A Brief History of the California Spatial Reference Center

Current Status of the California Real-Time Network

Art Andrew – Past CSRC Chairperson
2000
CSRC established

A continuation of the CGCC
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
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

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
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).
2003

► Prepared “A Modern Statewide Geodetic Control Network”

► One component of a “complete” spatial reference system

► Other component; “Real-Time positioning infrastructure”
CSRC Height Modernization Projects

2000-2006

Main focus was Height Modernization projects with NGS funding

National Height Modernization Study
Report to Congress

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service
National Geodetic Survey
June 1998
Statewide California Real Time Network (CRTN)

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

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
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
197 Real Time Stations
170 Real Time Stations
170 Real Time Stations
Southern California Area

CRTN
South
Topcon GNSS/GLONASS Receivers - 24
135 of the CRTN Stations are also part of the NGS CORS Network.

37%

NAD83(2011), Epoch 2010.00
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 2012.00
  - 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
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

► 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???