



A Brief History of the California Spatial Reference Center

October 3, 2014
Ontario, CA



October 10, 2014
Oakland, CA

Current Status of the California Real-Time Network

Art Andrew – Past CSRC Chairperson

CSRC - Brief History

2000

CSRC established

A continuation
of the CGCC



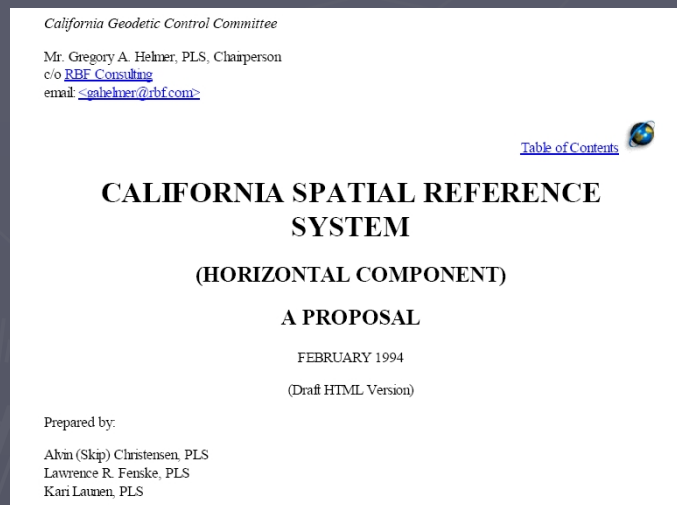
California Geodetic Control Committee

1993

- ▶ Formed in 1993 from members of CLSA Advanced Technologies Subcommittee
- ▶ A need to develop standards and specifications for high-production-type GPS surveys.
- ▶ Included 17 members from various public and private organizations
- ▶ To deal with horizontal spatial referencing issues:
 - ▶ Inadequate Network Accuracy
 - ▶ Errors detected by GPS
 - ▶ Existing control stations may be unsuited for GPS surveys; poor location, poor visibility
 - ▶ Limited Network Maintenance – NGS budget constraints have eliminated maintenance efforts

California Geodetic Control Committee

1994



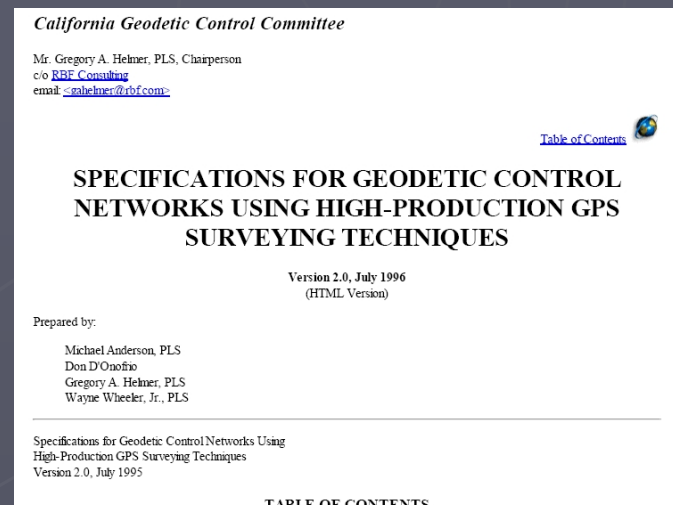
CSRS will be part of the NGRS; NGS is responsible for integrity, publication and distribution of CSRS data in the same manner as other NGS data.

Official Horizontal Spatial Reference System for California

Reference Control Network – HPGN

GPS Only

1996



Specifications for "High-Production" GPS Surveying

Supplement FGCS standards and Specifications

Why Needed? Advancements in GPS technology and methodology

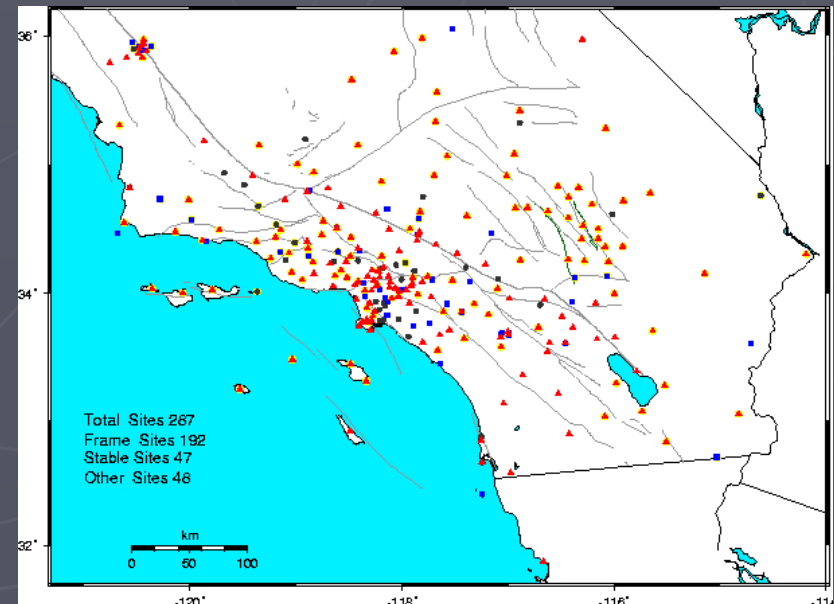
Proliferation of CORS

Southern California Integrated GPS Network (SCIGN)

- ▶ SCIGN was a collaborative effort by NASA/JPL, USGS, and SIO, under the umbrella of SCEC
- ▶ SCIGN became official in 1996
- ▶ Interest and funding for the SCIGN 250 station proposal occurred due to the Northridge Earthquake on January 17, 1994
- ▶ Network completed on July 6, 2001



1996



California Spatial Reference Center (CSRC)

► Who?

- Partnerships - surveyors, engineers, GIS professionals
- NGS, USGS, SOPAC, UNAVCO, the geophysics community
- Caltrans, city and county agencies



► Why?

- Provides a modern state-wide geodetic control network.
- 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.

► Where?

- Located at the Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics ([IGPP](#)) at [UCSD](#)'s Scripps Institution of Oceanography ([SIO](#)).

California Spatial Reference Center (CSRC)

2003

- ▶ Prepared "A Modern Statewide Geodetic Control Network"
- ▶ One component of a "complete" spatial reference system
- ▶ Other component; "Real-Time positioning infrastructure"



California Spatial Reference Center
Dr. Yehuda Bock, Director and Principal Investigator
Greg Helmer, Chairperson CSRC Coordinating Council
Cecil H. and Ida M. Green Institute of Geophysics and Planetary Physics, MC 0225
University of California San Diego (UCSD)
9500 Gilman Drive
La Jolla, CA 92093-0225
Website: <http://csrc.ucsd.edu>

