Orange County Real Time Network



OCRTN

County of Orange, California Presented by Arthur R. Andrew III

Chronology of OCRTN

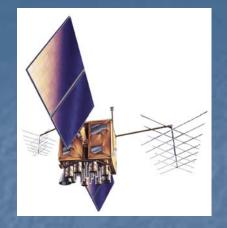
Concept – winter 2000

- Design network and order hardware fall 2001
- Installation late spring 2002
- Start of real-time streaming May 7, 2002
- RTK testing began in August 2002

OCRTN was declared 100% operational at the CSRC – OCRTN/BARTN meeting in Orange County on February 20th, 2003.



What is OCRTN?



OCRTN is a real-time network of 10 permanent GPS stations (CORS) that stream 1-second raw GPS data to a dedicated server for real-time processing and archiving

From this data, RTK corrections (RTCM) are generated and made available to anyone at no cost via the Internet

How can we benefit from OCRTN?

GPS static post-processing

- Data is now collected at 1 second epochs
- Rinex files can be created at any interval (1, 5, 15, 30, etc, files)
- Faster turn around time of Rinex availability

RTK surveying

- Local base stations are no longer needed
- RTK rover receives base station data via Internet
- Only 1 receiver needed
- Less personnel
- Multiple base stations for enhanced reliability and range.





Possible Users

Public and Private Surveyors

- GIS Specialists
- Emergency Response
- Police Department
- Vehicle Tracking
- Aircraft Navigation
- Bridge and Dam Deformation
- Scientific Community

Anyone needing real-time precise positioning

Current users

Current OCRTN RTK Users

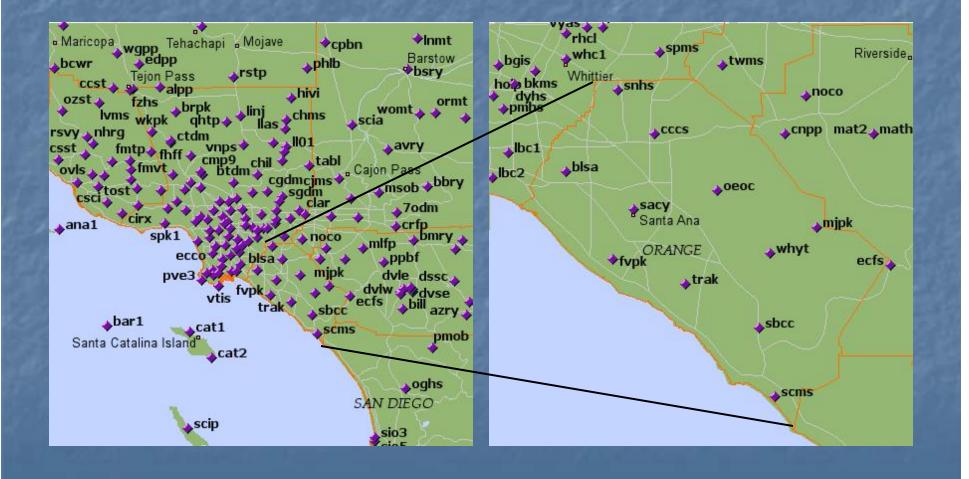
- Orange County crews 8 rovers
 - Ashtech, Leica
- Caltrans 4 rovers
 - Trimble
- Private Survey Firms
 - Leica, Trimble
- GPS Venders/Rentals
 - Ashtech, Leica, Trimble

