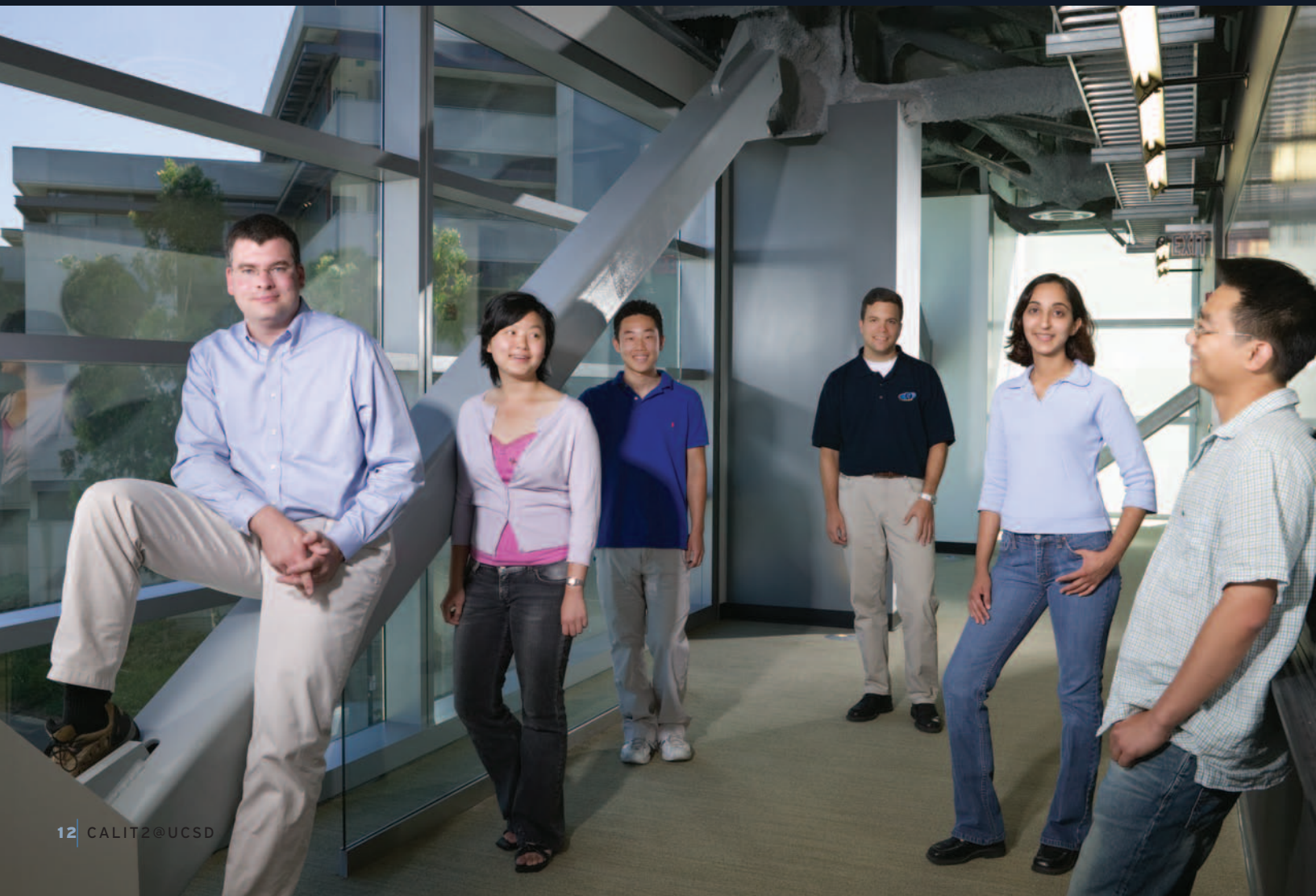
Software systems are becoming increasingly distributed and reactive. In the future they will be formed by composing individual–even personalized–software services running on any type of computing platform, ranging from large servers to small electronic control units in cars. Thus, software architecture and systems integration are essential to every project involving new technology. Together with the Software and Systems Architecture and Integration Team (SAINT), S3EL researchers provide those services and architectures to many projects within Calit2, including RESCUE, Runes and BioNet.

