

# 2012

CCST Annual Report

**BIG DATA**  
**BIG FUTURE**



California Council  
on Science  
and Technology

2012

ANNUAL REPORT



AUGUST 2012

## BIG DATA, BIG FUTURE

An important key to California's future — economic, technological, and social — is information. Research indicates that analyzing large data sets is rapidly becoming a key basis of competition, underpinning new waves of productivity, growth and innovation. This genuinely is the beginning of a new information age.

We have been hearing about the 'information age' for so long that the phrase has become trite. Nonetheless we are reaching a point where the knowledge available to us has exceeded our ability to easily grasp it. According to a recent report by Cisco, by 2015, global internet traffic may reach 966 exabytes ( $10^{18}$ ) per year. The Pentagon is working to expand its worldwide communication network to go beyond these limits, handling yottabytes ( $10^{24}$ ) of data, each of which is the equivalent of 500 quintillion ( $10^{18}$ ) pages of text.

The rise in information available coincides with the increasing ability to gather information inexpensively in a wide range of new settings. Networks of inexpensive sensors gather vastly expanded data collection on geochemical characteristics of land areas under environmental scrutiny. The costs of sequencing genomes have dropped from millions of dollars to hundreds, significantly expanding personalized diagnoses and treatments.

California is at the forefront of the big data revolution in a number of ways. It is home to many of the companies pioneering the acquisition of information (e.g., Google and 23andMe) and the integration of large data sets into practice, not to mention the Blue Gene Q supercomputer at Lawrence Livermore National Laboratory - currently the fastest in the world. California is also home to The Global Information Industry Center at UC San Diego, a nationally renowned interdisciplinary center that seeks to identify and describe the underlying issues and consequences of technology-enabled



Karl S. Pister  
*Board Chair*



Miriam E. John  
*Council Chair*



Peter Cowhey  
*Council Vice-chair*

change in information and communications practices in government and industry.

CCST has long advocated an approach to policy based on the best and most complete scientific knowledge available; being able to access and use substantially more data in its decision-making processes would, in principle, allow the state to adopt more efficient and effective approaches to infrastructure and environmental issues. In some cases, there is the possibility of solving highly complex technical problems, such as environmental management, in a more systematic way. Even more promising, though, is the notion that the wealth of data being gathered — still a largely untapped resource — stands to benefit most those research institutions and communities which are able to collaborate in new and potentially unprecedented ways.

The advent of big data poses challenges, as well. Concerns about privacy and security are real and significant. In addition, amassing overwhelming quantities of data without effective systems for storage and analysis may hinder, rather than enhance, productive discourse. Solutions to these issues will require state, national, and international coordination, but California can be an important trendsetter. Indeed, if there is any state poised to benefit from integrating and analyzing unprecedented amounts of information, it is California. CCST's role, as an unbiased facilitator for bringing together all sectors of the S&T community to advise the state and develop long-term visions for California, has never been more important.

*Karl S. Pister    Miriam E. John    Peter F. Cowhey*

CCST is a nonpartisan, impartial, not-for-profit 501(c)(3) corporation established via Assembly Concurrent Resolution (ACR 162) in 1988 by a unanimous vote of the California Legislature. It is designed to offer expert advice to the state government and to recommend solutions to science and technology-related public policy issues.

CCST is modeled in part on the National Research Council, and has developed a close working relationship with the National Academies. More than half of CCST's members and senior fellows are members of the National Academies, and four are Nobel Laureates.

Since its creation, CCST has worked directly with the governor's office, state and federal legislators, and agencies to recommend policies that will maintain California's role as a leader in generating science and technology innovation and maintaining a vigorous economy.

### Sustaining Institutions

The strength of CCST lies in the support and resources provided by its sustaining institutions, the University of California system, the California State University system, California Institute of Technology, Stanford University, University of Southern California, and the California Community Colleges, as well as its affiliate members, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratory in California, SLAC National Accelerator Laboratory, and NASA Ames Research Center and Jet Propulsion Laboratory. CCST also has strong connections to industry through its membership.

### Board and Council

A board of directors and council members volunteer their time to govern and guide CCST. The board, which meets twice a year, is made up of 15 leaders from industry and academia. Karl S. Pister, UC's former vice president for educational outreach and chancellor emeritus of UC Santa Cruz, serves as CCST board chairman.