California Spatial Reference Center

A MASTER PLAN for a MODERN CALIFORNIA GEODETIC CONTROL NETWORK

Approved By: CSRC Coordinating Council – October 18, 2002

Approved By: National Geodetic Survey – March 12, 2003

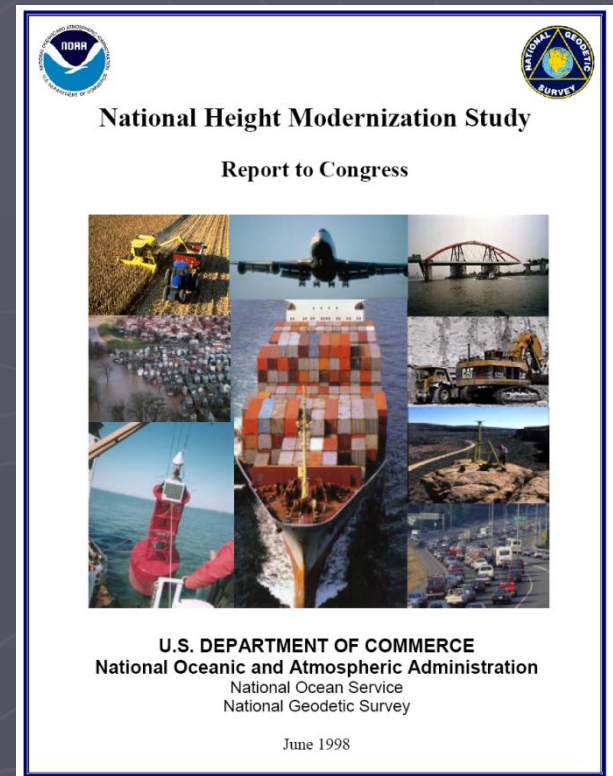
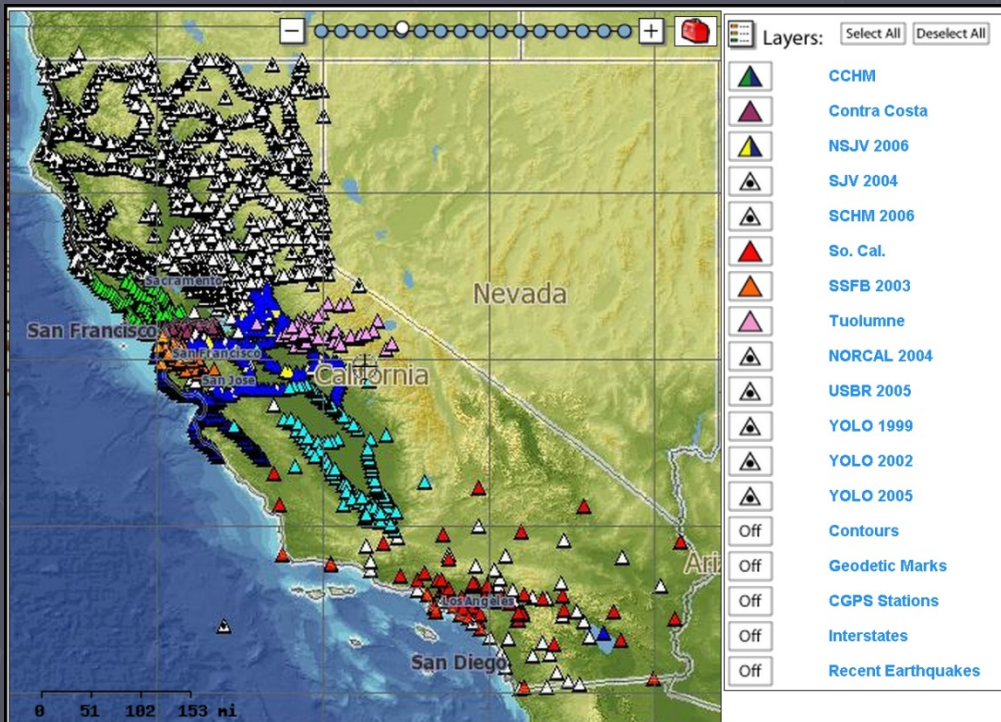
Prepared by the CSRC Committee for developing a
California Spatial Reference Network Master Plan:

- Don D'Onofrio, Chairperson
Retired NGS, CSRC Geodetic Consultant,
& Private geodetic consultant
- Larry Fenske, RCE, PLS, retired Caltrans
- Greg Helmer, PLS, RBF Consulting
- Fred Henstridge, PLS, Psomas and Associates
- Marti Ikehara, NGS State Geodetic Advisor
- Dr. Nancy King, USGS
- Dr. Glenn Sasagawa, UCSD

CSRC Height Modernization Projects

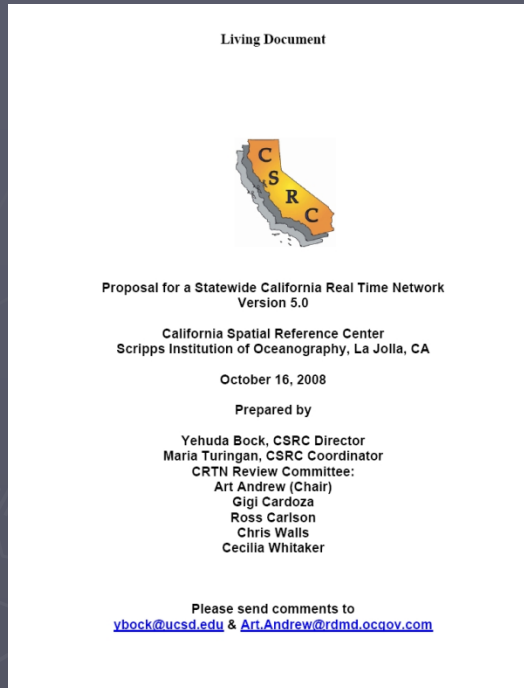
2000-2006

Main focus was Height Modernization projects with NGS funding



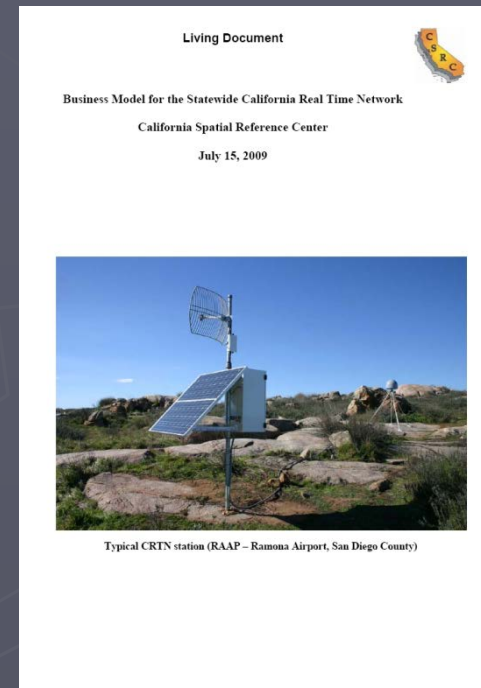
Statewide California Real Time Network (CRTN)

2008



Elements of statewide infrastructure
Describes CRTN and its components
Defines users
Management and Governance
Cost Recovery

2009



Describes CRTN Consortium
Data Availability
CRTN support and providers
Cost Recovery
Estimated Budget

California Spatial Reference Center (CSRC)