The team is creating, documenting, validating, verifying and implementing architectures for homeland security projects which demand flexibility, security, safety, scalability and robustness.

Researchers have also focused on automotive systems with limited resources but high demand for correctness and quality of service, and business information systems with complex user interfaces and flexible data and process integration tasks.

Working toward a methodological basis for service-oriented software, the researchers develop and use cutting-edge modeling and implementation technologies and apply them in industry and academic settings. The goal: to provide a service notion that is concise, descriptive, and traceable across the entire development process—from the capture and analysis of requirements, to design and implementation.

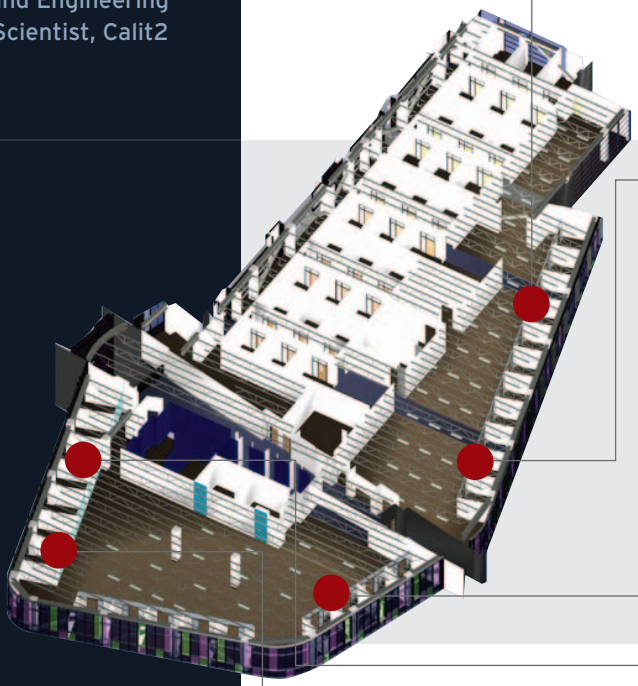
Sponsors include **Ford Motor**, **Toyota InfoTechnology Center**, **UC Discovery Grant/IUCRP** and **NSF**.



"The popularity of today's client/ server-based Internet applications, set-top boxes, cellular phones, PDAs and handheld computers points to the huge potential of highly distributed, interacting, service-oriented software systems."

- Ingolf Krueger
Director, S3EL/SAINT
Asst Prof in Residence, Computer Science and Engineering
Research Scientist, Calit2

4 4TH FLOOR



Pictured (l-r): Principal Investigator Ingolf Krueger; CSE graduate student Yenny Rusli; Calit2 Undergraduate Scholar Gunny Lee; Calit2/SAINT researcher Michael Meisinger; CSE graduate students Roshni Malani and To-Ju Huang.

Center for Networked Systems
CNS is a university-industry partnership with 20-plus engineering faculty who do fundamental research and technology development for robust, secure, and open networked systems. Corporate members include AT&T, Alcatel, Hewlett-Packard, QUALCOMM and Sun Microsystems.

Advanced Network Sciences Group
Research projects focused on theoretical aspects of communication network performance analysis, including random networks, distributed control, and statistical multiplexing.

Information Theory and Applications Center
New center at Calit2 with 25 faculty from six departments. Applications range from compression, communication, and error correction to bioinformatics, neuroscience, data mining, machine learning, cryptography, and finance.

Circuits Group
Calit2 collaboration with Center for Wireless Communications research teams for development and testing of wireless circuits.

Tactical Mobile Ad-Hoc Networks
Calit2 investigators at UCSD and UC Irvine are part of this six-university initiative on space-time processing for tactical mobile ad-hoc networks. Funded by DoD's Multidisciplinary University Research Initiative.