The council, which meets three times a year, currently includes 28 corporate leaders, academicians, scientists, engineers, and scholars of the highest distinction. Miriam E. John, former vice president, California Division, Sandia National Laboratories, is the chair, and Peter Cowhey, dean of the School of International Relations and Pacific Studies at the University of California, San Diego is the vice-chair.

The board establishes CCST's policies and provides oversight, while the council translates those directives into programs and projects that will ensure the state's science and technology leadership. The council is divided into subcommittees that manage and plan specific projects and studies.

### Senior Fellows

CCST senior fellows are a select group of distinguished scientists, engineers, and technical experts who volunteer their time to address specific projects or conduct reviews. CCST created the program in 1997; since then, CCST has appointed 140 senior fellows who are engaged in all aspects of CCST's work addressing important science and technology issues facing government, education, and industry.

### California Teacher Advisory Council (Cal TAC)

Cal TAC is a group of 12 outstanding K-14 science and math classroom teachers and is modeled after the successful National Teacher Advisory Council, established in 2002 by the National Academies. Cal TAC works to provide a valuable connection between the teaching community and the educational experts and policymakers who are shaping California's educational system. Brian Shay, Secondary Mathematics Teacher, Canyon Crest Academy is the chair and Heidi Haugen, Science Teacher, Florin High School is the vice-chair.

### Staff and Offices

Susan Hackwood is CCST's executive director and provides overall day-to-day leadership; she also sits on the board and council. CCST has two offices. One is in Southern California adjacent to UC Riverside; another is one block from the State Capitol in Sacramento.

## BRAVING A NEW WORLD

California is gathering more and more information on large-scale systems that perennially surface in policy discussions. We have been making difficult policy choices regarding greenhouse gas emissions, transportation networks, and infrastructure safety. Being able to more effectively model the propagation of pollutants in the air, the behavior of water distribution and transportation networks, and the ways in which structures interact with wind or seismic loads facilitates all of these discussions. As is often the case, however, improving policy discussions is not so simple as adding new data to the mix.

Take the distribution of power, for example. Traditional electrical meters require meter readers to physically examine the reader to determine actual power use by a home. These readings are taken periodically, perhaps every month or every other month. Power companies use past patterns of electricity usage to estimate what its customers are using at any given point. Replacing the old meters with new digital meters provides regular updates on actual power usage that would greatly enhance the power companies' ability to understand actual usage, responding more effectively to real-time fluctuations in power. The rollout of the replacement 'smart meters', however, met with well-publicized opposition, based on health and privacy concerns.

Concerns about the privacy of the information being collected go hand in hand with every effort to expand data collection, even those that depend on voluntary participation. The Mobile Millennium project, for instance, is a traffic app available for download. The goal is to provide real-time information on highway and arterial traffic, by using the cell phones to send measurements on their location and trajectory. The applications are intended to help improve traffic models, by learning the probability distribution of travel times and modifying statistical models accordingly. The phones anonymize the data being sent, but some users are still hesitant about the notion of voluntarily broadcasting their location and movements at all times.

User resistance to such programs rests in large part on the fact that data acquisition is far outstripping the policy infrastructures meant to guide and shape it, with sometimes troubling implications. There is a new National Security Agency facility in Utah. Part of an initiative underway for the past decade, by 2013 the \$2 billion center should be sifting through most forms of digital communication, including the complete contents of private emails, cell phone calls, and Google searches, as well as personal data trails ranging from parking receipts to bookstore purchases, with supercomputers designed to tackle even the most heavy-duty encryption being used for private communications.

We can no longer depend upon the anonymity of the crowd to serve as a de facto privacy wall - the notion of 'security through obscurity' no longer applies. This will require a much more focused and proactive policy framework for the use of the information already being collected.

The question is not whether or not to embark on a program of collecting 'big data'. We have already embraced a host of technologies that routinely gather information about ourselves and our environments, and researchers are eagerly exploring the possibilities of applying big data to large scale physical systems, healthcare, and more. What is needed is a better understanding of the implications in gathering ever-larger amounts of data, and a more unified and consistent approach to dealing with privacy and copyright concerns as we move forward. Big data holds a great deal of promise for California's citizens, policymakers, and the research community. Planning is essential to ensure that the new information doesn't raise more questions than it answers.



