AGENDA
COORDINATING COUNCIL SPRING MEETING
California Spatial Reference Center
PG&E Headquarters, 245 Market Street, San Francisco, CA 94105
Room 323 at 77 Beale Street
Thursday, May 6, 2010 - 9:30 a.m. to 3:15 p.m.

Time	Topic	Primary Lead
9:30	**Greetings and Orientation**	
10:00	**Opening** • Welcome and Introductions	Art Andrew
10:15	**Director's Report** • CSRC Overview • CRTN	Dr. Yehuda Bock
11:30	**CSRC Funding** • Financial Report • Funding Efforts	Maria Turingan
12:00	**Lunch Break**	
1:00	**Executive Manager's Report** • CRTN Outreach Efforts	John Canas
1:15	**Caltrans Report** • Update	Mark Turner
1:30	**UNAVCO PBO Report** • Update	Adrian Borsa
2:00	**Open Discussion** • CRTN • Consortium • Goals	All
3:00	**Closing** • Comments	Art Andrew
3:15	**Adjourn**	

Contacts: **Art Andrew, Chairman**
Phone 714-834-3804, Email art.andrew@ocpw.ocgov.com

Maria Turingan, Administrator
Phone 858-822-2156, Email mariaturingan@ucsd.edu

CSRC Director's Report

Yehuda Bock

Scripps Orbit and Permanent Array Center (SOPAC)

California Spatial Reference Center (CSRC)

Scripps Institution of Oceanography

La Jolla

CSRC Coordinating Council Spring Meeting

PG&E Headquarters, San Francisco

May 6, 2010

What Does The CSRC Do For You?

- Provides access to a modern statewide geodetic control network (CSRS/NSRS)
- Establishes and maintains the legal spatial reference system for California
- Provides a continual statewide CGPS positioning analysis as well as updated positions following significant seismic events
- Operates the California Real Time Network (CRTN)
- Provides access to SOPAC with state-of-the-art archive, web-based tools and resources for California GNSS projects

Master Plan

SOPAC/CSRC Staff

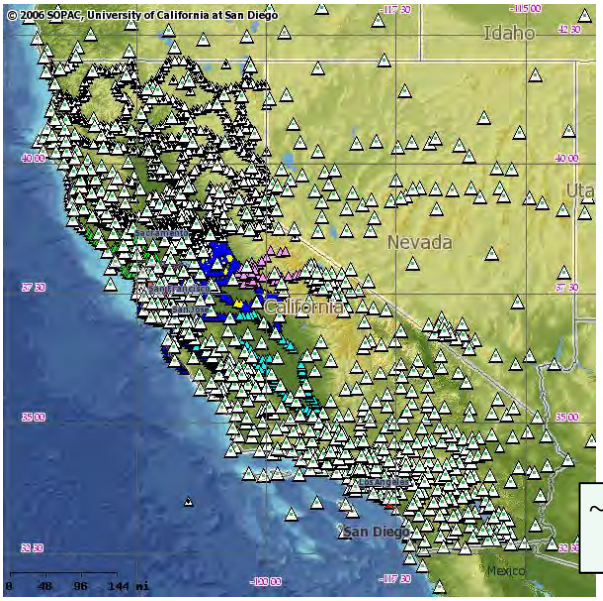
- Director: Yehuda Bock
- Coordinator: Maria Turingan
- Analysis: Peng Fang
- Web Administrator and Programmer: Paul Jamason
- System Administrator: Anne Sullivan
- Programmer Analyst: Mindy Squibb
- SCIGN and CRTN Field Support Staff: Glen Offield
- CSRC Executive Manager: John Canas, PLS
- Geodetic Consultant: Cecilia Whitaker, PLS

Lost 1.5 FTE's due to CSRC funding cuts

CSRS Coordinate Epoch (2009.00)

- 766 (551@epoch 2007.00) CGPS stations
- ITRF2005 (ITRF2000) coordinates & velocities
- NAD83 (NSRS2007) coordinates & velocities
- Includes uncertainties to comply with California Public Resources Codes
- Updated 2007.00 epoch coordinates

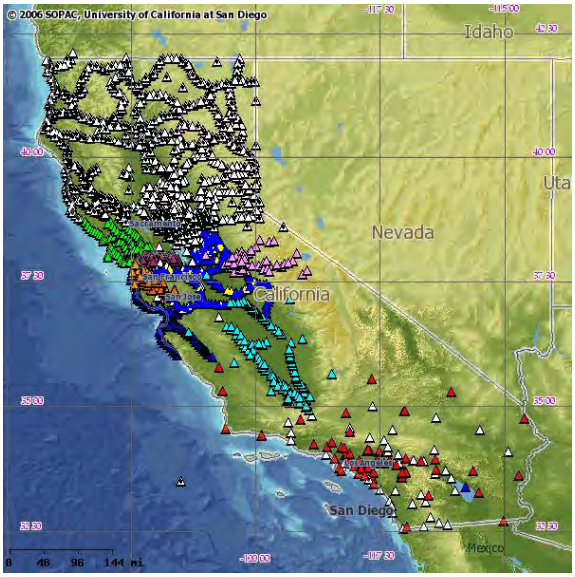
California Spatial Reference Network (CSRN)



Coordinates and velocities of the CGPS stations, and associated metadata and models define access to the California Spatial Reference System (CSRS)

~1500 passive monuments
766 CGPS stations

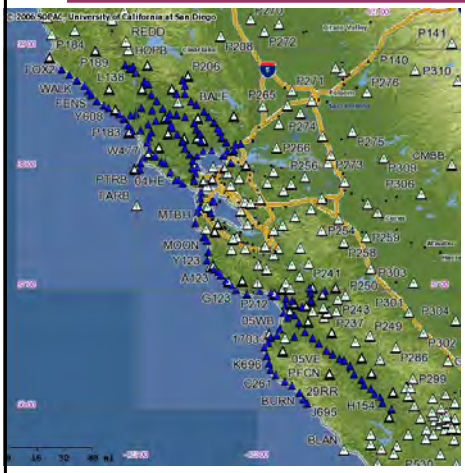
CSRC Height Modernization Projects



- NAVD88 Elevations (~1500 monuments in 13 HM projects)
- CSRS Densification (~2250 sites according to CSRC Master Plan)
- Subsidence (Yolo Co.)
- Co-/post-seismic deformation
- PGM data entry (tested on 8 height mod projects)
- CRTN demonstration project (SCHM2006)

http://csrc.ucsd.edu/maps/csrc2007.html

Central Coast Height Mod Project 2007



- CSRC staff (PGM)
- Towill, Inc., Contractor
- M. Ikehara (Proj. Manager)
- Contribution by Steve Sarsfield & colleagues
- Results and final report posted on CSRC website
- Submitted to NGS (not entered into NGS database)

Project Campaign Statistics
150 campaign monuments 49 CGPS sites
20 observers 28 receivers/antennas 2 months
101 sessions 471 observations 750 vectors

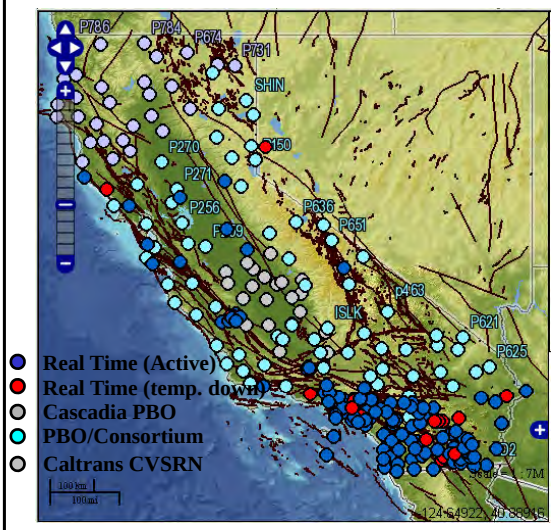
Further Height Mod Work?

Important:
- Complete North San Joaquin Valley project (CSRC, Dick Davis, Marti Ikehara) and submit to NGS
- Incorporation of newer geoid models (Geoid09)

Optional:
- New (real-time) CGPS stations?
- Update all height mod projects in CSRC database and portal to be consistent with latest PGM procedures
- Re-adjustment of all CSRS monuments
- Re-survey of selected monuments

Status:
- No specific height mod funding available until FY11.
- CRTN Consortium could decide to take on some of these tasks.

CRTN Operational Status



http://sopac.ucsd.edu/projects/realtime/

- Currently 130 stations operated by SOPAC, USGS, PBO, Orange County, San Diego County, and MWD (not counting CVSRN)
- Data sharing agreement signed with Caltrans for 22 CVSRN stations (7 PBO)
- Added RTCM 3.0 streams for single-base RTK users
- Purchased new CRTN server from NASA budget
- Completed latency testing

CRTN & California Public Resources Codes

CALIFORNIA CODES PUBLIC RESOURCES CODE, SECTION 8856-8858

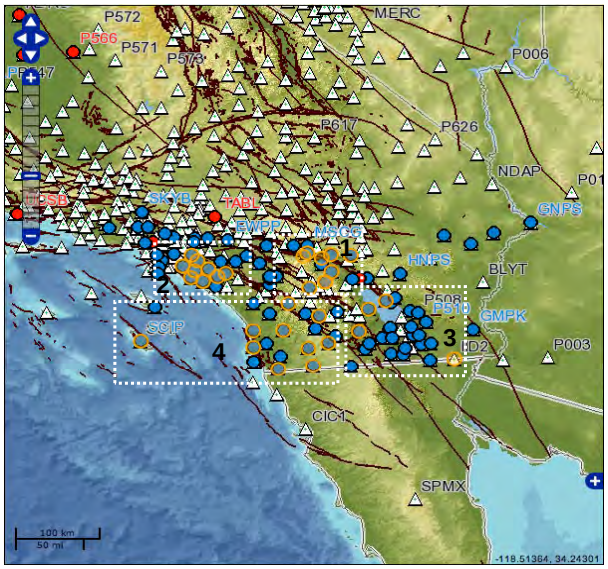
8856. The geodetic control stations within the State of California having horizontal positions conforming to all of the following requirements shall be part of the CSRN. The horizontal positions shall: (a) Be referenced to NAD83. (b) Have been determined by GPS survey methods. **(c) Be published by NGS or CSRC.** (d) Have a NGS or CSRC published network accuracy of two centimeters or better as defined by FGDC or a NGS or CSRC published accuracy of first order or better as defined by FGCS. **(e) Have a NGS or CSRC published horizontal velocity or a horizontal velocity that can be determined using procedures and values published by NGS or CSRC.**

8857. The geodetic control stations within the State of California having ellipsoid heights conforming to all of the following requirements shall be part of the CSRN. The ellipsoid heights shall: (a) Be referenced to NAD83. (b) Have been determined by GPS survey methods. **(c) Be published by NGS or CSRC.** (d) Have a NGS or CSRC published network accuracy of five centimeters or better as defined by FGDC or a NGS or CSRC published accuracy of fourth order, class II, or better as defined by FGCS.