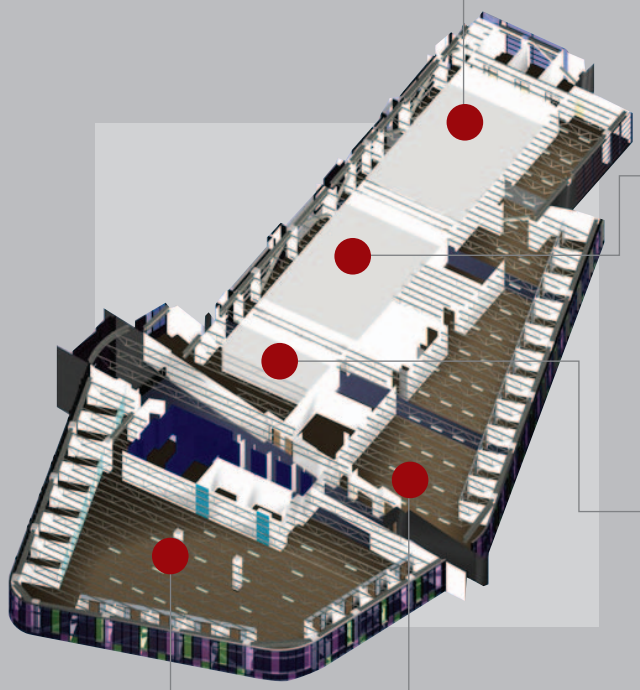
5

5TH FLOOR

WIRELESS | ADAPTIVE SYSTEMS

The Adaptive Systems Lab was one of the first large-scale projects developed from scratch within Calit2. Launched in 2002, it has a strong track record of innovation in wireless networking and has become an institute benchmark for successful industry partnership and commercialization. From the start, industry partner Ericsson dispatched several company researchers to work in the lab on a full or part-time basis. Since then Calit2 and Ericsson engineers jointly have worked on wireless communications systems that adapt dynamically to their environments. They have also developed the building blocks for other Calit2 projects that depend on wireless networking and applications.

The Adaptive Systems project has also spawned spin-out companies



Millimeter-wave and Low-Noise Circuits Laboratory
World-class analog/mixed-signal/microwave/millimeter-wave circuits lab. Research includes intelligent RF, multiple-antenna systems (MIMO), ADCs, DACs, PPLs, LNAs, MEMS and sensors.

High-Power Amplifier Laboratory
High and low-power RF amplifier experiments for high efficiency and high linearity. DC/DC 'super' converter with very high 95% efficiency and versatile power sharing for maximum battery life and minimum cooling. Wireless protocol-aware battery management circuits for maximizing the useful bits transmitted and received by a wireless device under each charge and over the life of the battery.

Circuit Assembly Laboratory
Pre-production assembly and test of prototype circuits for large-scale demonstrations of wireless networks for telecommunications, telematics, sensors, safety and disasters. Production capabilities for building dozens of modules of requisite types for each system.

UCSD Division Administration
Office of the Director, administrative services, business office, communications, industry relations.

Calit2 Project/Program Management
Offices of project managers and support staff working on existing and prospective faculty-led research projects in Calit2.

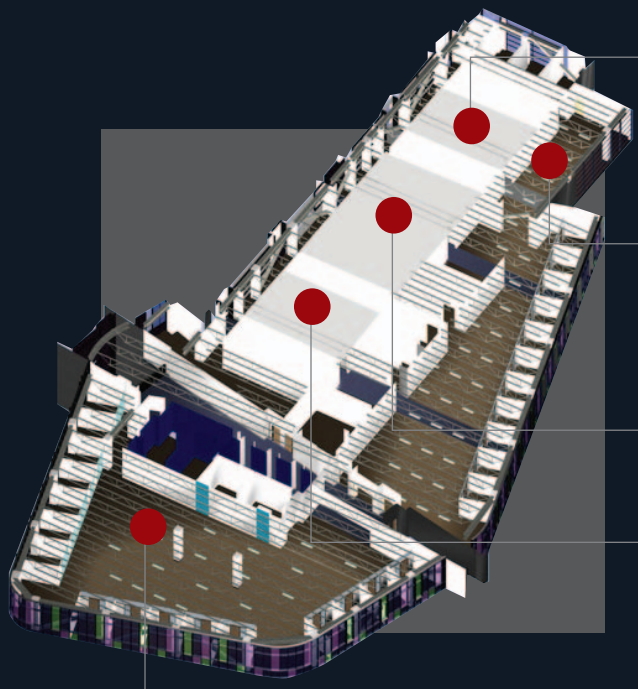
and technologies. In 2005, two of the lab's five founding faculty launched companies based on ideas germinated in the lab. With venture capital financing, Electrical and Computer Engineering professor Sujit Dey created Ortiva Wireless to develop and market systems for dynamically adapting data as a function of the type of network, device, and application being used. Separately, fellow ECE professor Rene Cruz and Calit2 researcher Cahit Akin launched Mushroom Networks. Mushroom's patent-pending technology can deliver increases in download speeds to residential users at low cost, through sharing of Internet access resources over local ad-hoc networks.