Susan Hackwood  
*Executive Director*

*Susan Hackwood*

## HIGHLIGHTS 2011-2012

### *Innovate2innovation*

In May 2010, a bi-partisan, bi-cameral group of legislators asked CCST to conduct a comprehensive assessment of California's "S&T innovation ecosystem," analyzing and reporting current global innovation systems, and recommending to the Legislature actions that should be taken to sustain the state's role as a global leader in science and technology. CCST delivered the report to legislators using a remotely piloted medical robot in August 2011, to underscore the importance of innovation to California's future.

### *S&T Legislative Policy Fellows*

The five-year pilot program, modeled after the Congressional S&T Fellows Program administered by the AAAS, placed the third group of fellows throughout legislative offices in Sacramento. A fourth group has been selected for the 2012-13 session.

### *Publication: Waste to Energy in California: Technology, Issues, Context*

This report, produced at the request of the Governor's office, addresses the conversion of post-recycled urban-derived biomass and municipal waste to energy. The report concluded that waste-to-energy technologies could have positive environmental impacts in California, but that both sides in the debate over converting municipal waste to energy have valid positions.

### *California Teacher Advisory Council (Cal TAC)*

Cal TAC has been involved in CCST's digital education initiative and is working with CCST on implementing a California Education Innovation Consortium. Cal TAC activities this year involved three meetings, including a summit on the integration of digital media into teacher preparation.

### *Digital Education*

Following on its 2011 *innovate2innovation* report on digital education, CCST released a new overview on the status of digitally enhanced education in California. In May 2012, a two-volume report covered the specifics of California's digital education landscape and policies. A third report is in production.

### *Publication: The Efficacy of Managed Access Systems to Intercept Calls from Contraband Cell Phones in California Prisons*

This report is in response to a request from four California State Senators, who asked CCST to provide input on the best way to prevent cell phones from getting into the hands of inmates and, if they do, how best to prevent calls from being completed without impairing the ability of prison authorities to make and receive official business cell phone calls.

### *California Climate Change Research Database*

In January 2012, CCST and The California Air Resources Board opened a public database of climate change research projects and programs taking place in California, focusing on projects or programs that receive federal funding.

### *Spotlight*

In January 2012, CCST transitioned from the thrice-annual newsletter, *CCST Report* - which it has published since 1996 - to a weekly online news feature, *CCST Spotlight*.

## SCIENCE AND TECHNOLOGY POLICY FELLOWS

The third class of California Science + Technology + Policy Fellows continued the program's growing tradition of excellence this year, beginning their terms in Sacramento in November 2011 just after the outgoing second class of Fellows was recognized for its service by the Legislature.

The Fellowship program places scientists and engineers in the California State Legislature for one-year appointments. Professional development opportunities enable fellows to work hands on with policymakers to develop solutions to complex scientific and technical issues facing California through their interaction with the legislative process. They assist their respective legislators and committees in formulating and evaluating S&T policy for California on issues ranging from healthcare to energy to water resource management.

The 2011-12 group of fellows began their terms in Sacramento with a month long intensive "boot camp" training regimen covering the legislative process, the effective translation of science for policymakers, and tips for success in the legislative environment. The range of issues covered have

included water issues and hydraulic fracturing (fracking) during a politically charged year full of controversial topics and an ongoing budget crisis. The Fellowship, adapted for California from the 36-year old American Association for the Advancement of Science (AAAS) Congressional Science and Technology Fellowship program, is the first in the nation to place Ph.D. level scientists and engineers in a state legislature.

The first two groups of fellows have successfully transitioned to new positions with the state Legislature, state agencies the President's Council of Advisors on Science and Technology in the White House, one of California's federal funded laboratories, a public health department in upstate New York, academia and industry.

The program is funded by a coalition of foundations including the Gordon and Betty Moore Foundation; Stephen Bechtel Fund/S.D. Bechtel Jr. Foundation; Kingfisher Foundation; The Heising-Simons Foundation; TOSA Foundation, and the Gen-Probe Fund.





2011-12 Science and Technology Policy Fellows

(Left to right) Ben Rubin, Erika Bustamante, Dharia McGrew, Le Ondra Clark, Stephen Francis, Alena Pribyl, Matt Holland, Rebecca Newhouse, Mandy Arens and Larry Baskett

## Senate Offices

**Larry Baskett – Senate Office of Research.** Larry received an M.S. in aeronautics and astronautics from MIT and a B.S. in mechanical engineering from Stanford. Larry was most recently a senior mechanical engineer with Sparkfactor Design, a product design firm based in Palo Alto.