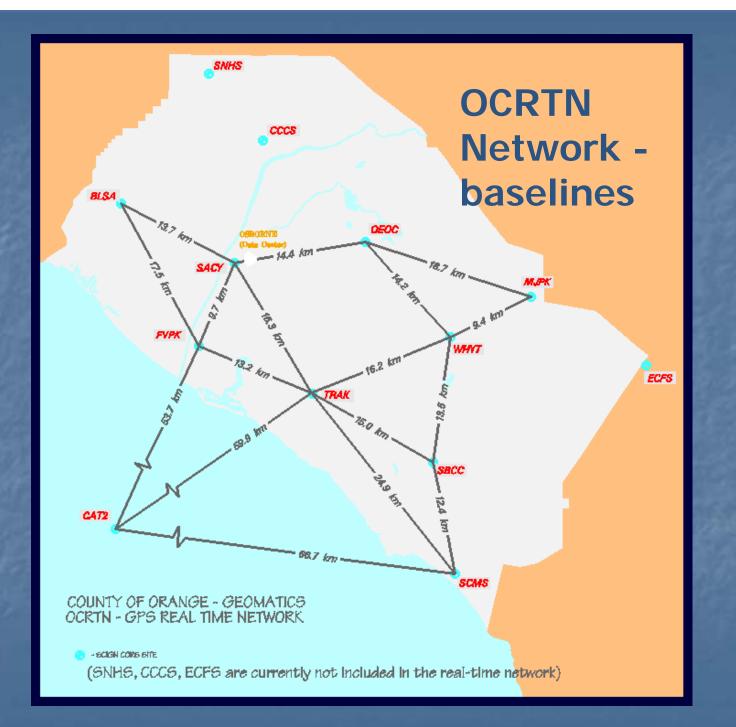
Types of Surveys

- Reconnaissance
- Aerial Target Control
- Landfill Quantities
- Monument Location
 Verification
- Construction
- GIS Inventory
- Topographic

SCIGN

OCRTN





Telemetry Connections:

Data streamed at 1 second using Spread Spectrum radios (900 MHz)





Telemetry Connections:



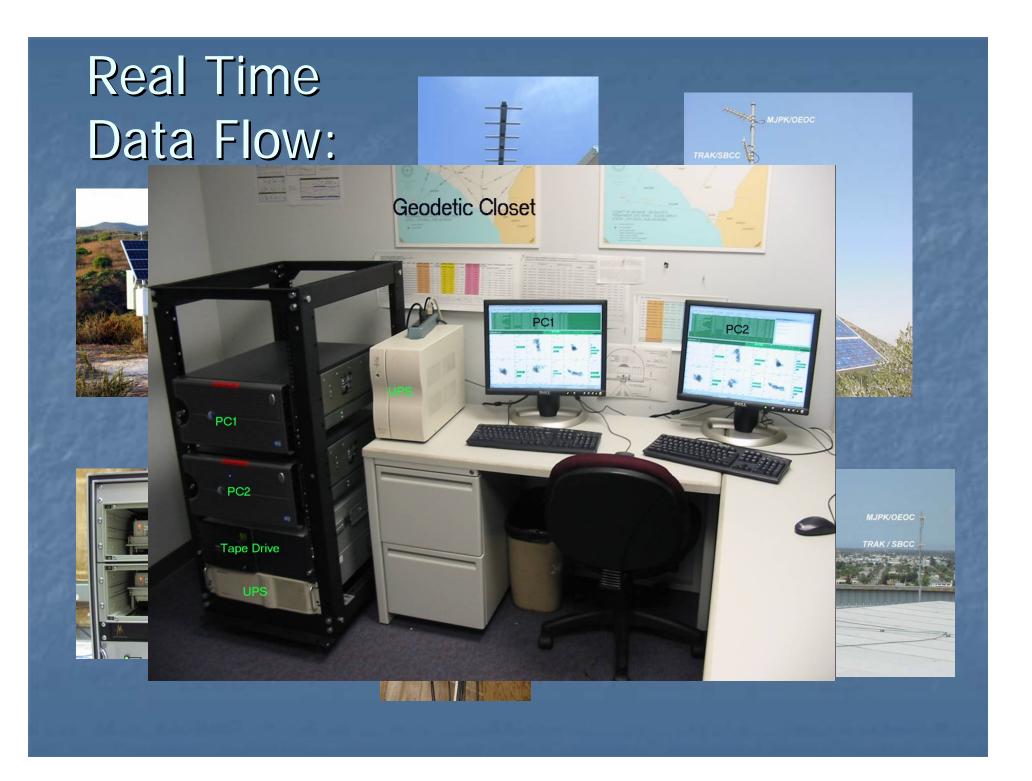
Testing at BLSA: Stream data at 1 second rate using CDMA modem