Sponsors include **Ericsson** and **UC Discovery Grant/IUCRP.**

Pictured (l-r): Postdoctoral researcher Mustafa Arisoylu; Ericsson researcher Rajesh Mishra; Calit2 project scientist and Mushroom Networks co-founder Cahit Akin; and ECE professor Sujit Dey, CEO of Ortiva Wireless.

"Finding solutions that will create more order in a world of wireless heterogeneity is an important research challenge for the institute."

– Ramesh Rao
Director, UCSD Division, Calit2
Principal Investigator, Adaptive Systems



Systems-on-Chip Laboratory

SOC lab provides infrastructural support for hardware/software platforms, including CalRadio, and research on networking protocols and embedded processing for mobile applications.

Undergraduate Research Laboratory

This lab supports undergraduate research as part of senior-level, project-based courses as well as the Calit2 Scholars summer research program.

Photonics and OptIPuter Laboratory

Photonics research and OptIPuter network infrastructure development.

Wireless Platforms Laboratory

Current platforms under development and test include portable software defined radio, bench-top software defined radio, wireless pulse oximeter, wireless/paperless patient tag, ground-based wireless mesh network nodes, wireless smart-door control, wireless patient drug dosage monitor, and UAV-based wireless mesh network nodes.

Calit2 Academic Professionals

Calit2 staff researchers range from recent Ph.D. graduates to seasoned engineers from the private sector.

6 6TH FLOOR

Pictured (l-r): WIISARD researchers include principal investigator and School of Medicine professor Leslie Lenert, computer science Ph.D. candidate Neil McCurdy, and Calit2 principal development engineer Doug Palmer. RESCUE researchers include former Calit2 Scholar and now Calit2 staff researcher Javier Rodriguez Molina, Calit2 staff researcher B.S. Manoj, and Alexandra Hubenko, project manager at UCSD.

"The current technologies supporting acute field care for victims of disasters are simply inadequate. The new technologies deployed by WIISARD bring cutting-edge wireless Internet technologies from the hospital to the mass-casualty field treatment station."

- Leslie Lenert, M.D.
Assoc Dir, Biomedical Informatics
UCSD Division of Calit2
Principal Investigator, WIISARD
Professor, School of Medicine