**Le Ondra Clark – Senate Business, Professions and Economic Development Committee and Office of Senator Curren Price.** Le Ondra received her M.S. in counseling and her Ph.D. in counseling psychology from the University of Wisconsin-Madison. She did her pre-doctoral clinical internship at the University of Southern California, post-doctoral fellowship at UCLA.

**Rebecca Newhouse – Senate Environmental Quality Committee.** Rebecca received a Ph.D. from the University of California, Santa Cruz in physical chemistry and a B.S. in biochemistry from Western Washington University. Previously, she investigated novel solid-state hydrogen storage materials at Sandia National Laboratories.

**Alena Pribyl – Senate Natural Resources and Water Committee.** Alena received a Ph.D. in fisheries science from Oregon State University, an M.A. in biology from the University of Colorado at Boulder. Alena was a National Research Council post-doctoral fellow at NOAA's Southwest Fisheries Science Center near San Diego.

**Ben Rubin – Senate Health Committee.** Ben received a Ph.D. in neurobiology from Duke University for his work on how the brain processes information about odors, and a B.A. in biology and psychology from Cornell University. He was a postdoctoral researcher at the California Institute of Technology and Brandeis University.

## Assembly Offices

**Mandy Arens – Assembly Water, Parks and Wildlife Committee.** Mandy received a Doctorate in veterinary medicine and a Master's in veterinary public health from the University of California, Davis. She also completed a Ph.D. in comparative pathology from UC Davis.

**Erika Bustamante – Office of Assembly Member Luis Alejo.** Erika received a Ph.D. from the Department of Developmental Biology at Stanford University and a B.S. in molecular, cell and developmental biology from the UCLA.

**Stephen Francis – Office of Assembly Member Henry Perea.** Stephen received a Ph.D. in cell biology from Yale University and a Sc.B. in neuroscience from Brown University. He concluded his Ph.D. dissertation research in Genentech's Research Oncology Department in South San Francisco.

**Matt Holland – Office of Assembly Member Holly Mitchell.** Matt received a Ph.D. in population biology from the University of California, Davis and an A.B. with honors in biology from Cornell University.

**Dharia McGrew – Assembly Environmental Safety & Toxic Materials Committee and the Office of Assembly Member Bob Wieckowski.** Dharia received a Ph.D. from Brandeis University in molecular biology specializing in vision science and inherited retinal degeneration. She received her B.A. in biology from Mount Holyoke College.

## CALIFORNIA'S ENERGY FUTURE



“We are moving from a world where supply is controlled to follow demand, to one where demand must follow an increasingly uncontrollable supply... The need for advances in load balancing technology is one of the largest gaps in the energy technology portfolio.”  
 - Electricity from Renewable Energy and Fossil Fuels with CCS Report



CCST released two new publications as part of the ongoing California's Energy Future (CEF) project, a broad study designed to help inform the decisions state and local governments must make in order to achieve California's ambitious goals of significantly reducing total greenhouse gas emissions over the next four decades.

In the initial May 2011 report, an analysis first estimated how emissions could be reduced through modifications to demand, including aggressive efficiency and electrification. The second report, released in July 2011, focused on Possibilities, Problems And Potential Envisioned For Nuclear-Powered California.

The third study, Transportation Energy Use in California (December 2011), found that total transportation energy demand could be reduced 30% relative to 2005 levels in 2050 through improving overall vehicle efficiency and the use of advanced electric drivetrains such as plug-in electric vehicles and fuel cell vehicles. Achieving high fleet penetration of efficient and alternatively fueled light-duty vehicles by 2050 will require rapid market adoption in the next decades and an expansion of efficiency policies to cover the entire range of transportation sectors, including aviation and marine.

The fourth report in the CEF series, Electricity from Renewable Energy and Fossil Fuels with Carbon Capture and Sequestration, examines electricity generation through fossil fuel combustion with CO<sub>2</sub> capture and sequestration (“fossil/CCS”) – a process that removes as much carbon as possible from major emissions sources such as power plants, and stores it in deep geological formations and renewable energy.

This report notes that carbon capture and sequestration is the only other currently scalable technology besides nuclear energy that can easily provide many tens of GW of baseload capacity in a future electric grid that would otherwise become increasingly dominated by variable wind and solar generation. Despite this fact, there are still GHG emissions associated with fossil/CCS electricity; while small, they will contribute noticeably to a stringent statewide cap.

The report also examines the potentials of renewable energy as well. One of the principal issues facing increased reliance on renewable power generation such as solar and wind is its intermittent nature; in order to accommodate it, significant changes will have to be made to the way California stores and administers electricity.