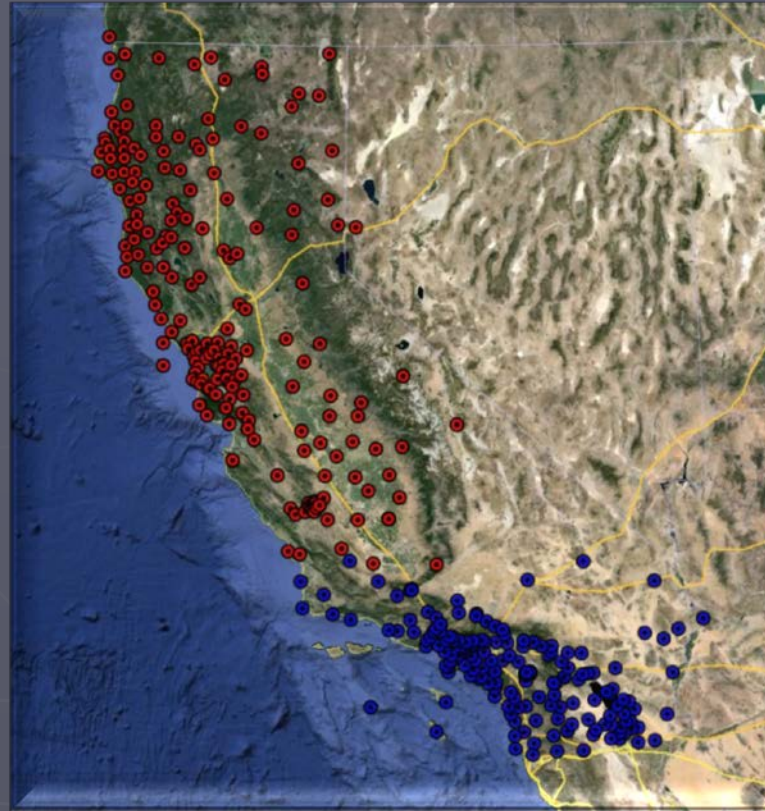
► Paid Staff (SOPAC & CSRC)

- Director: Yehuda Bock
- Researcher: Jennifer Haase
- Coordinator: Maria Turingan
- Analysis: Peng Fang
- Lead Programmer: Mindy Squibb
- System Administrator: Anne Sullivan
- Real-time Programmer: Bob Cunningham
- SCIGN and CRTN Engineer: Glen Offield
- Graduate Students: Dara Goldberg, Jessie Saunders, and Diego Melgar
- Postdoctoral Researchers: Jianghui Geng

John Canas – Executive Manager

► Volunteers (CSRC)

- 7 Executive Committee Members



California Real Time Network (CRTN)

Current Status

CRTN

367 Real Time Stations

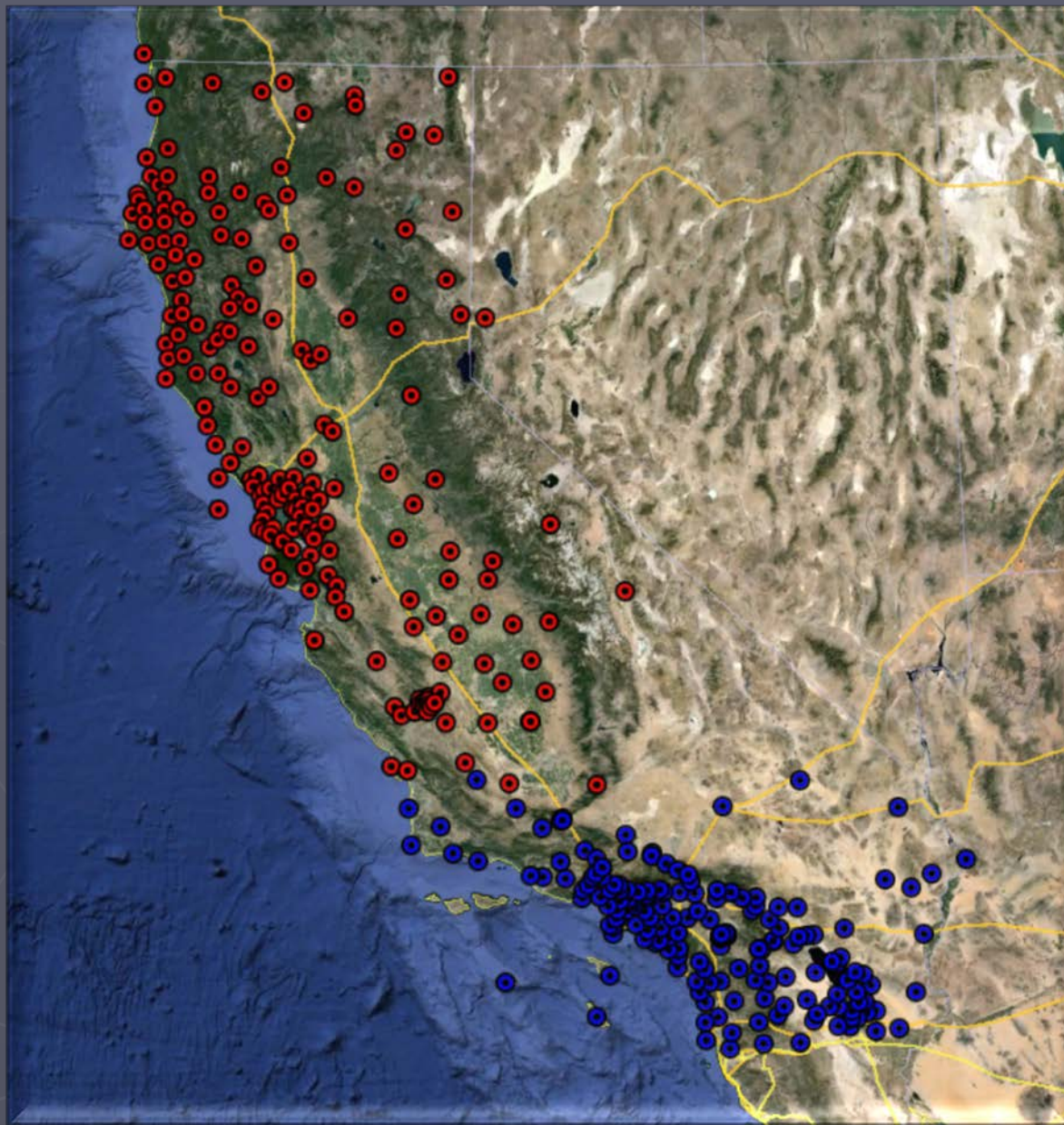
Available to users for
free via NTRIP

(one account)