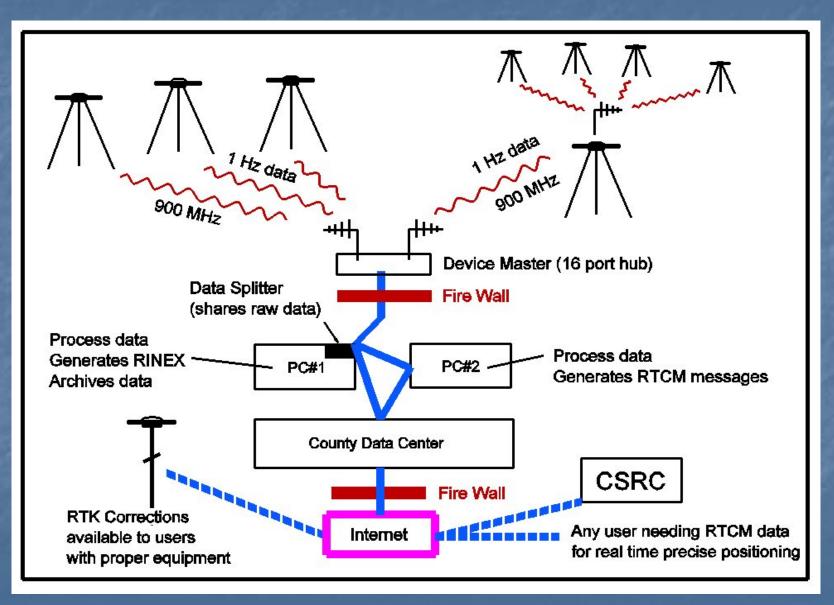


Typical OCRTN Site

Ashtech Z-XII/Micro-Z receiver w/ Choke Ring antenna FreeWave Spread Spectrum Radio w/ Yagi antenna



Current Network



Current RTK Solution

Single Base Station Mode:

- RTK rover picks which base station to use by dialing the IP and port address. This method allows rover to compute multiple positions from multiple base stations on a single point.
- Rover must have ability to control wireless modem (choose different port assignments)

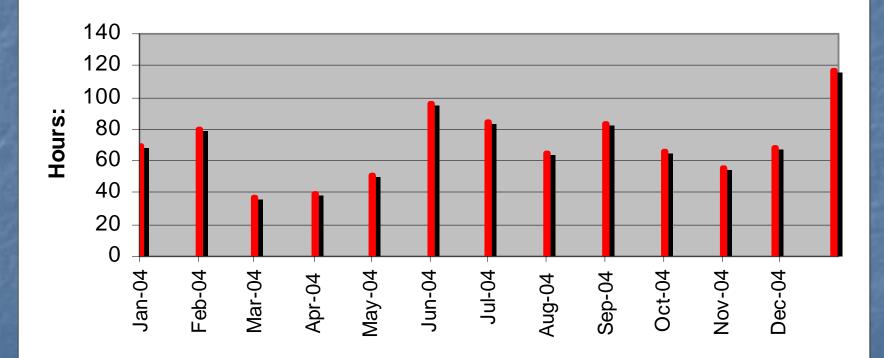
Nearest Base Station Mode:

- Server picks the closest base station to the rover position. Does not have the ability to pick and choose different base stations.
- Rover must sends NMEA GGA autonomous position (latitude, longitude, height) to network software via Internet.

 Server streams RTCM version 2.2, message types 3, 18, 19, and 22 from selected base station to rover.

RTD Server RTCM Usage

OCRTN RTCM Stream - Client Connection Time



Current Software Solution:

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ACY	Santa Ana Corp. Yard		10/10 17:51:51	Ashtech Z Series (du		TCP/IP	-2483933.1200	-4692212.6799	+3522794.0331	Adjust	Adjust			
1JPK	Modjeska Peak		10/10 17:51:51	Ashtech Z Series (du		TCP/IP	-2457037.4000	-4709794.6150	+3520995.0063					
BCC	Saddleback Community College		10/10 17:51:51	Ashtech Z Series (du		TCP/IP	-2470208.2313	-4712751.4230	+3505283.4237		Adjust			
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RTD

OCRTN Network RTK

How does it work?

It works no different than standard RTK. The standard RTK radios that are restricted by line-of-sight are replaced with wireless modems that use the cellular provider's cell site network.



OCRTN IP Address: 206.194.127.187

The site port assignments are as follows:

8000 – Nearest Base Station 8001 – BLSA 8011 - WHYT 8002 - CAT2 8013 - MJPK 8012 – SACY 8015 - SBCC 8014 – OEOC 8017 – SCMS 8016 – TRAK 8018 – FVPK

8010 - Geodetics Smart RTCM Client



RTK Receivers operating with OCRTN

Ashtech – Ranger (TDS Survey Pro)

- Z-Extreme
- Z-Surveyor
- Leica System 500 ■ SR530
- Trimble TSCE & TSC1 **5700**
 - **4700, 4800**
 - Spent considerable time in getting different receivers to work.
- Most limitations are do to interface software. Some can control the modem settings, some cannot.