## WASTE TO ENERGY

The conversion of municipal waste to energy holds potentially significant environmental benefits for California, although more information is needed on real emissions and performance data from operating waste to energy systems in California, according to a report CCST presented to the Governor's office in 2011.

The report, which was intended as a starting point for discussions concerning the conversion of municipal waste to energy, outlines the energy potentials and environmental impacts of each waste-to-energy system, as well as current barriers facing more widespread implementation of the technologies in California. "Converting municipal waste to energy is controversial," notes the report, prepared for CCST by Heather Youngs, Bioenergy Analysis Fellow at the Energy Biosciences Institute, UC Berkeley. "The actual impacts of any waste-to-energy system are spe-

cific to that system...[however] there are conversion technologies that will meet California's environmental quality standards."

California currently operates 105 facilities employing various waste-to-energy technologies, including incineration, harnessing landfill gas, wastewater treatment, and animal and food waste digestion, providing over 414 megawatts (MW) of power. This is, however, a small fraction of the state's total net power supply, which exceeded 77,000 MW in 2010. This is largely due to a reluctance to endorse substantial waste-to-energy because of concerns about emissions from incineration plants.

Although not directly part of the CEF group of projects, the Waste to Energy report complemented the work being done by the CEF group, which continues to explore technologies and power generation/emissions scenarios.



"Recovering energy from post-recycled organic materials can provide environmental benefits and need not impact other waste management goals. Carefully constructed policies can encourage waste reduction, recycling, landfill reduction, and energy recovery."

- Heather Youngs

## CALIFORNIA'S WATER FUTURE

CCST is conducting a yearlong project to determine how innovations in science and technology can be used to improve California's integrated water management, efficient water use, effective groundwater management and optimized river systems. The project follows on CCST's 2010 Innovate 2 Innovation assessment of California's innovation 'ecosystem', which identified water management as an area critical to the State's future innovation economy. A steering committee of water experts,

chaired by CCST Council member Jude Laspa, is surveying water experts around California and beyond for input on identifying current and emerging water related technologies which hold promise for the state, as well as regulatory and social barriers that may impede their implementation. The results of the California's Water Future study will be used to help inform the Department of Water Resources 2013 State Water Plan.

## CALIFORNIA TEACHER ADVISORY COUNCIL & DIGITAL EDUCATION

Formed in 2005, Cal TAC is a group of master teachers who provide a valuable connection between the teaching community and the educational experts and policymakers who shape California's educational system. Cal TAC is working closely with CCST to facilitate the implementation of the Digital Education Initiative, a partnership including the California STEM Learning Network designed to ensure that California's 21st century learning environments are grounded in digital learning.

In 2011, Cal TAC Chair Anne Marie Bergen was co-chair of the education component of CCST's i2i project, Digitally Enhanced Education, which offered recommendations on K-16 education that could have a widespread and dramatic difference in the day-to-day life in California classrooms. Among other things, it called for every California child to have access to broadband capability and for students

to study math and science in groundbreaking new courses that would depart from traditional teaching methods, in order to prepare them for life in the mid 21st century. Achieving this would require updating California's Education Code, which, according to the i2i report, works to block advances in digitally enhanced education.

Cal TAC focused on digital education throughout three meetings this year. In February 2012, Computer-Using Educators (CUE) hosted a workshop using iPads, presenting possibilities of digitally enhanced education in an applied classroom setting; each Cal TAC member was presented with one of the devices.

A two-volume white paper on digitally enhanced education in California was produced as background material for the May 2012 meeting, providing updated information on digital education

### 2011

- **Imagining the Future: Digitally Enhanced Education in California Summit** in partnership with Cogswell Polytechnical College on March 25, 2012  
*White Paper: Briefing for the California Teachers Advisory Council*

### 2012

- **Cal TAC Meeting with Computer Using Educators (CUE) iPad Training** Sacramento, February 7, 2012
- **Digital "How To" Workshop** in partnership with the Corporation for Education Network Initiative in CA (CENIC) on April 20, 2012  
*White Papers: Digital Education Programs - Volume 1 & Education Codes and Administrative Codes of Governing Regulations - Volume 2*  
*Summary Report: Using Digital Media to Improve Teaching and Learning*
- **Creating a Vision: Summit on the Integration of Digital Media into Teacher Preparation** in partnership with San Jose State University on June 18, 2012  
*White Paper: Educational Technology and Digital Media Use in California's Teacher Preparation Programs: A Status Report*  
*Summary Report: Creating a Vision for Integrating Digital Media into California's Teacher Preparation Programs*



“California needs to clarify its vision for digitally enhanced education, apply it consistently, and begin asking forward-thinking questions again.”