8858. The geodetic control stations within the State of California having orthometric heights determined by GPS survey methods and conforming to all of the following requirements shall be part of the CSRN. The orthometric heights shall: (a) Be based on NAD83 and referenced to NAVD88. **(b) Be published by NGS or CSRC.** (c) Have a NGS or CSRC published network accuracy of five centimeters or better as defined by FGDC.

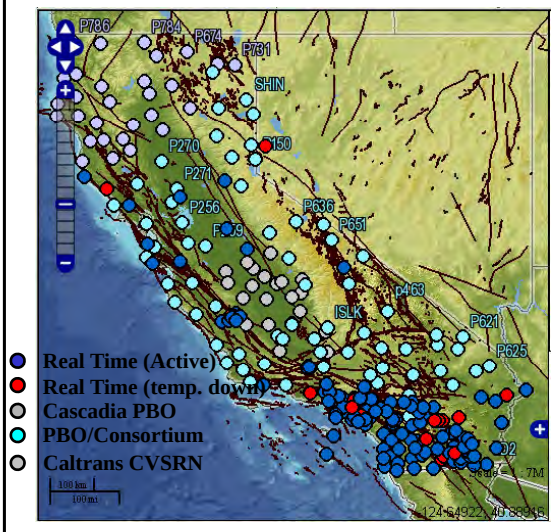
CRTN is directly tied to the California Spatial Reference System (CSRS) and National Spatial Reference System (NSRS), which fulfills the requirements of the California Public Resources Codes 8856(c)(e), 8857(c), and 8858(b) for GPS-derived geodetic coordinates and orthometric heights

USGS ARRA Project



- SOPAC awarded $190k ARRA grant through USGS to improve CRTN infrastructure
- Includes upgrades to 28 stations, one completed (IID2)
- Replace old (21) Ashtech Z-12 GPS receivers with (30) TopCon Net-G3A GNSS receivers and antennas
- Improve radio telemetry links
- Orange circles denote CGPS stations slated for upgrades

Elements of Statewide Expansion



With PBO, including Cascadia region already funded through ARRA funds

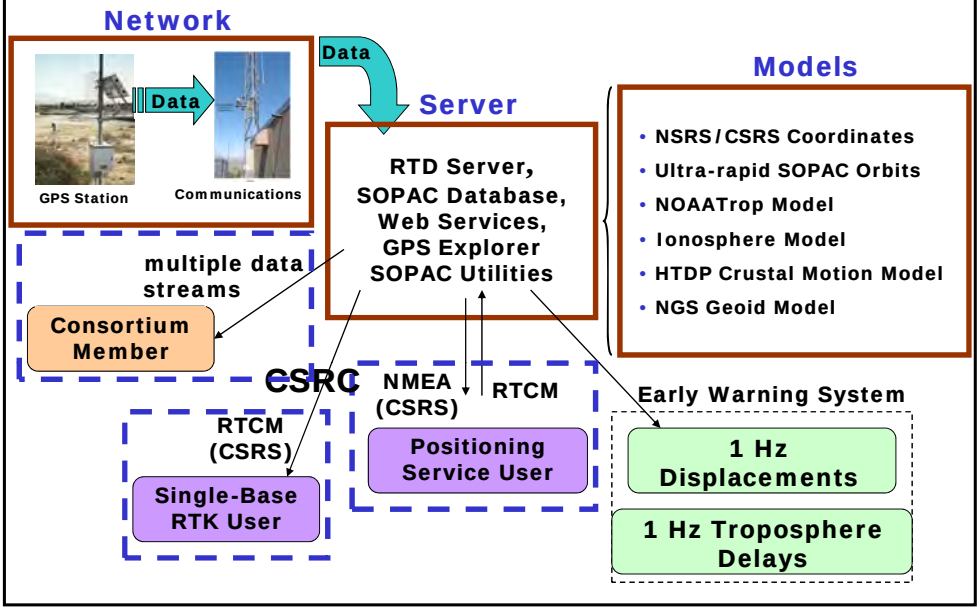
With Caltrans, to cover the Central Valley for positioning applications

With CRTN Consortium through contract with PBO to fill out a nominal 50-km grid

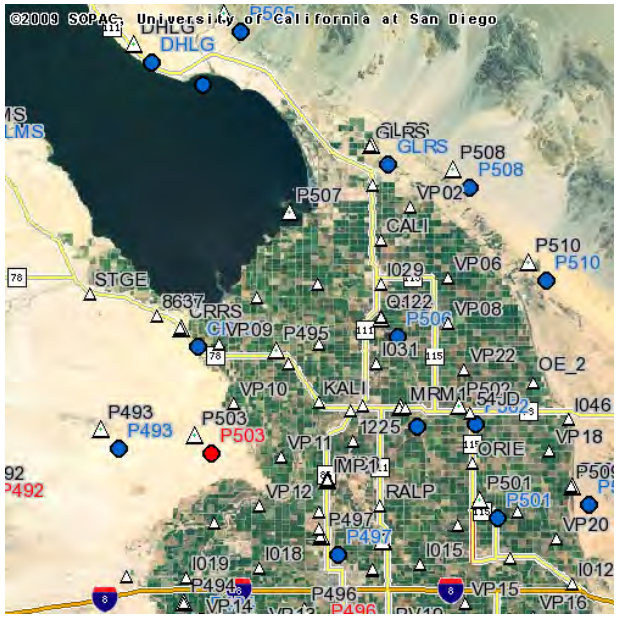
Proposed backbone network

- Includes 162 stations at a nominal 50 km spacing
- The current number of stations is 130 (only a fraction on map)
- Total of 225-250 stations (246 proposed in CRTN proposal 5.0)
- Budget prepared for 225-250 stations, and somewhat revised from business plan
- Only 71 PBO stations now needed under UNAVCO subcontract

CRTN Components

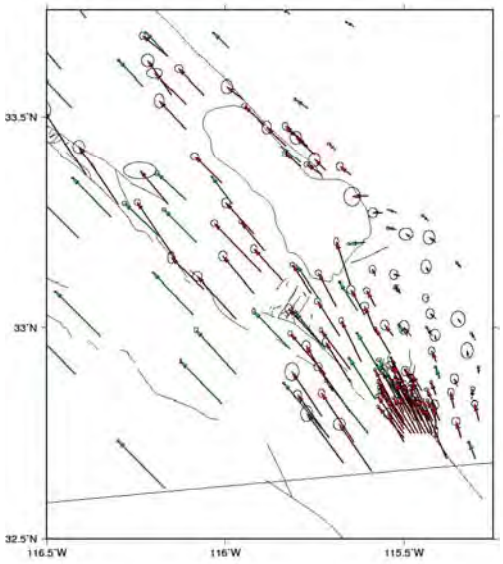


Application of CRTN Positioning Service

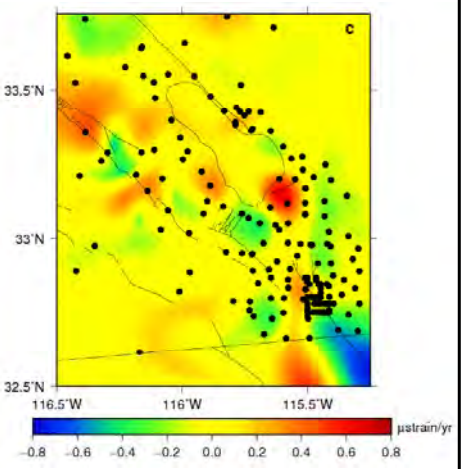


- Performed 3 rapid static GPS surveys performed by us between March, 2008 and March, 2009 with respect to the California Real Time Network (CRTN) to capture the transfer of strain between the Imperial fault and the San Andreas fault
- 2-3 15-minute occupations @ 1 Hz of each monument using 2-3 autonomous 2-person teams
- Analyzed data from our surveys and earlier surveys since 2003 using instantaneous positioning to compute station velocities

Strain Anomaly on Obsidian Buttes fault



Velocities since 2003



Change in

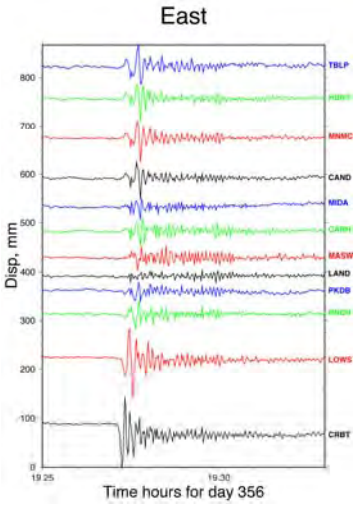
Maximum Shear Strain Rate

Test Bed for Early Warning Systems

- Earthquake Geodesy (coseismic motions)
- GPS Seismology (dynamic motions)
- Volcano monitoring
- Landslide monitoring
- Tsunami warning
- Structural monitoring
- Flood Control