EMERGENCY RESPONSE

RESCUE AND WIISARD

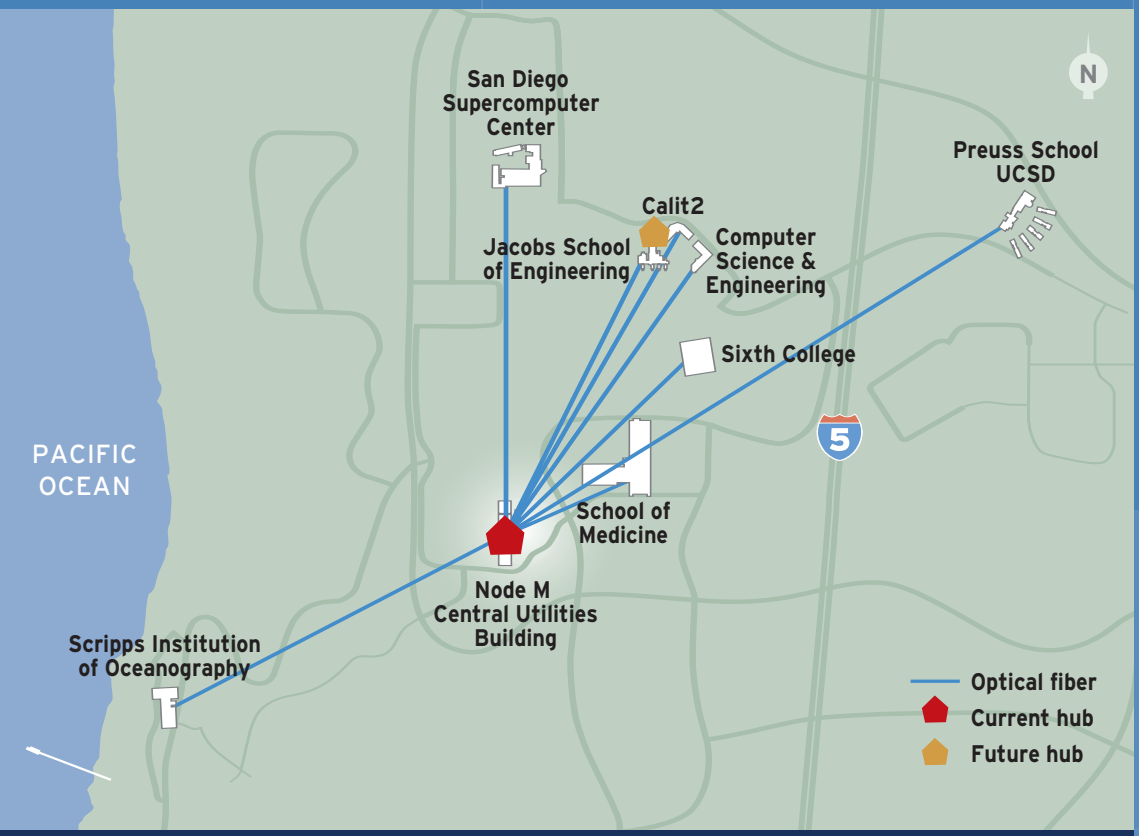
In the wake of 9/11, Calit2 launched a multidisciplinary effort to harness technology for improved response to natural and man-made disasters.

Responding to Crises and Unexpected Events (RESCUE) is a partnership between the UC Irvine and UC San Diego divisions of Calit2. The goal: radical transformation in the ability of first responders to collect, analyze, share, and disseminate critical information to enable rapid and effective crisis response. The early focus is on situational information—including the state of civil, transportation, and information infrastructures—and resource availability (medical facilities, law enforcement, and more). Calit2 researchers are developing scalable, robust information technology solutions that provide the real-time data needed by emergency officials to assess damage and make decisions.

The Wireless Internet Information System for Medical Response in Disasters (WIISARD) uses sophisticated wireless technology to coordinate and enhance in-field care of mass casualties in disasters. The project aims to provide emergency personnel and disaster command centers with medical data to track and monitor the condition of hundreds or thousands of victims on a moment-to-moment basis over a period of hours or days after a disaster. Working closely with the first-responder community, Calit2 researchers are prototyping a series of wireless-enabled technologies and testing them in full-scale disaster drills.

Sponsors include **NSF** (RESCUE) and **NIH's National Library of Medicine** (WIISARD).

AROUND THE CAMPUS



NETWORKING
OPTIPUTER

A powerful distributed cyberinfrastructure to support data-intensive scientific research and collaboration, the OptIPuter ushers in an era of what some call 'supernetworking.' Under principal investigator and Calit2 director Larry Smarr, a broad multidisciplinary team led by UCSD and the University of Illinois at Chicago is conducting large-scale, application-driven system experiments with data-intensive e-science efforts in the Earth sciences and biomedical imaging. The OptIPuter project exploits a paradigm shift in which the central architectural element of cyberinfrastructure is optical networking, not computers. In San Diego, OptIPuter researchers as well as visualization, compute and storage clusters at eight locations scattered across campus (map above) are linked by an optical-fiber network. The infrastructure permits 10-Gigabit-per-second 'lightpaths' through a central hub (which will migrate to Calit2's new server room in 2006). The network also provides an on-ramp to advanced research networks linking UCSD to UC Irvine and other locations in California, Chicago, and international hubs.