- Digital Education Programs - Volume 1 Report

policy and practice. Volume 1 summarizes the potential advantages which digital education has to offer, including an unprecedented ability to personalize learning experiences for each student, as well as potential cost savings. However, there are challenges inherent in adopting technologies with the potential to alter the teaching environment significantly; empirical research about the impact of digital education on the academic achievement of K-12 students remains sparse. The report states that overall, the state lags behind the average: one assessment of digital education nationwide ranked California last overall based on progress towards a digitally enhanced education system.

Volume 2 details the education codes and regulations pertaining to digital education in California, of which there are many. In fact, an August 2011 report by the California County Superintendents Educational Services Association

declared that California has created the “most complicated, confusing, and impenetrable set of policies” of any state. For instance, California state law does not draw formal distinctions among the categories of distance learning, online learning, and online instruction, providing overlaps in policies pertaining to execution and funding of digital education.

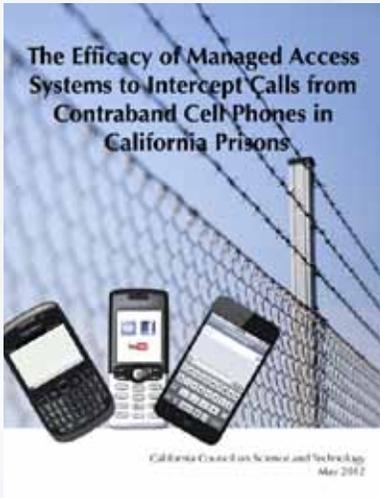
The third meeting of the year, hosted at San Jose State University by President Mohammad Qayoumi, focused on creating a vision to integrate digital education experiences into teacher preparation programs, with the intent of preparing teachers how to use them effectively in their K-12 classrooms. Teachers, university faculty members, and technical experts discussed the challenges that exist and how teacher preparation programs could be adapted to better incorporate digital education as a key component.



2012 California Teacher Advisory Council

(Left to right) Lewis Chappellear, Caleb Cheung, Brian Shay, Jeff Bradbury, Jennifer Santos, Katherine Ward, Jeff Foote, Diana Herrington and Heidi Haugen

## CELL PHONES IN PRISON



“A more direct and likely cost efficient way to address the problem would be to stop or minimize cell phone entry into prisons with more consistent and complete screening of all personnel moving in and out of the prison confinement areas. However, if CDCR moves forward with MAS then it should be done first as a pilot project and with robust oversight and continuing evaluation for efficacy and effectiveness”

- Charles Harper,  
CCST Board Member and  
Chair  
of the Project Team that  
developed the report

In May 2012 CCST released a report advising the State of California to use security screening systems, similar to those in airports, in state prisons before investing millions in untested technology intended to block calls by inmates from contraband cell phones. The report also urged the California Department of Corrections and Rehabilitation (CDCR) to consider a robust pilot project before implementing a managed access system (MAS), or any other technology across the CDCR facilities. CCST provided recommendations and suggestions to insure the operational goals of MAS, or other technologies that CDCR might consider, are achieved.

California State Senators Elaine Alquist, Loni Hancock, Christine Kehoe and Alex Padilla, initiated this report by asking CCST to analyze the use of contraband cell phones in state prisons, as well as the viability of the technology approach referred to as MAS in blocking signals from phones smuggled into prisons.

Inmate use of mobile phones is a growing problem throughout the country. While some inmates may use them to talk with family members and play games, they can also use them to order hits, intimidate witnesses and coordinate gang activities. In 2011, the CDCR reported that approximately 15,000 contraband cell phones were confiscated at California state prisons, but the number remaining in the prisons could be much higher.

MAS is currently used to block

inmate calls in only one U.S. prison, a remote prison in Mississippi, which is having difficulty implementing and managing MAS to the level of performance desired. In theory, MAS uses a data base of authorized cell numbers as a filter to intercept calls from unauthorized numbers, then block those unauthorized calls from reaching cellular networks.