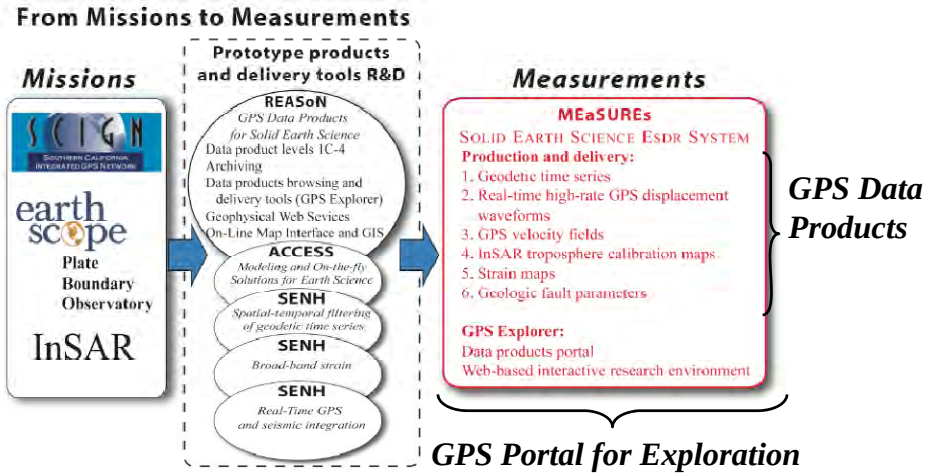
2004 Stromboli eruption

LA freeway after 1994 Northridge earthquake

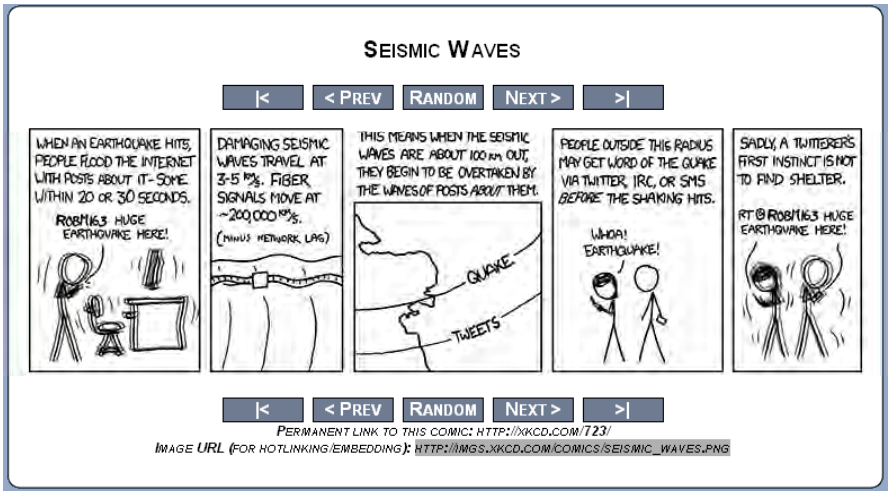


Displacement waveforms, 2004 Parkfield event

NASA MEaSUREs + AIST Projects



Popular Description of Earthquake Early Warning



Uses of Earthquake Early Warning

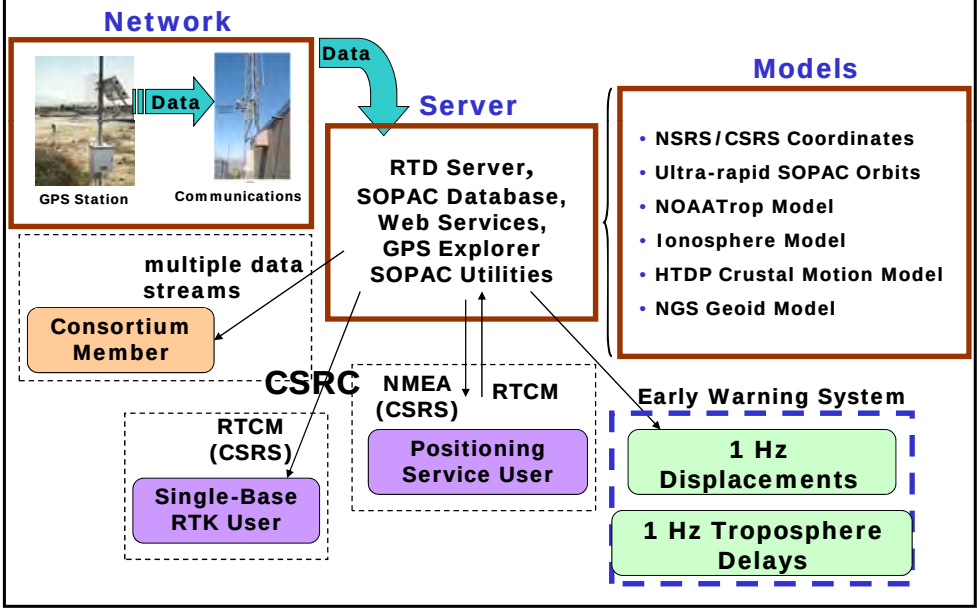
Public service guidelines for earthquake early warning in Japan

Some targets of early warning:

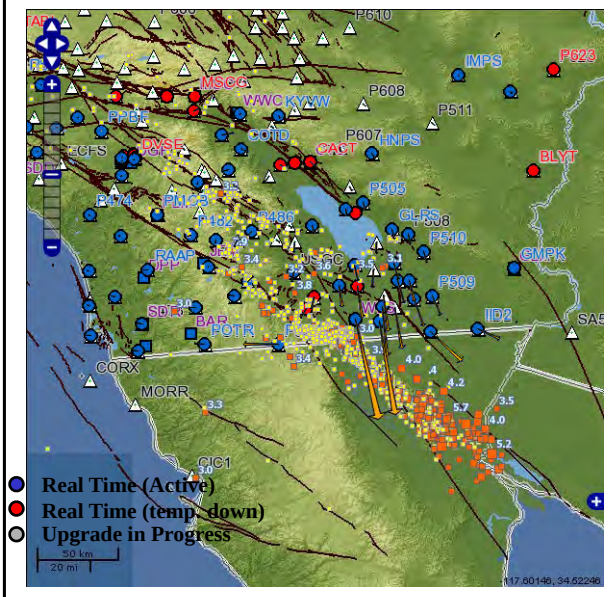
- emergency service providers
- transportation (public & private)
- power plants
- gas supplies
- factories
- schools
- hospitals
- shopping malls
- police
- structures (dams, bridges)
- public (see graphic to the left)

Of course, this requires interfacing properly with first responders and development of automatic procedures and rapid response guidelines

CRTN Components



April 4, 2010 Mayor-Cucapah Earthquake



- M 7.2 earthquake occurred in northern Baja California on Easter Sunday (3:42 PM, local time) and was felt throughout southern California, and as far away as Phoenix and Las Vegas
- CRTN stations captured the earthquake and a robust set of 1 Hz data were transmitted in real-time to Scripps and on-the-fly displacements were computed
- Earthquake aftershocks are continuing on the Laguna Salada fault and northward along the Elsinore & San Jacinto faults

First Announcement after Earthquake

Ground displacement measurements from the Magnitude 7.2 earthquake in Baja California on April 4, 2010

*By **Yehuda Bock**, Research Geodesist, UCSD/SIO Institute of Geophysics and Planetary Physics*

From an email the author sent around 4:34 PM on April 4, shortly after the quake:

> *Forum: CRTN Community Notices*
> *Subject: Earthquake in Baja*
>
> *Message: I'm sure most of you felt the ~M=7 earthquake at around 3:42 PM this afternoon. Our CRTN stations picked up the dynamic shaking and coseismic displacements very nicely. Looking at the closest stations in Imperial Valley, peak to peak dynamic displacements equaled about 1 m, primarily in North and East directions, and there was about 10 cm of permanent (coseismic) deformation in each horizontal component. These were easily picked up by our early warning system. Very little deformation in the vertical direction. More details later.*
> *-- Yehuda*

SOPAC Response to Mayor-Cucapah Earthquake

• Created a special portlet for the GPS Explorer portal maintained by JPL and Scripps (http://geoapp03.ucsd.edu/gridsphere/gridsphere) and posted data and results as they were received/produced.

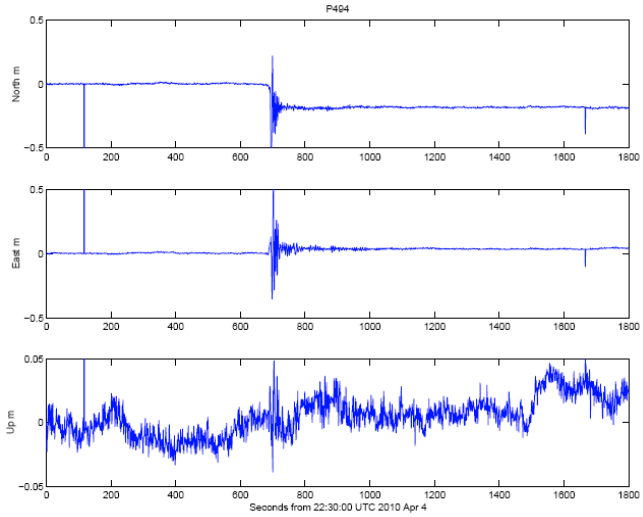
• The California Real Time Network (CRTN) collected CGPS 1 Hz RINEX files from 93 stations during the event. On-the-fly 1 Hz relative displacements were computed in 9 sub-networks with overlapping stations (see station P500, as an example).

• These were combined in a network adjustment to produce 1 Hz total displacement waveforms over the entire network (waveforms, plots), a movie of 1 Hz displacements, and rapid coseismic horizontal displacements (values, map).

• Data from CRTN and other CGPS stations in Southern California were analyzed with GAMIT/GLOBK to produce a post-processed set of 3-D coseismic displacements (values, map) using daily segments of 15-second data before and after the event, which can also be viewed as layers on the interactive map.

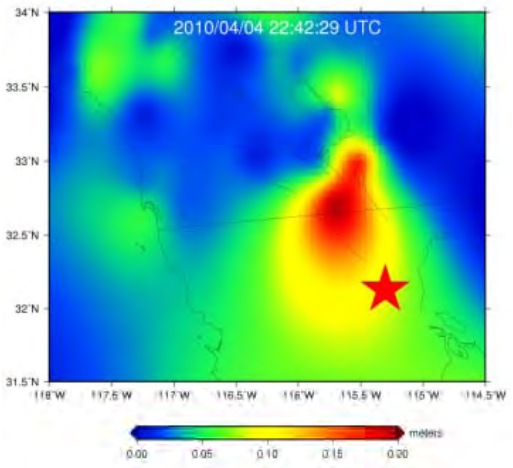
• A preliminary finite-fault slip model for the Mayor-Cucapah Earthquake was created from the 3-D coseismic vectors (fault model , coseismic displacement model , horizontal motion, vertical motion). The fault geometry is 65 km long, 20 km deep, striking at 320 degrees and dipping towards the west at 80 degrees. The computed moment magnitude from our model is 7.15, mostly strike slip, with a magnitude between 1.2 and 1.7 meters, reaching a maximum near the hypocenter.