Wireless Internet Modems

allows access to Internet data (TCP/IP)

CDMA/1XRTT - Code Division Multiple Access Static and Dynamic IP, uses TCP/IP

Cost around \$200 - 800 per modem

In Orange County, Verizon and Sprint are the providers. Service charge is \$79.99 per month, unlimited use.

Operates @ 50 – 70 Kbps

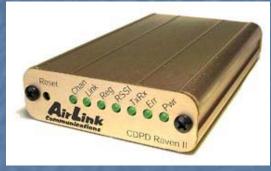
GSM/GPRS – General Packet Radio Service Access

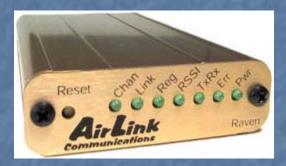
Dynamic IP, uses TCP/IP

Cost around \$200 - 800 per modem

In Orange County, AT&T / Cingular are some of the the providers. Service charge is \$79.99 per month, unlimited use.











OCRTN Network RTK

How *well* does it work?

It works only as good as the GPS receiver you're using works.

Some receivers may do better on longer lines.

Some receivers may fix the ambiguities (TTF) quicker than others.



RTK Field Test

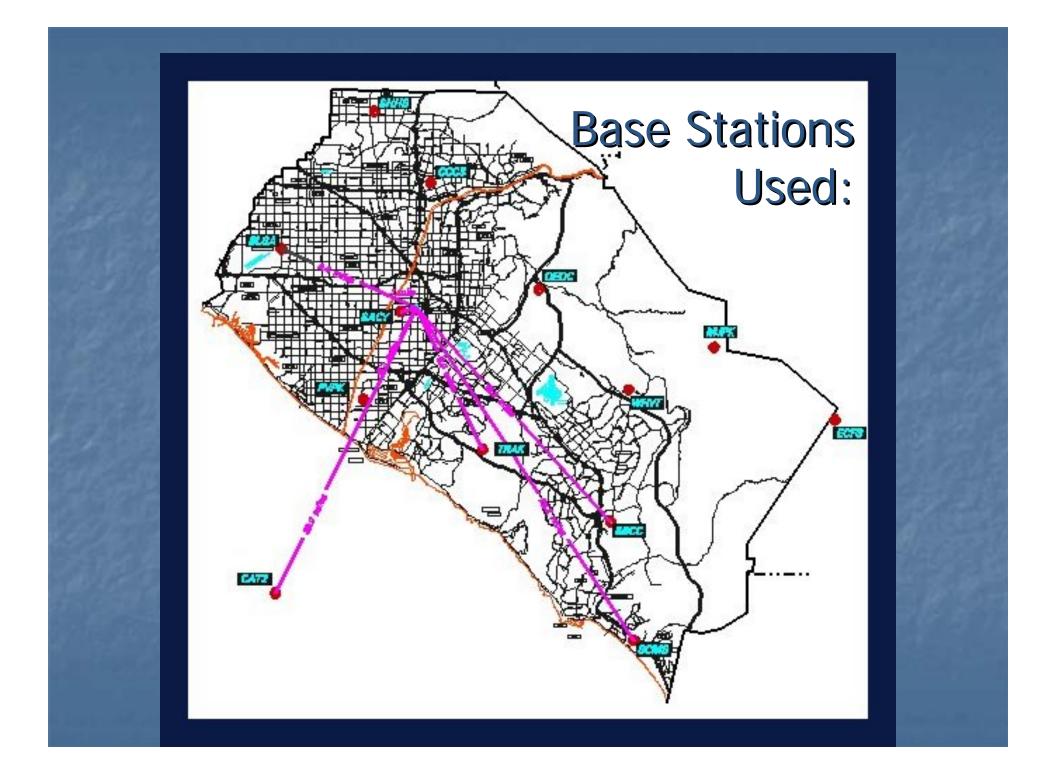
- Instrument Leica SR530 GPS receiver
- Locate two monuments located on County parking garage
- Position monuments multiple times from 6 different base stations at different baseline lengths
- Compare positions to "truth" positions
- "Truth" = six 4 hour static sessions over a period of 2 weeks