Additional accounts
available for a fee

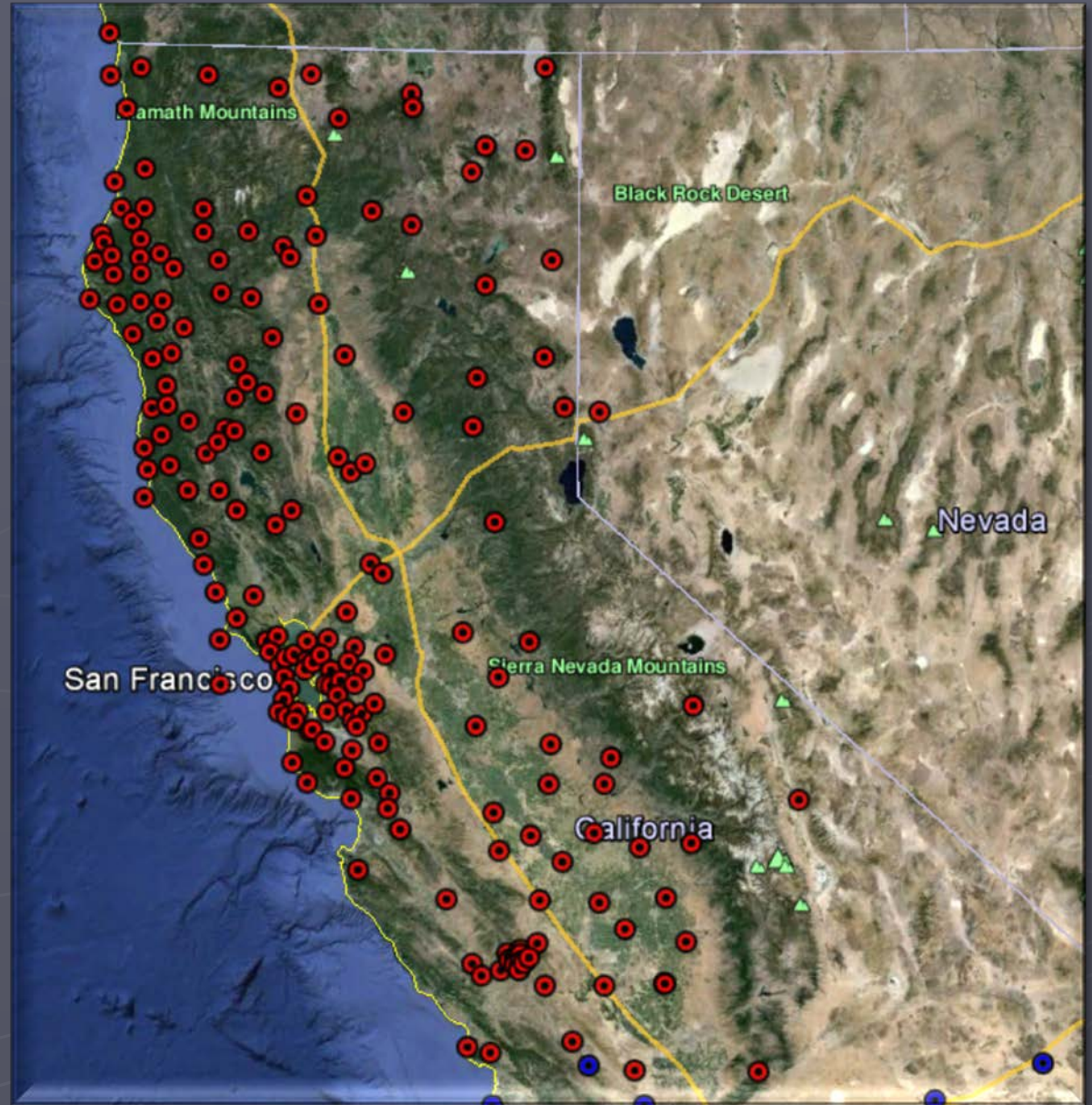
"Standard RTK"