Example of Absolute Displacement Waveforms



Total displacements (meters) in north, east, and up directions at station (P494) closest to the epicenter

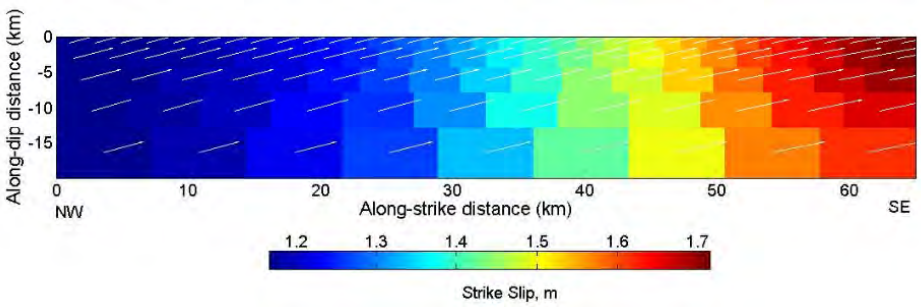
Movie of 1 Hz Displacements



Contoured map of 1 Hz ground displacements during Mayor-Cucapah earthquake – shown to the left is single frame of movie. Movie can be accessed through link to GPS Explorer shown below.

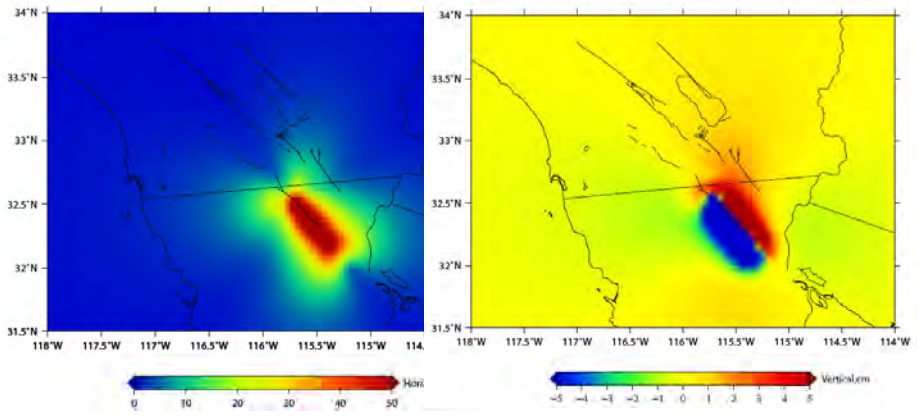
http://geoapp03.ucsd.edu/gridsphere/gridsphere?cid=Sierra+El+Mayor+Earthquake

Finite Fault Model Inversion



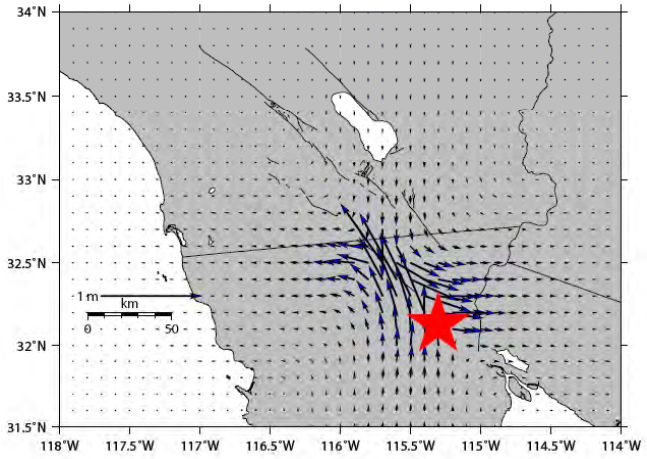
A preliminary finite-fault slip model for the Mayor-Cucapah earthquake on April 4, 2010 was created from the 3-D coseismic vectors. The fault geometry is 65 km long, 20 km deep, striking at 320 degrees and dipping towards the west at 80 degrees. The computed moment magnitude from our model is 7.15, mostly strike slip, with a magnitude between 1.2 and 1.7 meters, reaching a maximum near the hypocenter.

Model of Horizontal and Vertical Motion



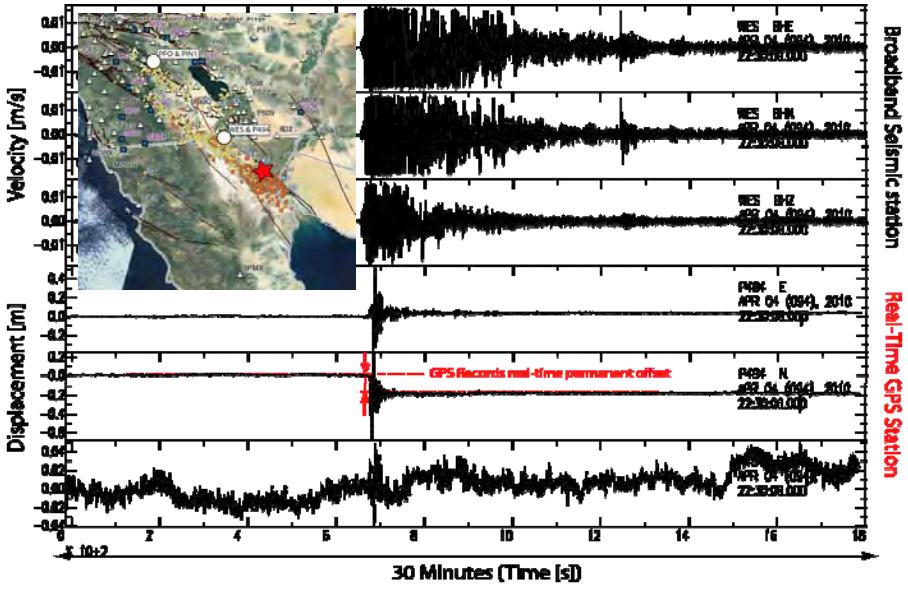
Modeled horizontal and vertical displacements for the M7.2 Mayor-Cucapah earthquake on April 4, 2010

Coseismic Displacement Model

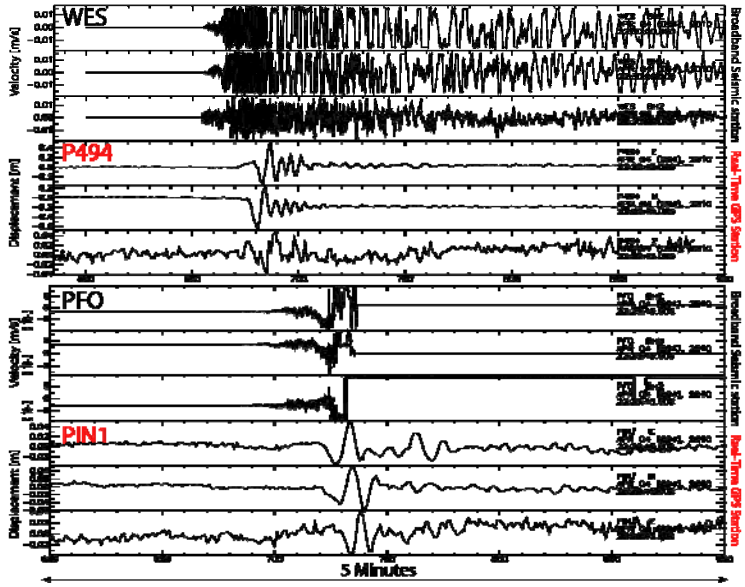


Modeled coseismic (horizontal) displacement grid in northern Baja and southern California for the M7.2 Mayor-Cucapah earthquake on April 4, 2010