Sponsors include **NSF**, corporate partners and international affiliates.

TRANSPORTATION & SECURITY
COMPUTER VISION AND ROBOTICS RESEARCH LAB

Located in the SERF building, CVRR is the center of Calit2 activity at UCSD in intelligent transportation and telematics. Its Laboratory for Intelligent and Safe Automobiles (LISA) is a multidisciplinary effort based on computer vision to make future cars safer and smarter, with experimental platforms based on the Infiniti Q45 and VW Passat. On the homeland security front, CVRR received one of the first federal counter-terrorism grants after 9/11 to develop distributed interactive video arrays (DIVAs) for homeland security. These arrays of cameras and processors work cooperatively and automatically, and use pattern-recognition and handoff techniques to 'observe' a scene. In August 2005, CVRR completed a testbed to explore Systems for Human Interactivity Visualization and Analysis (SHIVA), which permit observation and analysis of human activity in spaces ranging from smart rooms and cars to public spaces.

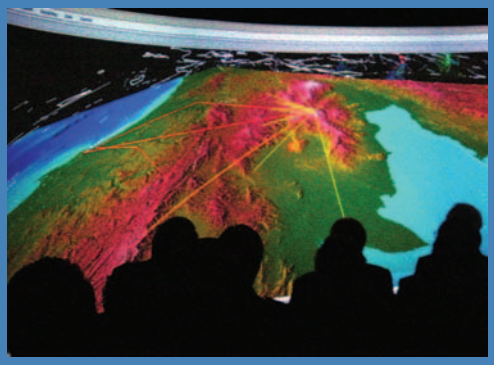
Sponsors include **Nissan Motor**, **VW-Audi**, **DaimlerChrysler**, **Technical Support Working Group**, and **Department of Homeland Security**.

MEDICINE

MULTIMEDIA TELEMEDICAL DIAGNOSTIC SYSTEM

Launched in 2003, this project—dubbed StrokeDoc—teams Calit2 with the UCSD School of Medicine and corporate partners BF Technologies and QUALCOMM. The vast majority of stroke victims never receive a potentially life-saving treatment because it must be administered within three hours of a stroke's onset. To speed diagnosis by trained stroke specialists, StrokeDoc allows an on-call UCSD Stroke Center specialist with a laptop to participate remotely in an examination of a suspected stroke victim at a community hospital emergency room. The specialist can then advise the ER doctor on whether the patient is a good candidate for the clot-busting therapy. The system involves advanced video compression and synchronization technologies as well as techniques to guarantee quality of service for real-time video and medical telemetry over IP networks. Engineers at BF Technologies developed StrokeDoc in collaboration with UCSD neurologists, with Calit2 creating the synergy that brought the partners together.

Sponsors include **NIH's National Institute of Neurological Diseases and Stroke.**



EDUCATION

ACTIVECAMPUS

An experiment in community-oriented ubiquitous computing, ActiveCampus aims to provide location-based services for educational networks. The project also explores how such systems can be used. Its flagship application, ActiveCampus Explorer, uses a person's location and the location of buildings and other users to engage the student in campus life more fully. ActiveClass enables collaboration between students and professors by serving as a visual moderator for classroom interaction. CSE professor Bill Griswold is now developing a potential commercial application called ActiveCity. Running on a mobile phone, the software would keep the user apprised of nearby opportunities based on his or her location, time, day and personal profile (e.g., 'pushing' a today-only coupon to the cell phone if it's noon and the consumer is two blocks from a fast-food restaurant offering the coupon). The Jacobs School's von Liebig Center is funding an operational demonstration of the technology.