NAD83 (NSRS2007),
2011.00 Epoch



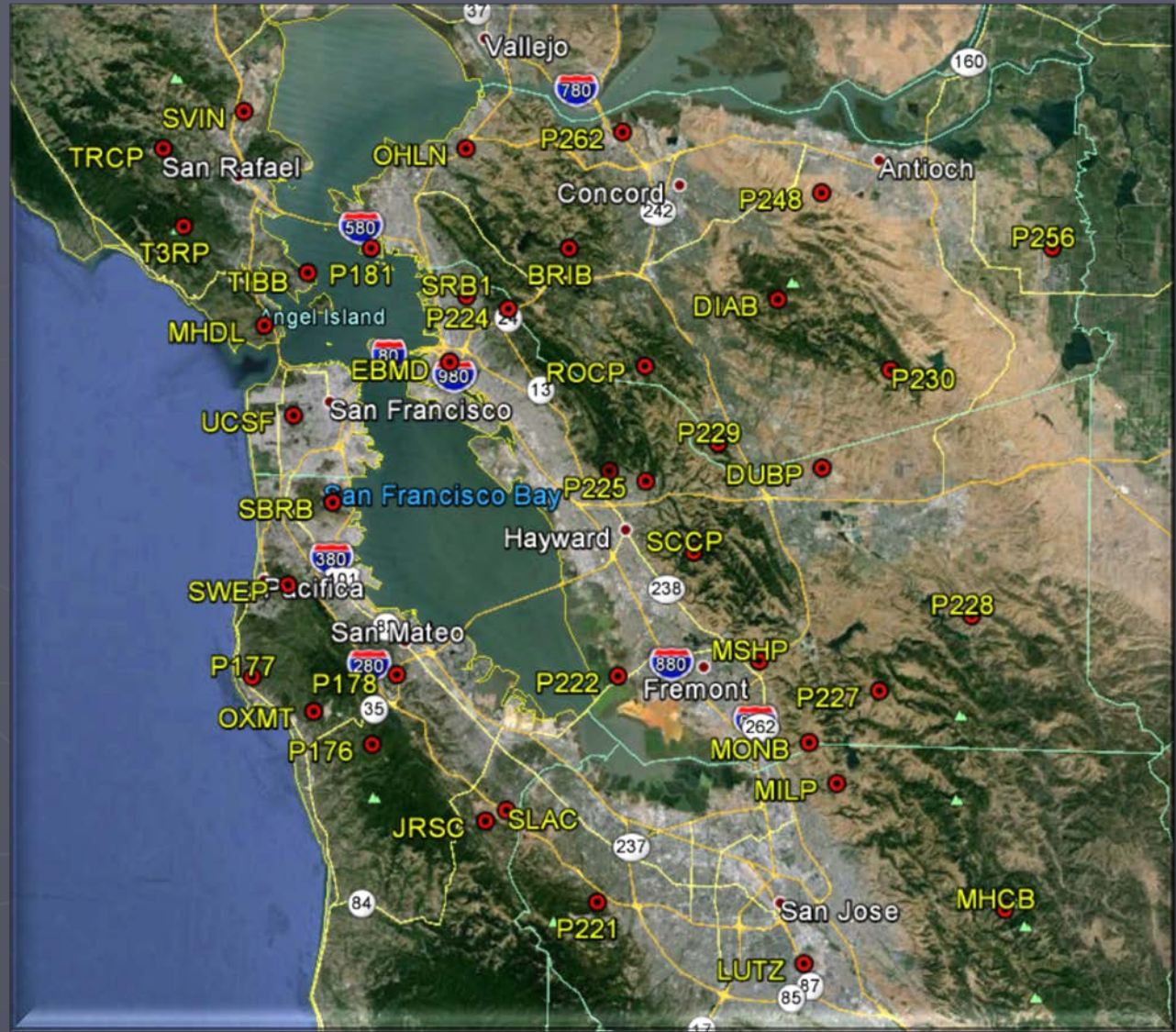
CRTN North

197 Real Time Stations



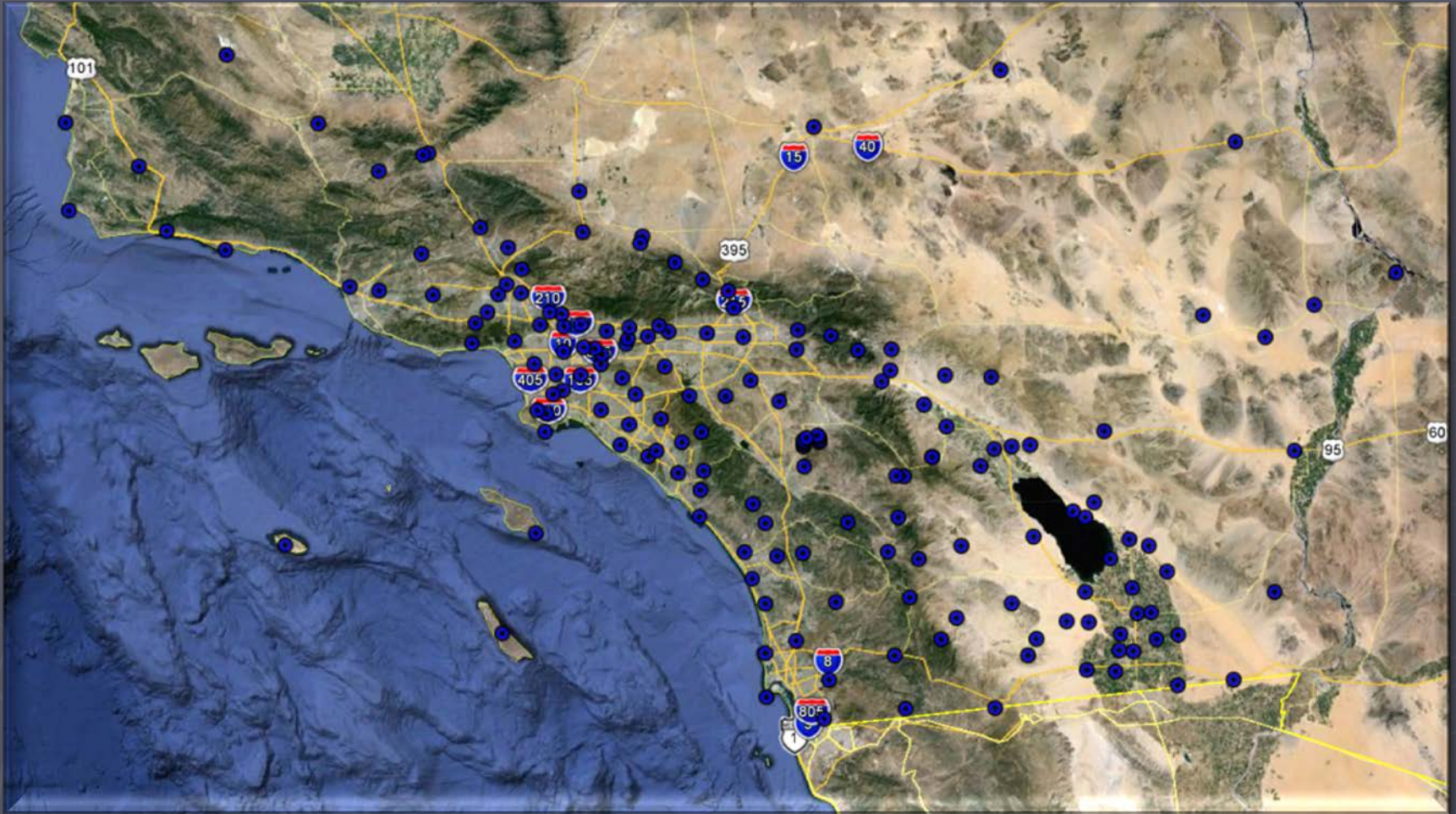
CRTN
North

Bay Area



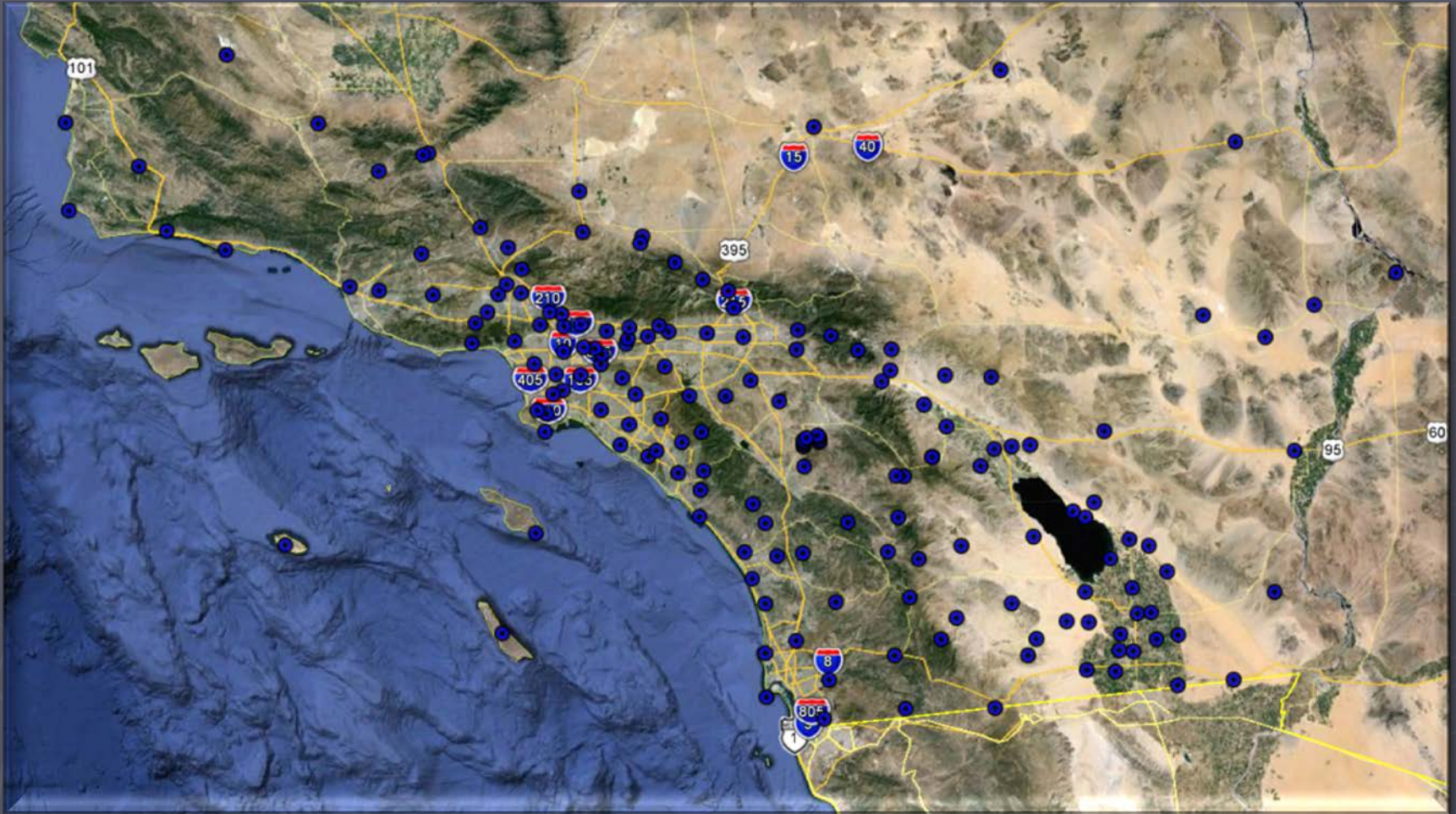
CRTN South

170 Real Time Stations