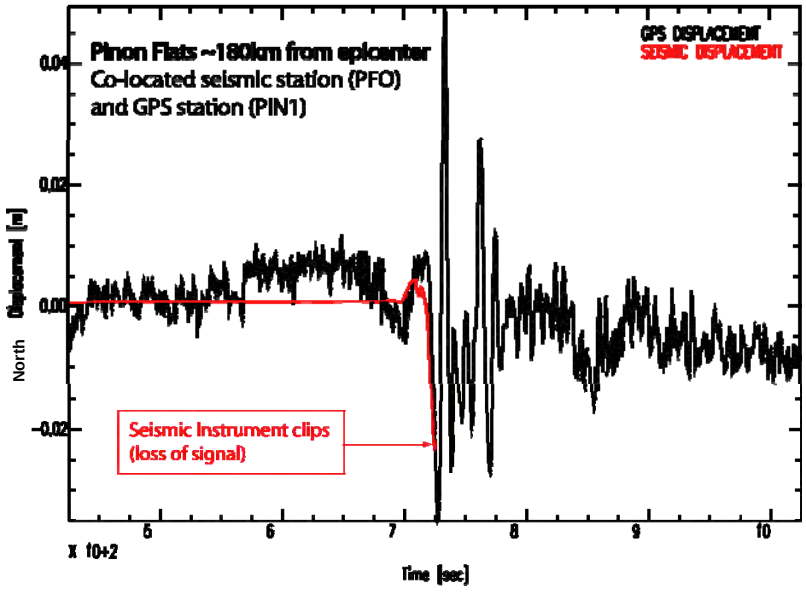
Broadband seismometers vs GPS stations



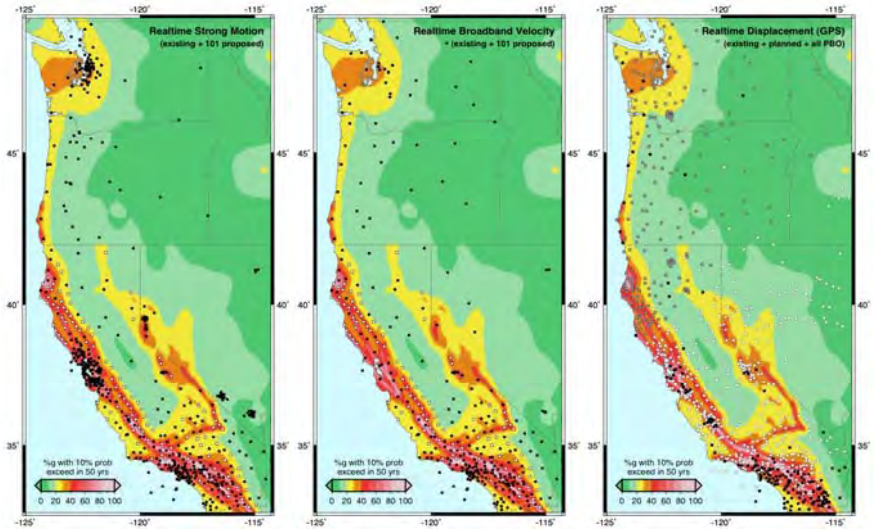
GPS instruments do not clip



Comparison of Seismic and GPS displacements

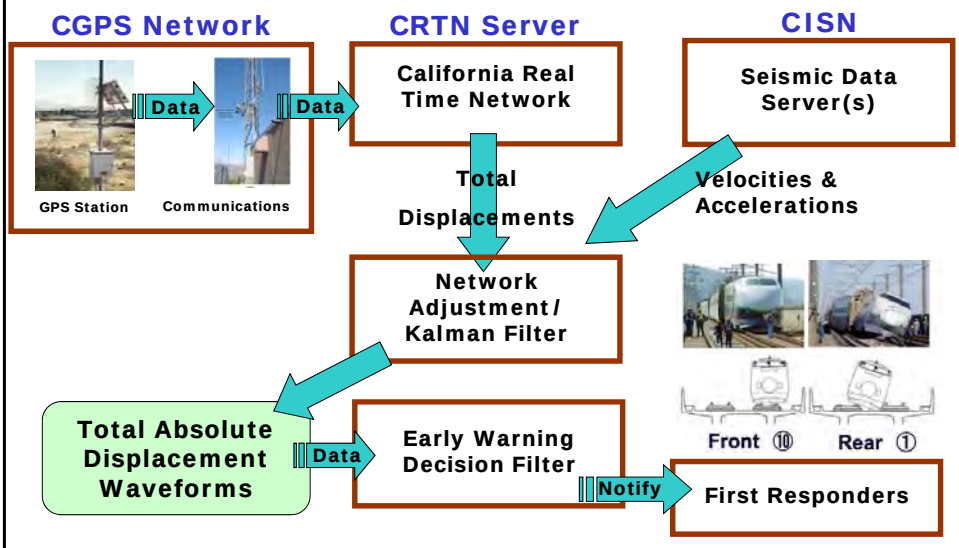


Real Time Geophysical Networks in Western U.S.

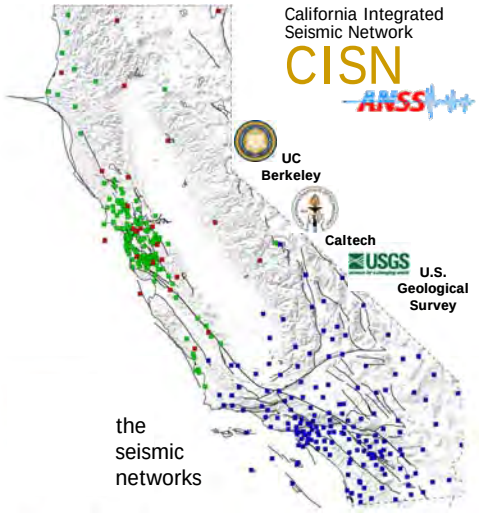


20km spacing in high hazard regions, 40km in moderate regions
[courtesy of Richard Allen (UC Berkeley)]

GPS/Seismic Early Warning System



Earthquake Early Warning in California



courtesy of Richard Allen

- Ongoing effort since 2006 to develop earthquake early warning in California under the auspices of CISN, with funding from USGS
- Testing three methodologies using strictly seismic data
  (1) ElarmS (UC Berkeley)
  (2) Virtual Seismologist (Caltech/ETH)
  (3) Onsite warning (Caltech/National Taiwan University)
- Results from 2010 Mayor-Cucapah earthquake indicate that earthquake early warning must also use geodetic methods, since most broadband seismic instruments clipped during this event
- One of our project goals is to contribute directly to this effort

Improved Latency of GPS Real-time Data Streams

Conducted real-time data latency tests and improved SIO Telemetry Buffer firmware to eliminate ramping behavior

SIO Telemetry Buffer

SIO Telemetry Buffer Description

- Designed to ensure maximum data retrieval with minimal latency
- Short-term buffer (non-volatile SRAM) to accommodate typical radio performance
- Long-term buffer (memory cards) to accommodate catastrophic events
- Receives supply power directly from the GPS receiver or via auxiliary connector
- Consumes only 265 mW of power when communicating to serial modem, 555 mW when communicating over Ethernet
- Operates across a temperature range of -20C to +50C and from a wide supply voltage range of 9-36 Vdc making it ideally suited to the solar powered CGPS stations
- Packaged in a rugged enclosure (7.75" x 4.5" x 2.0")
- Operator programmable serial port baud rates
- Downloadable firmware stored in flash EEPROM

Used also in Earthquake/Tsunami Early Warning System projects in Indonesia and Mexico

Effect of SIO Telemetry Buffer Upgrades on Latency

Example of latency testing for 8 CRTN stations, making up the Metropolitan Water District subnetwork. The medians and interquartile ranges (iqr) are shown in units of seconds before and after telemetry buffer upgrades. The median latency improves by about a factor of two to about 0.4 s, and the scatter denoted by the iqr improves by about a factor of 4 to about 0.2 s. This allows the effective "dead" zone for early warning to be reduced.

site	median (s)	iqr (s)	95%	receiver	sub-net	% data	run length	start date
Before Telemetry Buffer Upgrade:								
cnpp	0.78	0.60	0.89	trimble	mwd	99.998	23:49:15	24-Sep
ewpp	0.76	0.60	0.88	trimble	mwd	99.997	23:49:14	24-Sep
gnps	0.75	0.57	0.85	trimble	mwd	99.995	22:52:07	25-Sep
hnps	0.76	0.57	0.85	trimble	mwd	99.988	22:50:30	25-Sep
imps	0.76	0.57	0.84	trimble	mwd	99.995	22:52:07	25-Sep
mat2	0.78	0.57	0.85	trimble	mwd	99.999	24:06:41	26-Sep
mlfp	0.77	0.58	0.85	trimble	mwd	99.995	23:41:07	1-Oct
ppbf	0.99	1.07	1.58	trimble	mwd	99.635	24:02:55	26-Sep
After Telemetry Buffer Upgrade:								
cnpp	0.40	0.17	0.25	trimble	mwd	99.992	24:05:04	2-Nov
ewpp	0.38	0.17	0.25	trimble	mwd	99.991	24:05:01	2-Nov
gnps	0.35	0.17	0.26	trimble	mwd	99.422	23:56:47	2-Nov
hnps	0.37	0.17	0.25	trimble	mwd	99.410	23:56:40	2-Nov
imps	0.38	0.17	0.25	trimble	mwd	99.995	24:05:03	2-Nov
mat2	0.42	0.16	0.23	trimble	mwd	99.987	24:04:58	2-Nov
mlfp	0.38	0.16	0.24	trimble	mwd	99.993	24:05:00	2-Nov
ppbf	0.49	0.45	0.66	trimble	mwd	99.634	23:59:52	2-Nov

EEWS in Mexico GPS & Seismic Instruments

Public Interest in Earthquake Early Warning

...broad societal penetration

earthquake early warning is
...of widespread interest
...and has a high value with society

"And seismologists at the University of California Berkeley have announced plans for an earthquake alert system that would give a 10-20 second warning before an earthquake hits.

That's not enough for people to get to safety, but it's enough time for the insurance companies to cancel all the policies."

- Jay Leno

CRTN Expansion Milestones

- **CRTN Proposal version 5.0 published on 10/16/2008**
- **CRTN Business Plan distributed on 7/15/2009**
- **Inaugural Consortium meeting held at SIO on 10/2/2009**
- **Endorsement by County Engineers Association of California (CEAC) dated 11/25/2009**
- **2nd Consortium meeting held at SIO on 1/21/2010**
- **SOPAC funded by USGS American Recovery and Reinvestment Act (ARRA) project to upgrade 28 CRTN stations, including GNSS equipment and telemetry upgrades**
- **Received CRTN cost proposal from UNAVCO on 2/8/2010**
- **Expanded coverage into Northern California with PBO "NOAA" stations on 3/25/2010**
- **Signed data sharing agreement with Caltrans for CVSRN data on 5/5/2010**
- **The planning for a statewide expansion of CRTN has achieved important milestones through a 3 year community process, and we see a clear path to a fully operational statewide network within 2 years**

CRTN Proposal, 10/16/08

Living Document

Proposal for a Statewide California Real Time Network
Version 5.0

California Spatial Reference Center
Scripps Institution of Oceanography, La Jolla, CA

October 16, 2008

Prepared by

Yehuda Bock, CSRC Director
Maria Tiringan, CSRC Coordinator
CRTN Review Committee:
Art Andrew (Chair)
Gigi Cardoza
Ross Carlson
Chris Walls
Cecilia Whitaker

Please send comments to
ybock@ucsd.edu & Art.Andrew@rdmd.ocgov.com

CRTN Business Model, 7/15/09

Living Document

Business Model for the Statewide California Real Time Network

California Spatial Reference Center

July 15, 2009

Typical CRTN station (RAAP – Ramona Airport, San Diego County)

CRTN Budget: CSRC Component

Maintaining the CSRS (270k, ~20%)

- IT Systems Administration, Maintenance, Support, and Development
- GPS Data Archiving
- Data Processing, Analysis, Validation, and Quality Control
- Time Series Generation
- Database Administration
- Oracle, Red Hat, APC. Cisco Software Maintenance and Support
- Computing/Networking Supplies
- Data Archive Equipment

Maintaining the CSRC/CRTN Data Portal ($126k, ~10%)

- IT Systems Administration, Maintenance, Support, and Development
- Data Portal Enhancements
- Web Services and Software Development
- Web Applications Development

CRTN Budget: Real-Time Component

Maintaining the Real-Time Infrastructure, $1052k, ~ 70%

- Maintenance and Repair of CGPS Stations in So. Cal.
- Maintenance of Real-Time Servers and Networks
- CRTN Lab and Field Technician/Engineer
- CRTN Real-Time Infrastructure Development and Enhancement
- CRTN Technical Support
- Consultants: PLS, Education & Outreach
- Subcontract to UNAVCO (~71 stations)
- Subcontract to So. Cal. Network Providers
- CRTN Fieldwork Costs: CGPS Parts and Vehicle Costs
- Real-Time Software Maintenance and Support
- Software Maintenance and Support and Computing/Network Supplies
- Consortium Meetings and Teleconferences
- Management, Oversight, and Coordination
- Development of Partnership and Collaborations
- Education and Outreach: Travel, Conferences, and Materials

CRTN Requirements Sent to UNAVCO

2. Latency requirements

Latency is defined as the time interval between the time of arrival of data (e.g., RTCM, BINEX) at the CRTN server in La Jolla and the time at which the (raw) data were received at the GPS station. The CRTN latency requirement is 1.2 s, set by the needs of surveyors who use the RTCM data as input to network RTK software. Based on our tests, PBO stations will need to be upgraded to third-generation modems such as LanCell2 CDMA modems. Also, based on our tests, we have developed metrics (median and interquartile range) as follows:

(1) excellent: Median 0.5 s, IQR 0.2 s
(2) good: Median 0.8 s, IQR 0.2 s
(3) fair: Median 1.0 s, IQR 0.2 s
(4) poor: Median greater than 1.2 s, IQR greater than 0.5 s

We have demonstrated good performance for data retrieved from the PBO RT server for stations with LanCell2 CDMA modems.