The report uncovers significant problems that would be expected with MAS, which is one, among a number of options, for preventing inmate cell phone use. For example, MAS could interfere with correctional and public safety cell phone use. If a prison is in a populated area, MAS could also prevent members of a surrounding community from making emergency cell phone calls to 911 because their numbers would not be on the MAS database. The report acknowledges that CDCR tried to test MAS technology, but describes the test as extremely limited in scope and scale.

In August 2012, CCST representatives brought the report to Washington D.C., holding a briefing and a series of meetings on Capitol Hill, as well as a meeting with staff at the Federal Bureau of Prisons. Numerous committees expressed interest in the report and possible follow-up legislation, including the House Judiciary Committee - Intellectual Property/Tech Issues, House Appropriations Committee - Commerce, Justice, the Science Subcommittee, and the House Committee on Science, Space & Technology

## Overview of CCST Report on Managed Access Systems for Intercepting Calls from Contraband Cell Phones in Prisons

- Contraband cell phone use by prison inmates in state and federal prisons is a serious and growing problem. In 2011, approximately 15,000 cell phones were seized in California's 33 prisons alone.
- Inmates use contraband cell phones to communicate with family members and for entertainment. They can also use them to coordinate criminal activity inside and outside prisons, including the ordering of hits and witness intimidation.
- One of the challenges facing state and federal prison authorities is how to deploy jamming technology without impairing legitimate calls by correctional employees.
- The report advised the California Department of Corrections and Rehabilitation (CDCR) to use security systems, similar to those in airports, before investing millions of dollars in inadequately tested technology such as MAS, or managed access system.
- Theoretically, MAS uses a database of authorized cell numbers to filter out and block unauthorized numbers from within an area covered by a MAS umbrella. However, CCST's report identified several issues that would limit the effectiveness of MAS, and perhaps carry unintended consequences.
- CCST is recommending that California work in coordination with other states and California's congressional delegation to seek exceptions for prisons from anti-jamming regulations enforced by the Federal Communications Commission (FCC).
- However, if MAS is pursued then pursue it wisely: Independently test one or more pilots before contracting for a MAS with oversight by an independent consortium that includes technical expertise from research organizations, cellular network operators, and from the California Legislature.
- The MAS technology discussed in the CCST report can block inmate cell phone calls, but could also interfere with correctional and public safety cell phone use. If a prison is in a populated area, MAS could possibly prevent members of a surrounding community from making emergency cell phone calls to 911, because their cell would not be included in the MAS database.
- Even if MAS can be configured to be relatively successful when launched, continuing advances in cell phone technology could soon render MAS ineffective in blocking rapidly evolving cell phone technologies without concurrent upgrades of the MAS system. As currently contracted by CDCR, MAS cannot capture Wi-Fi, Mi-Fi, Skype or satellite transmissions. Also, text message capture capability would need further study to determine its efficacy.

## COUNCIL MEETING SUMMARIES

### Big Data

October 2011

The October 2011 meeting focused on the potential and challenges in 'Big Data', the unprecedented rise in the quantity of data being collected in a variety of contexts and the challenges inherent in using that data effectively and responsibly.

The increasing ability to amass large quantities of data has the potential to permit much more accurate modeling of large scale physical systems, such as elements of California's energy, water, and transportation infrastructure. The models offer the possibility of breakthroughs in understanding and developing new forms of energy storage, biofuels, and even nuclear energy reactors. It also offers significant changes in healthcare, as the cost of mapping the human genome has dropped

dramatically over the past several years. However, the pace at which data is being acquired is outstripping our ability to make sense of it all; many scientific problems are now rate-limited by access to and analysis of data, leading to an increased need to develop capabilities to rapidly access, search, and mine datasets.

Michael Chui, Senior Fellow at the McKinsey Global Institute, was the dinner speaker. His presentation was titled Big Data: Next Frontier for Innovation, Competition, and Productivity.



### IT and Social Change

February 2012

Robert M. Kaplan, Director of the Office of Behavioral and Social Science Research (OBSSR) at the National Institutes of Health (NIH) was the guest speaker. His presentation focused on the role of new wireless technologies in biomedical research and healthcare delivery.

"The use of 'mHealth' - a diverse application of wireless mobile technologies designed to improve health research, services, and outcomes - offers significant potential," Kaplan said. "Such technologies as wireless blood pressure and glucose monitors can provide continuous data over time, and mobile



phone apps allow users to provide input in real-time, instead of trying to recall, for example, how much pain they experienced over the previous days or weeks. This is an approach that offers much more accuracy.”