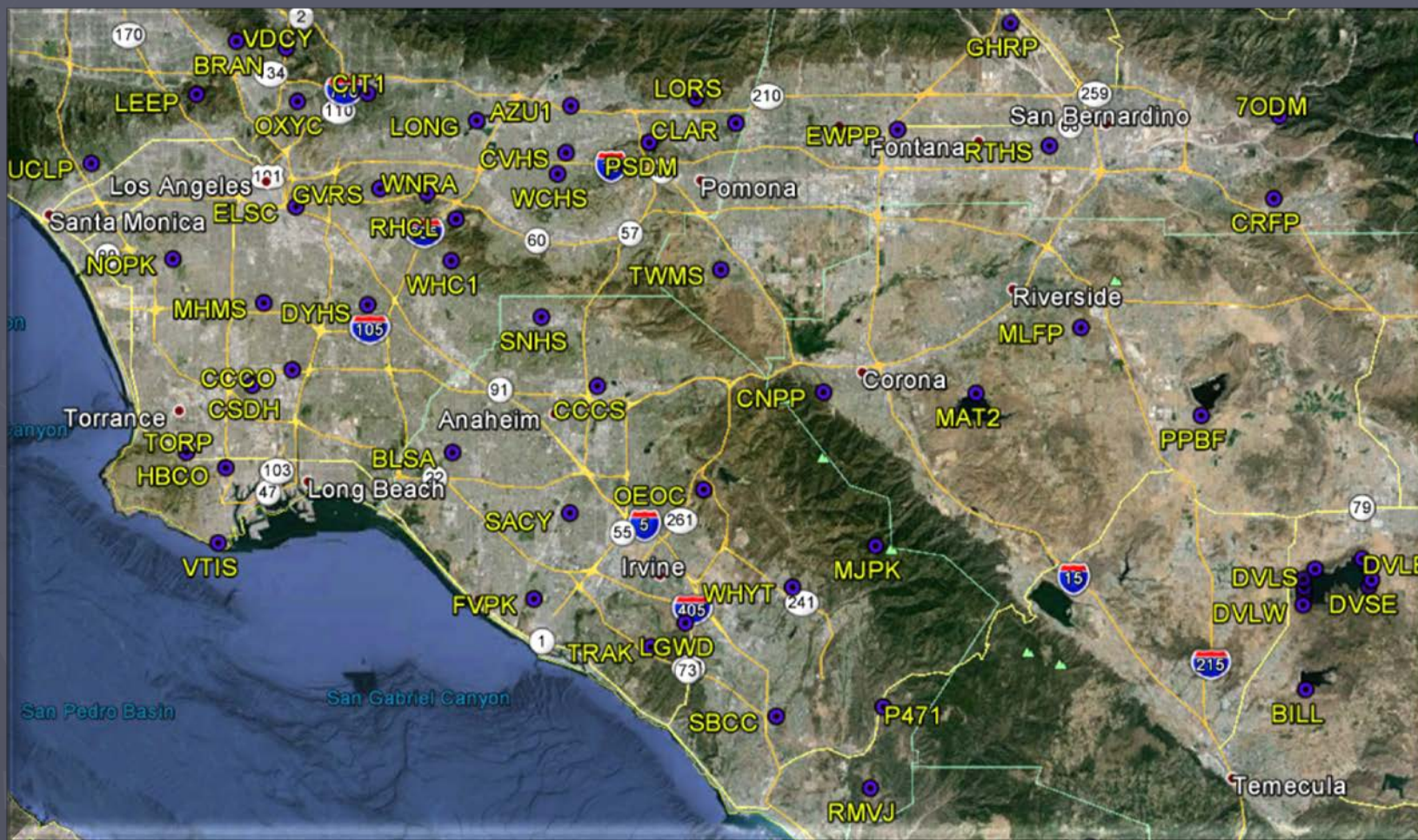


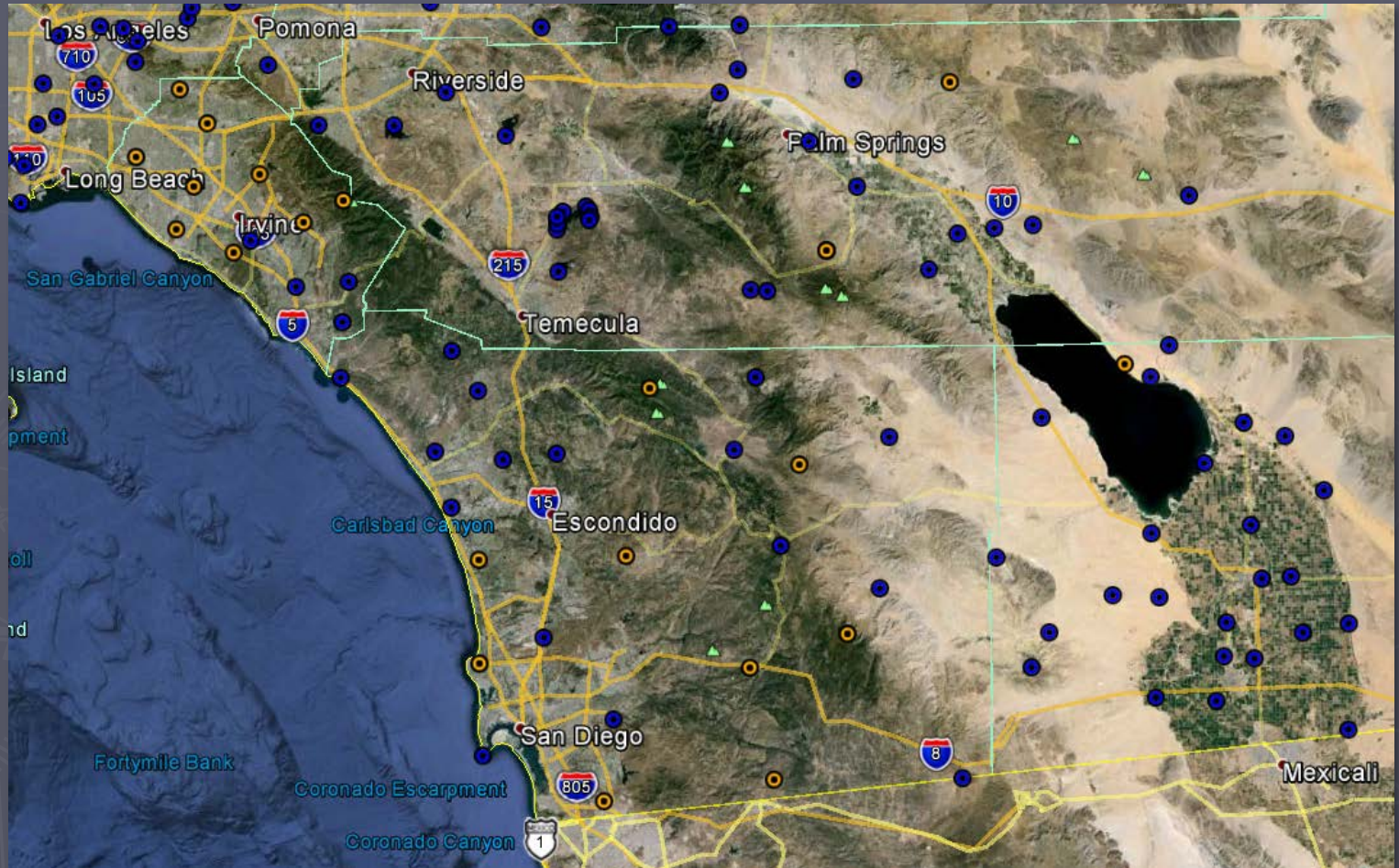
CRTN South

170 Real Time Stations



Southern California Area



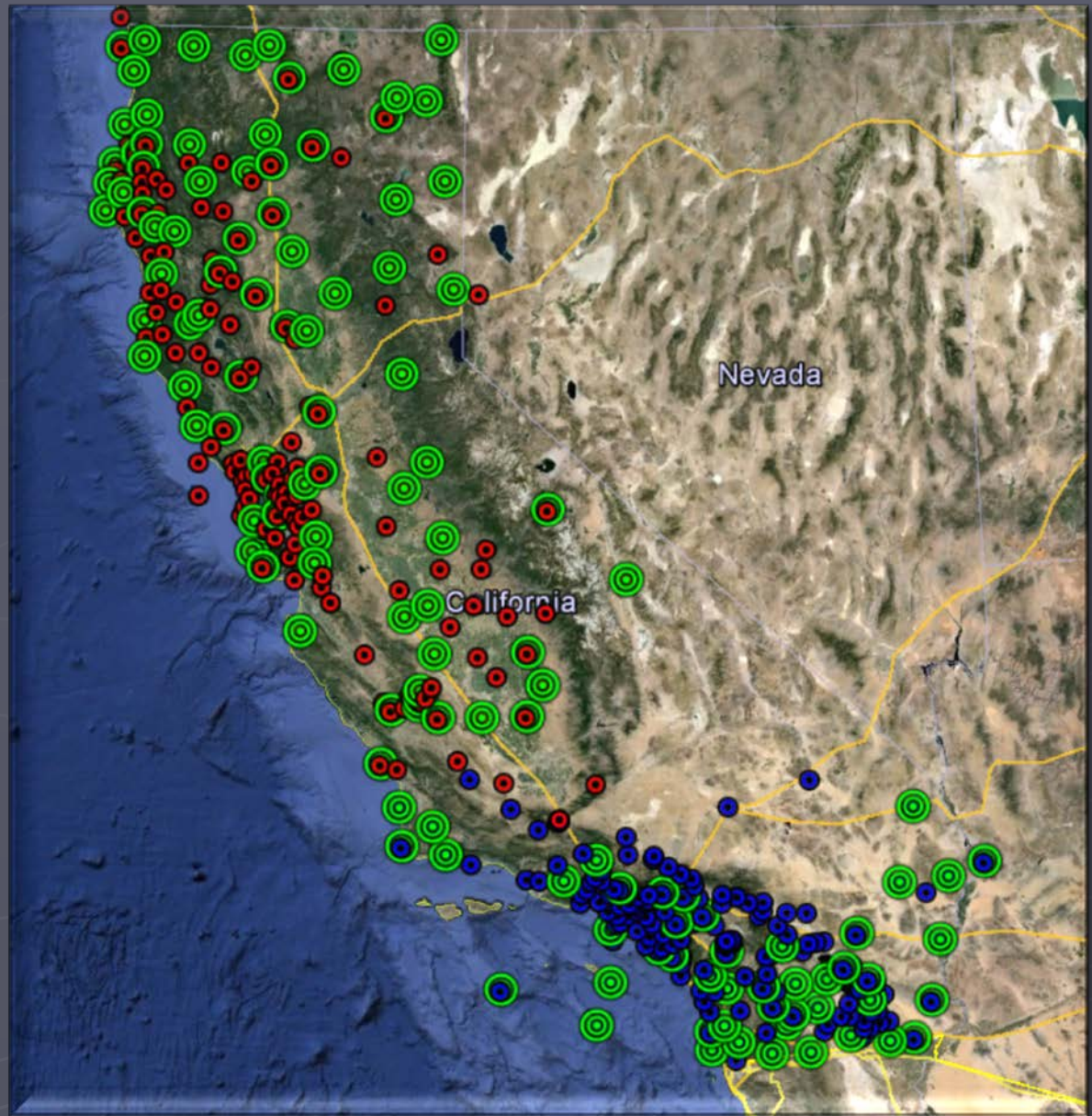


CRTN NGS CORS

135 of the CRTN
Stations are also
part
of the NGS CORS
Network

37%