CRTN Requirements Sent to UNAVCO

3. Data completeness

Since CRTN is not concerned (per se) with archiving of data for the PBO stations (already done by UNAVCO), data completeness is directly related to meeting our latency requirements. So data completeness for us is the percentage of time when the latency of 1.2 s is achievable. The metrics for completeness are:

(1) excellent: 100%
(2) good: 99%
(3) fair: 98%
(4) poor: less than 98%

To put this in perspective, acceptable (fair) performance is receiving 98% of the data with a median latency of 1.0 s, and an IQR of 0.2 s.

UNAVCO/PBO SOW: Some Details

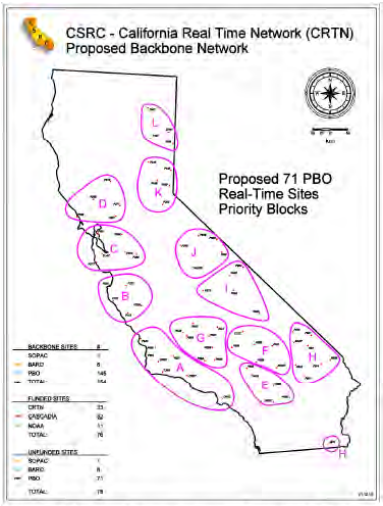
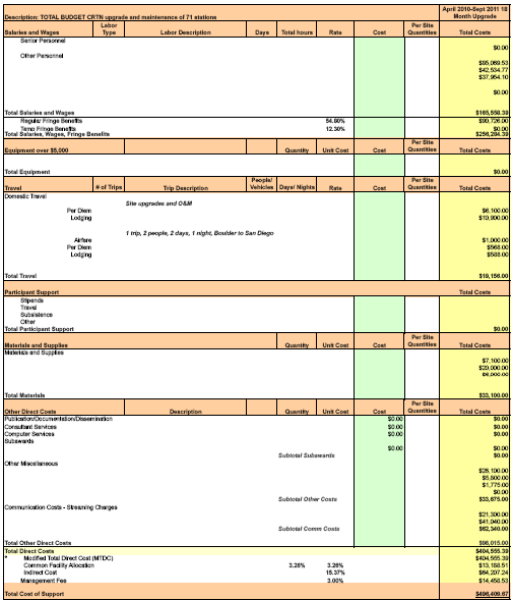


Figure 2. Proposed stations organized by priority. Station groups A-G (43 total) will be updated by September 30, 2010 assuming a 1 April 2010 start date. Station groups H-L updates will be completed by January 2011.

- UNAVCO makes no guarantee of the availability, quality, reliability, usability, or suitability of any UNAVCO GPS data stream for any particular purpose.
- Data streams will be made available to CRTN in BINEX (http://binex.unavco.org/) or RTCM format, with 1-hour-averaged latency to the CRTN server at or under 1.2 seconds and a data completeness of 90% or better measured over a 4-week period.
- UNAVCO reserves the right to distribute data streams to other users including scientific or commercial data distributors.
- Once a streaming station comes on line, CRTN will provide UNAVCO with real-time position estimates from PBO stations so they can be displayed on the PBO website and distributed to other interested groups.
- CRTN will benefit from existing PBO stations, ongoing upgrades for NOAA, and upgrades in the Cascadia region.

UNAVCO/PBO SOW: Budget



Description: TOTAL BUDGET CRTN upgrade and maintenance of 71 stations — April 2010-Sept 2011 19 Month Upgrade

Salaries and Wages	Labor Type	Labor Description	Days	Total hours	Rate	Cost	Per Site Quantities	Total Costs
Senior Personnel								$0.00
Other Personnel								$35,069.53
								$42,534.77
								$37,954.10
								$0.00
Total Salaries and Wages								$165,558.39
Regular Fringe Benefits					54.66%			$90,726.00
Temp Fringe Benefits					12.36%			$0.00
Total Salaries, Wages, Fringe Benefits								$256,284.39

Equipment over $5,000			Quantity	Unit Cost	Cost	Per Site Quantities	Total Costs
Total Equipment							$0.00

Travel	# of Trips	Trip Description	People/ Vehicles	Days/ Nights	Rate	Cost	Per Site Quantities	Total Costs
Domestic Travel		Site upgrades and O&M						
Per Diem								$6,100.00
Lodging								$10,900.00
		1 trip, 2 people, 2 days, 1 night, Boulder to San Diego						
Airfare								$1,900.00
Per Diem								$568.00
Lodging								$568.00
Total Travel								$19,156.00

Participant Support	Total Costs
Stipends	
Travel	
Subsistence	
Other	
Total Participant Support	$0.00

Materials and Supplies	Quantity	Unit Cost	Cost	Per Site Quantities	Total Costs
Materials and Supplies					$7,100.00
					$20,000.00
					$6,000.00
Total Materials					$33,100.00

Other Direct Costs	Description	Quantity	Unit Cost	Cost	Per Site Quantities	Total Costs
Publication/Documentation/Dissemination				$0.00		$0.00
Consultant Services				$0.00		$0.00
Computer Services				$0.00		$0.00
Subawards				$0.00		$0.00
		Subtotal Subawards				$0.00
Other Miscellaneous						$26,100.00
						$5,500.00
						$1,775.00
						$0.00
		Subtotal Other Costs				$33,875.00
Communication Costs - Streaming Charges						$21,300.00
						$41,040.00
		Subtotal Comm Costs				$62,340.00
Total Other Direct Costs						$96,215.00
Total Direct Costs						$456,555.39
Modified Total Direct Cost (MTDC)						$434,505.39
Common Facility Allocation				3.28%	3.28%	$15,188.01
Indirect Cost					15.37%	$66,237.24
Management Fee					3.05%	$14,450.53
Total Cost of Support						$496,409.67

- Summary budget for real-time, high-rate GPS data flow from 71 PBO stations. Budget includes 43 upgrades between April-September 2010 and 28 upgrades between October 2010-January 2011. Costs include 18 months of dataflow management and real-time high-rate station Operations and Maintenance. Total: $496,409.67
  - Year 1 budget for real-time, high-rate GPS data upgrades for 43 stations covering the period between April-September 2010. The budget includes seven O&M station visits. Total: $186,126.38
  - Year 2 budget for real-time, high-rate GPS data upgrades for 28 stations covering the period between October 2010 and September 2011. The budget includes 22 station O&M visits. Total: $310,283.29
- Sample outyear budget for continuing operations and maintenance for 71 stations. Total: $302,032.53

Funding Summary

- CSRC funding has been reduced to $100k in FY09 to $0k in FY10 from NGS height modernization program – has resulted in staff layoffs and degradation in services at CSRC and SOPAC
- SOPAC funding for real-time GPS research is strong but basic infrastructure support is lacking, which we received previously from NGS height mod funding
- The SIO Director's office have made significant efforts to secure NOAA funding for FY11 through congressional earmark, with considerable help from CSRC community members
- Some progress in CRTN consortium (first subscriber from LA City, other local SoCal subscribers imminent, limited interest in NoCal)
- Future of CSRC and to some extent SOPAC basic services depends on our ability to raise funds from local and state sources (through CRTN Consortium) and renewed NOAA funding in FY11

Executive Committee Recommendations

- The CSRC should remain as "status quo" as best as possible. This entails keeping all current services that the CSRC offers functioning. In order to do this, the CSRC needs to define the ***absolute minimum amount*** of funding required for this.
- We also need to really understand the relationship between the CSRC and SOPAC and how one affects the other. The CSRC also has many long standing relationships with agencies and colleagues that depend on CSRC services and it would be unwise to abruptly cutoff these services that users need.
- Current CSRC funding conditions are poor and we are now challenged with the decision of how to survive with minimal, or possibly no funding at all. Based on CSRC EC discussions, we feel that the following bullets are important and must continue to be met regardless of the funding situation:
  - The CSRC is vital to the state of California and should remain functioning as long as possible.
  - The CSRC must continue to make available the 2007.00 and 2009.00 epoch coordinates and velocities on the CGPS stations that are part of the CSRN.

EC Recommendations (Cont.)

Below are the CSRC EC member's recommendations on how the CSRC proceeds when funding has been depleted:

1. A "notice" should be placed immediately on the CSRC website with a statement such as:

> **NOTICE**
>
> The CSRC must consider ceasing to provide services due to lack of funding.
>
> Some services such as access to the free CRTN data streams will not be publicly available as of June 30, 2010.
>
> On June 30, 2010, the CSRC website will continue in an unmaintained mode.
>
> Please send your comments, questions and concerns to the CRTN Users Forum @ http://troy.ucsd.edu/ubbcgi/ultimatebb.cgi?category=6

2. Services that require CSRC funding should be made publicly unavailable on June 30, 2010 and remain that way until future funding can support these services.
3. The CSRC website shall continue to be available after June 30, 2010 in a static and/or unmaintained mode as best as possible. The 2007.00 and 2009.00 epoch coordinates and velocities data sheets shall remain publicly available.
4. Consortium member benefits and services ***must*** continue to be available to paid members only.
5. The CSRC must continue to seek funding.