According to Kaplan, mHealth is about revolutionizing measurement, which then changes diagnostics, treatment and ultimately impacts health at a global level.

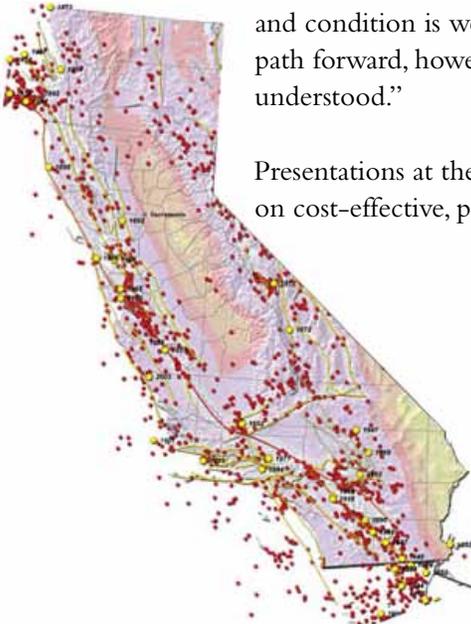
## California's Physical Infrastructure

June 2012

The June CCST Council meeting focused on California's infrastructure, the framework of interdependent networks and systems that provide services and support of social and economic activities including transportation systems, utilities, and public facilities such as schools and government buildings.

“The National Academy of Engineering has identified the restoration of our nation's infrastructure as a ‘grand challenge’ for engineers,” said Ziyad H. Duron, Engineering Chair and Professor, Harvey Mudd College. “The need for assessment and evaluation of infrastructure health and condition is well understood. The path forward, however, is not as well understood.”

Presentations at the meeting focused on cost-effective, practical, and reliable



“Having billions of mobile devices plus billions of sensors offers opportunities for population-level sensing,” said Kaplan. “It is thus a powerful tool for research as well as an opportunity to personalize care. With enhanced measurement and remote monitoring comes better management of chronic disease.”



monitoring techniques for risk assessment and structural health monitoring in the face of serious budget cuts likely to last for years. Discussions also focused on earthquake sensing and warning networks and the potential benefits and problems posed by ‘fracking’ – hydraulic fracturing used to release petroleum and natural gas deposits from underground.

“New and emerging technologies can be used to monitor and predict structural health performance,” said Duron. “The context informs the needs, which in turn allows for a selection of appropriate structural health monitoring techniques.”

## INPUT THAT COUNTS

Since 1988, the state's leaders have turned to the California Council on Science and Technology for advice on the scientific and technological issues that frequently affect policy decisions. CCST's science policy and technical work is almost entirely conducted by members who provides a public service by working outside the framework of government to ensure independent advice on matters of science, technology, and medicine. CCST enlists the state's top scientists, engineers, and other experts, who volunteer their time to study and report on specific issues. The reports that result from their deliberations frequently lead to significant and lasting improvements in the health, education, and welfare of all Californians.

In 2009, CCST began a program to make scientific expertise even more accessible to policymakers: the California Science and Technology Policy Fellows. And as the third group of Fellows enters the final months of their terms, the value of this program to the state has become ever more apparent. The program is billed as an educational experience for the young scientists. And there is a lot for them to learn. But the offices in which they serve learn just as much. Fellows are in a unique position, able to offer input to legislators and other government officials as policy issues are discussed. They bring a vital perspective to these discussions, helping policymakers understand not just what answers to provide to problems, but what questions to ask. Fellows draw on their experience and expertise to do background research, identify experts and reliable sources of information where needed,

drafting legislation, and following a bill through to completion.

The program, although limited in scope and only a few years old, is a significant success. Before the program started, not many policymakers saw the value in taking a Fellow under their wing; today, policymakers vie to host one.

Congress has been benefitting from similar input from AAAS Congressional Fellows for over thirty-five years. But California is the only state where an equivalent program has been put into place.

Why is this important? CCST continues to examine a wide range of issues for the state, ranging from digital education to waste energy management. We strive to provide the best information available to policymakers so that they can make the informed decisions. But sometimes it is not a case of answering questions so much as it is asking the right questions to begin with. The Fellows are in the trenches, so to speak, of the policymaking process. They are, of course, learning about policy and government - and often using that experience in their subsequent career paths. However, the Fellows are also providing the benefits of their expertise and scientific training to the offices where they are hosted, injecting valuable perspectives into discussions at a formative stage where CCST, and indeed few outside policymaker staff, usually does not get involved.

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