NAD83(2011),
Epoch 2010.00

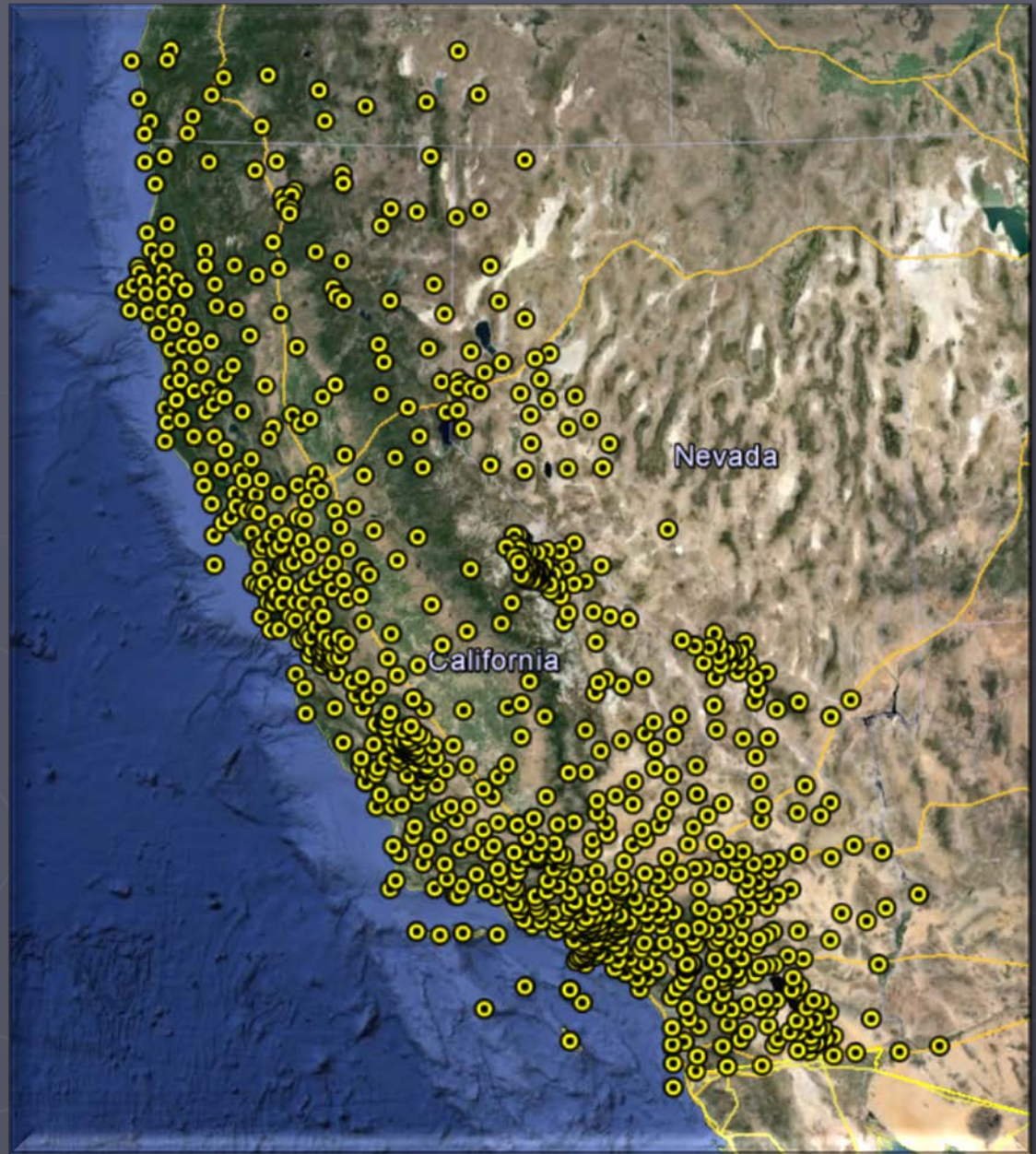


CSRN 2011.00 Epoch

Coordinates, velocities,
and uncertainties

830 CGPS

ITRF2005 &
NAD 83(NSRS2007)
EPOCH - 2011.00



CSRC Published Adjustments/Epochs

► Coordinates, velocities, and uncertainties:

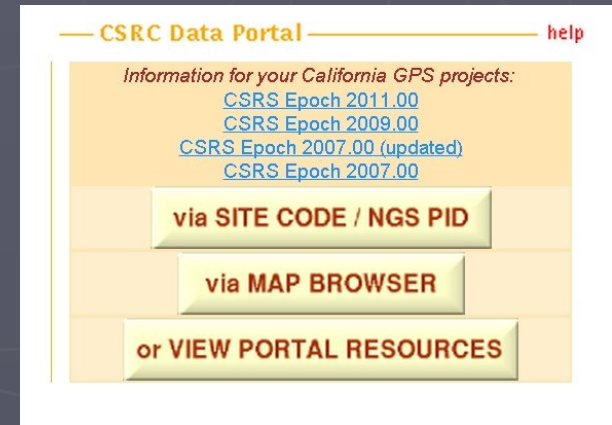
- CSRS Epoch 2011.00 **830 Stations**
- CSRS Epoch 2009.00 **766 Stations**
- CSRS Epoch 2007.00 **551 Stations**

ITRF2005, NAD83(NSRS2007)
NGS Relative Antenna Def.

► Next?

- CSRC Epoch **201?.00**
- CSRC Epoch 2010.00

IGS08/ITRF2008, NAD83(2011)
NGS Absolute Antenna Def.



Align with NGS

CRTN Survey Monkey

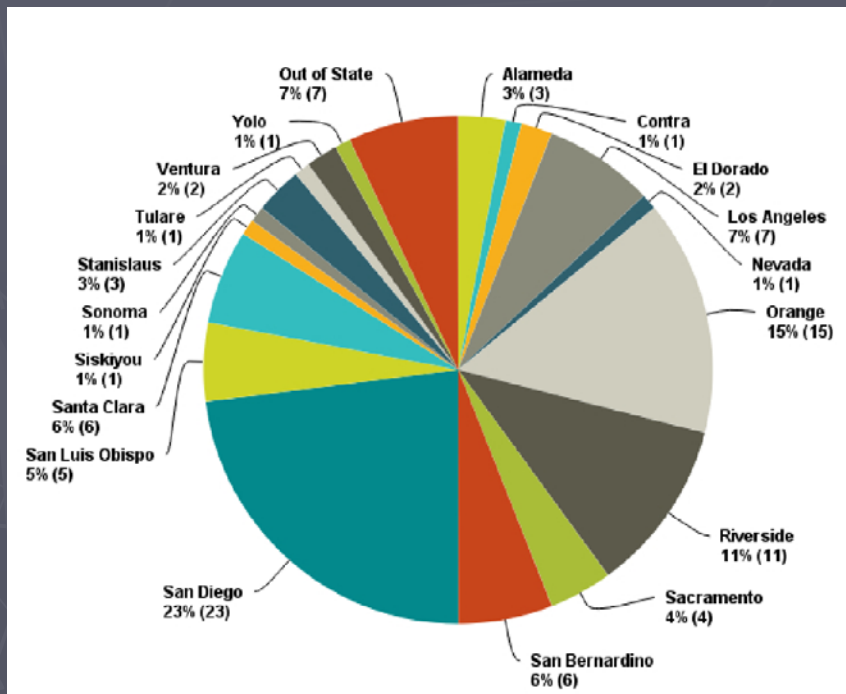
- ▶ Emailed to CRTN NTRIP user accounts on September 10, 2014
- ▶ 15 Questions
 - Importance
 - Benefits of CRTN and CGPS
 - Drawbacks of CRTN and CGPS
 - Additional Features
 - Subscription



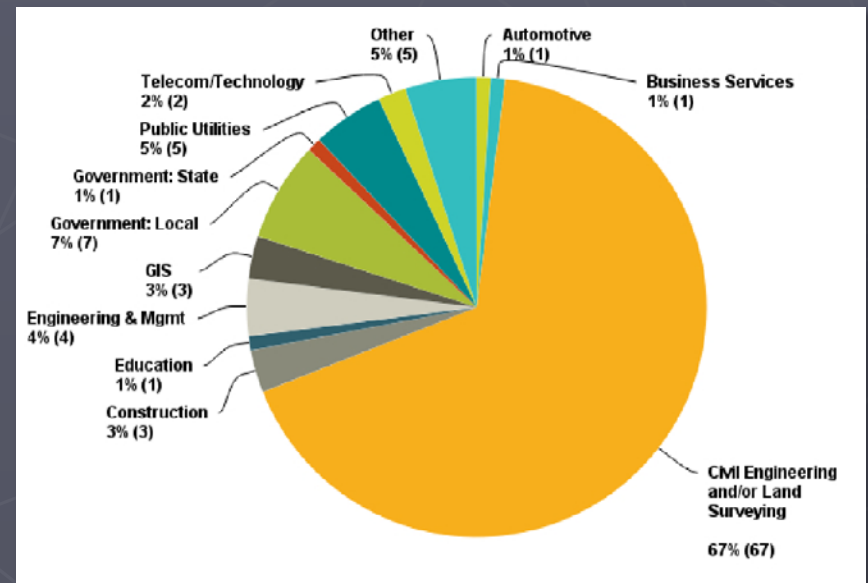
CRTN NTRIP User Accounts

313 Registered Users

Location



Industry



100+ Responses

Explain how CRTN directly benefits you

1. Saves time and money

- Not setting up and worrying about a base station
- One man crew

2. Ties to State Plane Coordinates

- Tie to published Datum
- Public Resources Code

3. Backup for Private paid networks

- When private network is down
- No coverage

List specific drawbacks to using CRTN

1. Reliability

- Station not always available
- Unannounced outages

2. No GLONASS

- GPS only
- Not all stations have GLONASS

3. Poor Cell Phone Coverage

- No coverage in some areas
- Project outside of cell phone coverage

Recommendations to improve CRTN

1. GLONASS / GNSS

2. Network Solution

3. Network Reliability

- Tech and maintenance support needs improvement
- Keep equipment modern and reliable

CRTN Data Access

- ▶ **One NTRIP Account is Free:**

Account requested by emailing CSRC Director, Dr. Yehuda Bock @

ybock@ucsd.edu

Additional Accounts

- ▶ **Contributing Members:**

Donates \$1,000 annually for each additional NTRIP account

- ▶ **CRTN Consortium Members:**

Contribute \$15,000 annually for 20 NTRIP accounts

- ▶ **Statewide CRTN Consortium Members:**

Contributes \$150,000 annually to fund CRTN and has access to all real-time CGPS sites 24/7. Unlimited NTRIP accounts

CRTN Current Membership

- Consortium Members

- San Diego County
- City of Los Angeles
- County of Orange
- Riverside County Flood Control District
- Santa Clara Valley Water District
- Riverside County Transportation
- City of Long Beach Oil & Gas
- California Land Surveyors Association (CLSA)

(\$15,000 annually)

- Contributing Members

- East Bay Municipal Utility District
- East Bay Regional Park District
- Rail Surveyors and Engineers Incorporated
- RBF (Michael Baker Corp.)
- Psomas

(\$1,000 annually)

CSRC Future

- ▶ Network Solution
- ▶ Updated Website
- ▶ Publication of new adjustment/epoch
- ▶ Additional Funding Sources???