CSRC Financial Report and Funding Efforts

Maria Turingan

CSRC Coordinating Council Spring Meeting, May 6, 2010

Hosted by PG&E, 77 Beale Street, San Francisco

Agenda

- **Financial Report**
  - Funding History and Funding Sources
  - Current Budget
  - CRTN Membership and UCSD Indirect Costs
- **Coordinating Council Membership**
  - Coordinating Council Roster
  - Vacant Positions
  - Executive Committee
- **Funding Efforts**
  - Congressional Representatives
  - Developments
  - Letters of Support

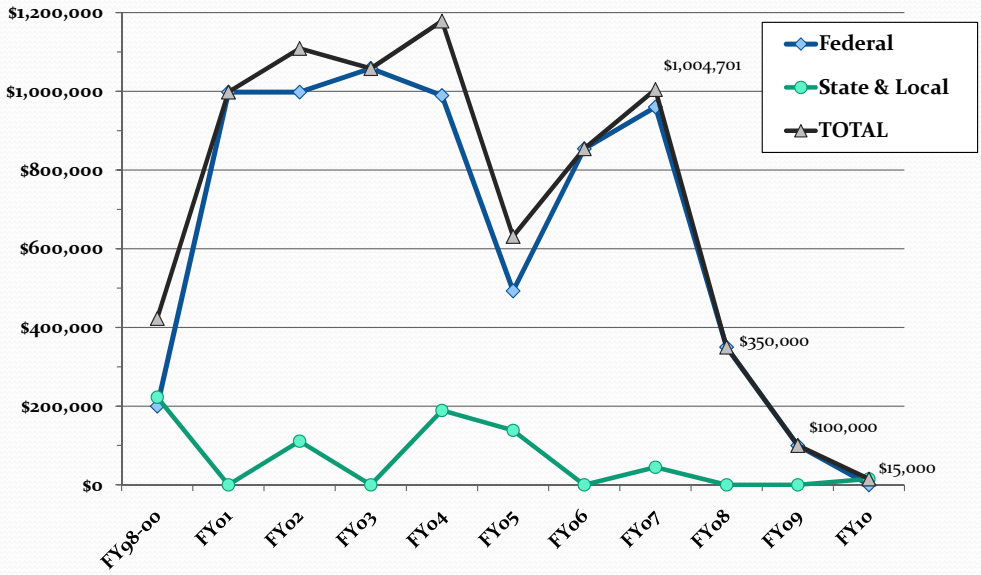
Financial Report

- Funding History and Funding Sources
- Current Budget
- CRTN and UCSD/Scripps Indirect Costs

Funding History and Funding Sources through June 2011

Sources of Support	Jul-98 Jun-01	Jul-01 Jun-02	Jul-02 Jun-03	Jul-03 Jun-04	Jul-04 Jun-05	Jul-05 Jun-06	Jul-06 Jun-07	Jul-07 Jun-08	Jul-08 Jun-09	Jul-09 Jun-10	Jul-10 Jun-11	Total
Federal												
Federal FY Oct-Sep	*FY99-01*	*FY02*	*FY03*	*FY04*	*FY05*	*FY06*	*FY07*	*FY08*	*FY09*	*FY10*	*FY11*	
Federal FY Budget	*FY98-00*	*FY01*	*FY02*	*FY03*	*FY04*	*FY05*	*FY06*	*FY07*	*FY08*	*FY09*	*FY10*	
NOAA's National Geodetic Survey	$200,000	$998,000	$998,000	$1,058,000	$989,477	$492,829	$854,100	$960,000	$300,000	$100,000		**$6,950,406**
JPL/NASA									$50,000			**$50,000**
Federal Subtotal	**$200,000**	**$998,000**	**$998,000**	**$1,058,000**	**$989,477**	**$492,829**	**$854,100**	**$960,000**	**$350,000**	**$100,000**	**$0**	**$7,000,406**
State & Local												
Caltrans	$181,600		$59,897			$138,399		$44,701				**$424,597**
Contra Costa County	$16,750											**$16,750**
Glenn County					$14,500							**$14,500**
Los Angeles, City of											$15,000	**$15,000**
Orange County*												**$0**
Riverside County			$12,000									**$12,000**
Riverside County Flood Control*			$25,000									**$25,000**
San Diego County	$10,000				$174,515							**$184,515**
Yolo County	$14,500		$14,000									**$28,500**
State & Local Subtotal	**$222,850**	**$0**	**$110,897**	**$0**	**$189,015**	**$138,399**	**$0**	**$44,701**	**$0**	**$0**	**$15,000**	$720,862
TOTAL	**$422,850**	**$998,000**	**$1,108,897**	**$1,058,000**	**$1,178,492**	**$631,228**	**$854,100**	**$1,004,701**	**$350,000**	**$100,000**	**$15,000**	**$7,721,268**

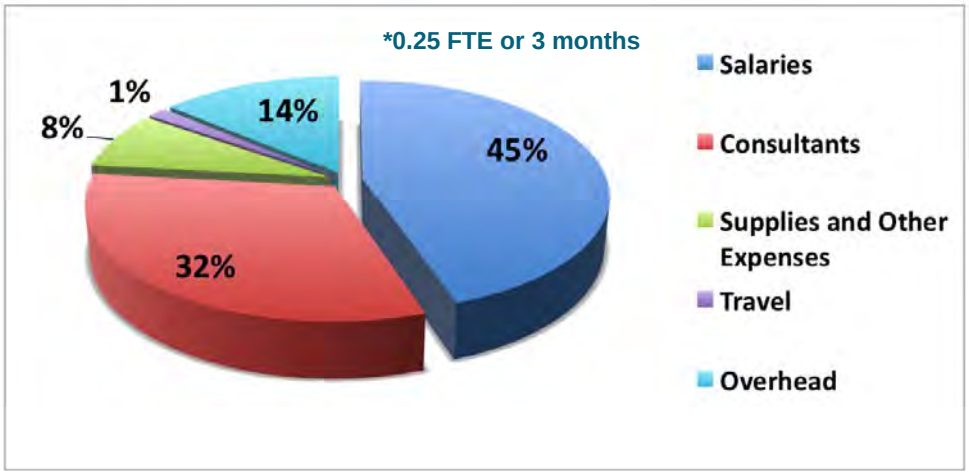
Funds Received All Sources through July 2011



Financial Report July 1, 2009 to February 28, 2010

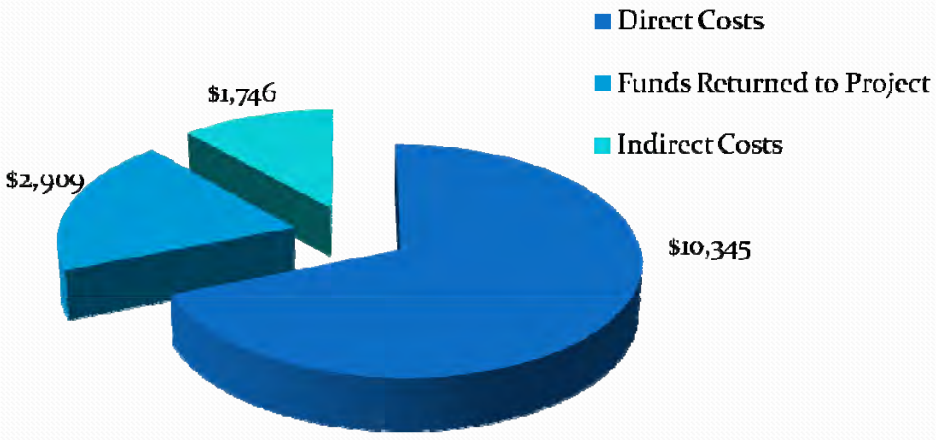
TASK	Task 1 Educ & Outreach	Task 2 Regional Efforts	Task 3 Info Tech for Ht Mod	Task 4 CGPS Operations & Maint	Task 5 Real Time GNSS Ntwk Partnering	Task 6 Ht Mod Projects	Task 7a Mgmt & Admin	Task 7b Executive Manager	FY0708 HM Proj: Adjust N San Joaquin	FY0708 HM Proj: Central Coast	TOTAL
REVENUE											
FY08-09 Carry Forward Balance	0	0	0	1,060	0	0	0	0	0	0	*1,060*
FY09-10 Award	20,000	0	0	30,000	0	0	20,000	30,000	0	0	*100,000*
FY09-10 Budget	*20,000*	*0*	*0*	*31,060*	*0*	*0*	*20,000*	*30,000*	*0*	*0*	*101,060*
EXPENSES											
Salaries*	7,315	0	0	17,850	0	0	13,760	0	0	0	**38,925**
Consultants	0	0	0	0	0	0	0	20,335	0	0	**20,335**
Subcontractors	0	0	0	0	0	0	0	0	0	0	**0**
Supplies and Other Expenses	956	0	0	1,644	0	0	144	0	0	0	**2,744**
Equipment	0	0	0	0	0	0	0	0	0	0	**0**
Travel	0	0	0	0	0	0	0	0	0	0	**0**
Total Direct Costs (DC)	8,271	0	0	19,494	0	0	13,904	20,335	0	0	**62,004**
Indirect Costs (IDC)	1,323	0	0	3,119	0	0	2,225	3,254	0	0	**9,921**
EXPENSES THROUGH FEB 28, 10	**9,594**	**0**	**0**	**22,613**	**0**	**0**	**16,129**	**23,589**	**0**	**0**	**71,925**
BALANCE	*10,406*	*0*	*0*	*8,447*	*0*	*0*	*3,871*	*6,411*	*0*	*0*	*29,135*
PROJECTED EXPENSES											
Salaries	1,817	0	0	6,342	0	0	293	0	0	0	**8,452**
Consultants	3,000	0	0	0	0	0	2,500	5,527	0	0	**11,027**
Subcontractors	0	0	0	0	0	0	0	0	0	0	**0**
Supplies and Other Expenses	3,124	0	0	500	0	0	544	0	0	0	**4,168**
Equipment	0	0	0	0	0	0	0	0	0	0	**0**
Travel	1,030	0	0	440	0	0	0	0	0	0	**1,470**
Projected Total DC	8,971	0	0	7,282	0	0	3,337	5,527	0	0	**25,117**
Projected Total IDC	1,435	0	0	1,165	0	0	534	884	0	0	**4,019**
PROJECTED THROUGH JUNE 30, 10	**10,406**	**0**	**0**	**8,447**	**0**	**0**	**3,871**	**6,411**	**0**	**0**	**29,135**
PROJECTED BALANCE	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

FY2009-10 Budget of $100K: Expenses Including Projected



CRTN Membership and UCSD Indirect Cost Rate

88% or $13.3K of the $15K CRTN Membership Fee Directly Benefits the CRTN



Coordinating Council Membership

- Coordinating Council Roster
- Vacant Positions
- Executive Committee

Coordinating Council Membership (Part 1)