Sponsors include **Hewlett-Packard, Microsoft** and **The von Liebig Center for Entrepreneurism and Technology Advancement.**

EARTH SCIENCE

CENTER FOR EARTH OBSERVATIONS AND APPLICATIONS

Based at the Scripps Institution of Oceanography, this new center supports many of the researchers at Scripps who collaborate with Calit2 on Earth science projects such as the Laboratory of Ocean Observation Knowledge Integration Grid (LOOKING), the Scripps Visualization Center, and ROADNet. CEOA's mission is to stimulate, support, and coordinate multidisciplinary activities in Earth observations at UCSD. The center is led by longtime Calit2 participant John Orcutt, Deputy Director of Scientific Affairs at Scripps. The two institutions are also talking with the Jacobs School of Engineering to explore the possibility of developing a pool of engineers and technical personnel to promote the availability of specialized and high-end engineering expertise.

Sponsors include **NSF**, **UCSD** and others.

WORKING WITH INDUSTRY

From its inception, Calit2 has emphasized dialogue and partnership with industry. We are here to help make California companies more competitive in the global innovation economy.

In the preceding pages, you've seen the variety of companies which are already partnering with us. They are large and small, established and emerging, public and private. So how do they and other industry partners benefit?

- **Sponsored Research:** Working with private sector researchers, Calit2 faculty collaborate to develop research projects that are of academic interest to Calit2 and of strategic importance to industry.
- **Teamwork:** Calit2 pulls together teams to tackle multidisciplinary challenges beyond the reach of most companies acting on their own.
- **Training the Workforce of Tomorrow:** Through a variety of mechanisms (sponsored research, internships, fellowships) Calit2 industry partners work with both graduate and undergraduate students at UCSD—many of whom have gone on to successful careers at the same companies.
- **Leveraged Investment:** The UCSD Division of Calit2 can leverage industry investment with matching funds from the State and other sources to expand the depth of research activities.

Since QUALCOMM's groundbreaking $15 million pledge in 2000, dozens of companies have become industry partners of the UCSD Division. Ten companies have each committed more than $1 million in cash or in-kind contributions to fund endowed chairs, fellowships, lab equipment and/or sponsored research. Besides QUALCOMM, the list includes Ericsson, IBM, AMCC, Conexant, Intersil, Nissan Motor, TeraBurst Networks, SAIC and AT&T. Another 16 corporations have invested at least $100,000 to date; they include Blue Titan, Ford Motor, Hewlett-Packard, Hughes Research Laboratories, Lockheed Martin, Polexis, Raytheon, Rockwell International, Sammy Studios, SBC, Skyworks Solutions, SMC Networks, STMicroelectronics, Sun Microsystems, Toyota Motor, and Volkswagen-Audi. And dozens of other companies partner with Calit2 on a project-by-project basis every year. [For a complete list of industry partners, visit the Calit2 website.]

GET INVOLVED

Faculty and students... corporations and funding agencies... community organizations and private foundations... national and international research institutions... are invited to get involved in Calit2 at UCSD.

We stand ready to engage with your organization in innovative ways. Calit2 offers industry, academia and non-profit institutions our clean rooms, communication circuits and systems labs, visualization centers and other shared facilities to develop state-of-the-art technologies. These exciting co-development projects also offer compelling opportunities for private foundations and philanthropists to support Calit2 through grants, naming gifts and other support for UCSD's 10-year fundraising campaign.

Industry, state and federal funding is critical to Calit2's ability to support faculty and groom students for careers in research. More than 100 students have participated in the summer Calit2 Undergraduate Scholars program since 2001, and many more in senior-level design courses, all made possible by generous corporate donations. Hundreds more students have received support through research assistantships and the Calit2 Graduate Fellows program. Faculty also benefit from Calit2's financial and administrative support for large-scale project proposals, and the UCSD Division has a successful track record in securing funding from federal and state agencies.

GET IN TOUCH

The UCSD Division of Calit2 offers substantial support for its partners, including industry, faculty, students, funding agencies, community organizations and private foundations. We stand ready to work with you to further discovery and innovation in California.

For more information, contact:

Ramesh Rao, Director
UCSD Division
rrao@ucsd.edu
858-822-4572

WWW.CALIT2.NET

UCSD DIVISION
CALIFORNIA INSTITUTE FOR TELECOMMUNICATIONS
AND INFORMATION TECHNOLOGY
9500 GILMAN DRIVE
LA JOLLA, CA 92093-0436
858-822-4998