Organization	No.	Incumbent
CELSOC, North	1	Vacant
CELSOC, South	1	Clyde C. Cabrinha
CLSA, President	1	Matt Vernon
CLSA, North	1	David Ryan
CLSA, South	1	Michael McGee
Total	5	
ACSM	1	Vacant
ASPRS	1	Jerry A. Wagner
League of California Surveying Organizations (LCSO)	1	Vacant
Total	3	
CGIA	1	Vacant
URISA, North (BAAMA)	1	Dennis Wuthrich
URISA, South	1	Vacant
GIS Professionals (at large)	2	Bruce Joffe
		Kevin M. Kelly**
Total	5	
BARD	1	Dr. Nicolas Houlie
BARGEN	1	Dr. Brian Wernicke
PANGA	1	Dr. Timothy Melbourne
PBO, North	1	Vacant
PBO, South	1	Vacant
Southern California Geophysical Researchers	2	Dr. Nancy King
		Dr. Frank Webb
Geophysical Professional (at large)	1	Dr. Duncan Agnew
Total	8	
BLM	1	Vacant
Bureau of Reclamation	1	Vacant
FEMA	1	Vacant
Forest Service	1	Vacant
GPS/JPO	1	Thomas J. Nagle
NGS, Director	1	Juliana Blackwell
NGS, State Geodetic Advisor	1	Marti Ikehara***
USCE	1	
USGS	1	Dr. Kenneth W. Hudnut
Total	9	
BCDC	1	Vacant
Coastal Commission	1	Jonathan Van Coops
DWR	1	Scott Martin
Geological Survey	1	Vacant
Resources Agency (at large)	1	Gary Darling
Total	5	

Coordinating Council Membership (Part 2)

Other State Agencies	BPELS	1	Ric Moore	
	Caltrans	2	Giana (Gigi) Cardoza**	
			Mark Turner	
	Food and Agriculture	1	Vacant	
	Forestry and Fire Protection	1	Vacant	
	OES	1	Edward Bortugno	
	Other State Agencies (at large)	1	Vacant	
	Total	7		
Cities, Counties, and Local Agencies	County Engineers Association, North	1	Tony Pratt	
	County Engineers Association, South	1	Michael Emmons	
	League of California Cities	1	Vacant	
	City/County/Local Agency Professionals (at large)	2	Art Andrew*	
			Bob Packard	
	Local Agencies (at large)	1	Ross Carlson*	
	Total	6		
Utility Firms, Organizations and Districts	MWD	1	Michael Duffy	
	Water, Utility, Flood, Irrigation/etc. Prof. (at large)	2	Brian Wiseman**	
			Brett Baker	
	Flood/Irrigation Districts (at large)	1	Bill Hofferber	
	Utility Companies (at large)	1	Jeff Little	
	Total	5		
Educational Professionals (Surveying, GIS, and Geophysical)	UC-San Diego	1	Vacant	
	CSU-Fresno	1	Dr. Mushtaq Hussain	
	Educational Professional (at large)	1	Jose Javier Gonzalez Garcia	
	Total	3		
Non-Designated Professionals	Various Professionals (at large)	12	Michael Butcher	Steve Martin**
			John Canas	Ray Mathe
			Adrian (Dick) Davis*	Steve Sarsfield
			Larry Fenske	Jim Swanson
			Dan Gilleland**	Darrell Bain
			Greg Helmer	Cecilia Whitaker*
			Kari Launen	
	Total	12		
UCSD/SIO	Director of Center	1	Dr. Yehuda Bock***	
	Chancellor of UCSD (or designee)	1	Dr. John Orcutt***	
	Director of IGPP (or designee)	1	Guy Masters***	
	Total	3		
	COUNCIL TOTAL	71		

Coordinating Council Vacant Positions

- CELSOC, North
- ACSM
- League of California Surveying Organizations (LCSO)
- CGIA
- URISA, South
- BLM
- Bureau of Reclamation
- FEMA
- Forest Service
- BCDC
- Geological Survey
- Food and Agriculture
- Forestry and Fire Protection
- Other State Agencies (at large)
- League of California Cities
- UC-San Diego

Executive Committee

- Art Andrew, Orange County, Chairperson
- Dr. Yehuda Bock, UCSD/Scripps, Director
- Adrian "Dick" Davis, Caltrans
- Marti Ikehara, NGS
- Kevin Kelly, ESRI
- Ross Carlson, Treasurer
- Cecilia Whitaker, Secretary
- Gigi Cardoza, Caltrans
- Brian Wiseman, MWD
- Steve Martin, East Bay Municipal Utility District
- Dan Gilleland, Santa Clara Valley Water District
- Dr. John Orcutt, UCSD/Scripps
- Guy Masters, Scripps

Funding Efforts

- Congressional Representatives
- Developments
- Letters of Support

CSRC Government Relations Efforts for Federal FY2011

Government Relations Focused on Congressional Representative in 3 Areas:

- **Northern California**
- **Southern California- Los Angeles Area**
- **Southern California- San Diego Area**

Northern California

- **Congressman Mike Honda**
  - Representing California's 15th Congressional District: Silicon Valley, San Jose, and Santa Clara County
- **Congressman John Garamendi**
  - Representing the 10th District: Alameda, Solano, Contra Costa, and Sacramento Counties

CSRC Government Relations Efforts for Federal FY2011

Southern California- Los Angeles Area

- **Congresswoman Lucille Roybal-Allard**
  - Representing California's 34th Congressional District: Los Angeles County including downtown Los Angeles
- **Congressman Adam Schiff**
  - Representing the 29th District: Los Angeles County including Pasadena and Burbank

Southern California- San Diego Area

- **Congresswoman Susan Davis**
  - Representing California's 53rd Congressional District: San Diego County including La Jolla
- **Congressman Duncan Hunter**
  - Representing the 52nd District: San Diego County including the City of San Diego

CSRC Government Relations Efforts - Developments

House of Representatives Committee on Appropriations:
Subcommittee on Commerce, Justice, Science, and Related Agencies

- **Congressman Mike Honda**
  - Requested $1M for CSRC in the federal FY2011 budget (October 2010 to September 2011)
- **Congressman Adam Schiff**
  - Requested $200K for CSRC in the federal FY2011 budget

CSRC Users

- **Letters of Support**
- **Emails to and Participation in Teleconferences with Congressional Staffers**
- **Support from CSRC Users**

CSRC Government Relations Efforts – Quotes from Users

- "The CSRC provides a valuable service in helping the professional surveying and mapping community offer more cost-effective services." - Mike Hart, Towill, Inc.
- "CRSC provides a very necessary portal and service from which highly accurate data and information may be retrieved and reliably utilized. This information serves as the basis for the majority of the surveying and engineering projects we complete at Psomas." - Sean P. Logal
- "We utilize the stations and data provided by the CSRC on nearly all projects at Penfield & Smith, both public and private." - James P. Fallon, Penfield & Smith Engineers Inc.
- "The information and data provided by the CSRC supports many of the surveying and engineering design projects completed by RBF Consulting." - Greg Helmer and Daniel Bustamante
- "The geodetic control established and maintained by the CSRC has served as the basis for much of our surveying projects both locally and across the State of California." - Michael Farrauto, Andregg Geomatics
- "The geodetic infrastructure that the CSRC has put in place, is one of the best tools I have seen implemented and is an excellent example of tax dollars being spent wisely...This technology allows me to stay competitive in this tough economy." - Robert Shellman, Landmark Surveying, La Mesa, CA

Questions and Contact Information

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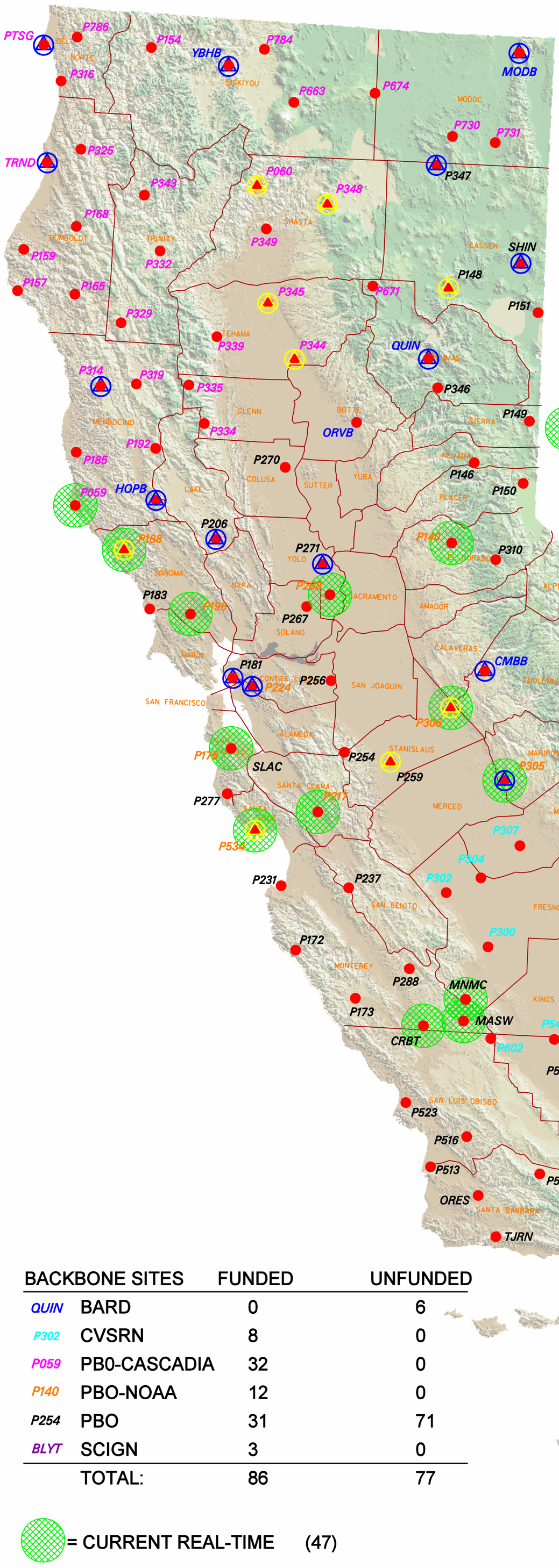
CSRC - California Real Time Network (CRTN)
Proposed Backbone Network (163 Sites)



BACKBONE SITES		FUNDED	UNFUNDED
QUIN	BARD	0	6
P302	CVSRN	8	0
P059	PB0-CASCADIA	32	0
P140	PBO-NOAA	12	0
P254	PBO	31	71
BLYT	SCIGN	3	0
	TOTAL:	86	77

= CURRENT REAL-TIME (47)

= CURRENT NGS CORS (28)

= PROPOSED NGS CORS (18)

03.25.10