SACY 2km/1.2 miles

BLSA 15km/9.3 miles





TRAK 16km/10 miles

SBCC 29km/18 miles





SCMS 41km/26 miles

CAT2 64km/40 miles



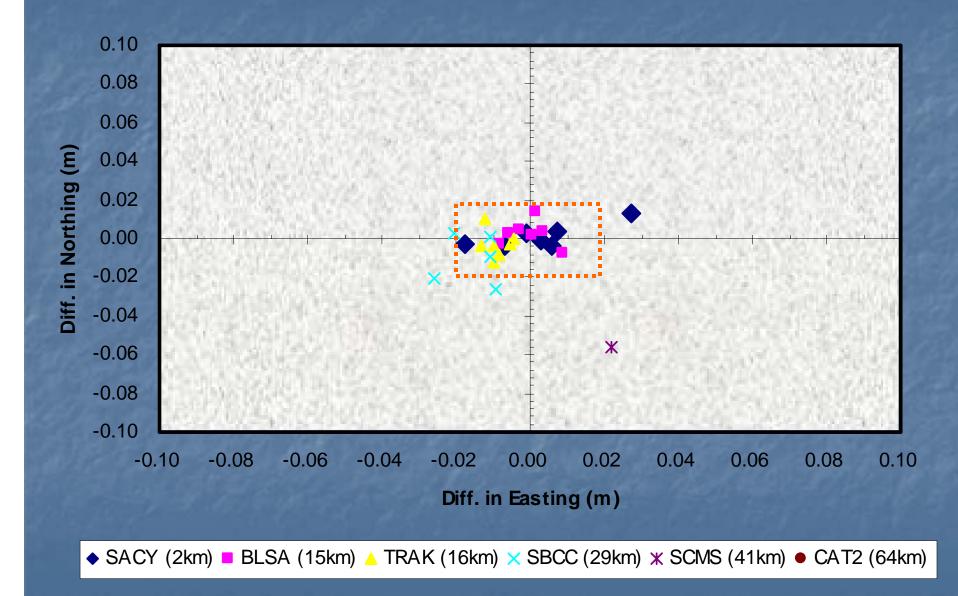


Procedures:

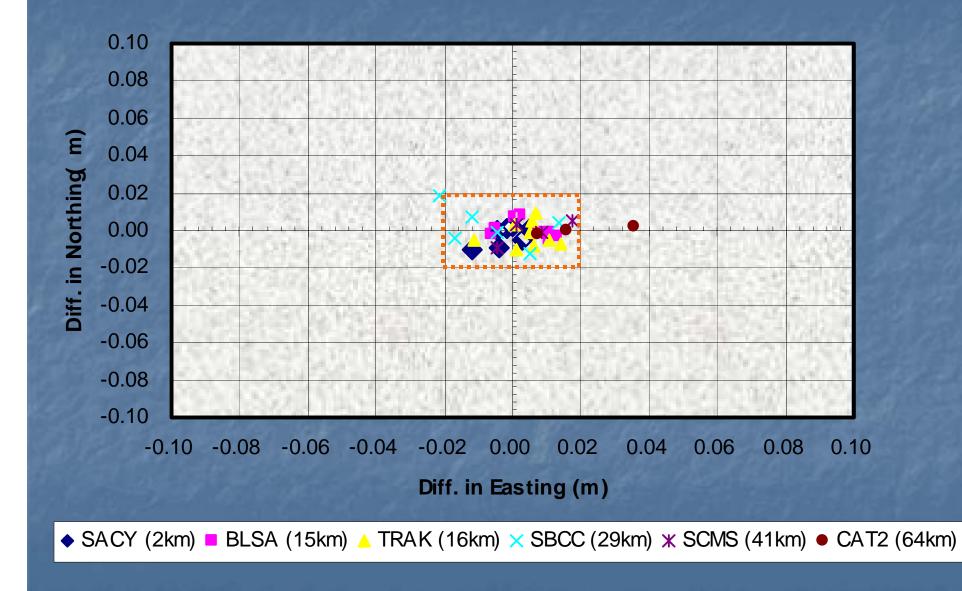
- Single Base Station RTK observations
 Interger Fixed Solutions
 Observation = 20 epochs @ 1 second
- Waited no longer than 3-4 minutes to obtain fix

Base Station	#9000	#9001
SACY (2km)	7/7	9/9
BLSA (15km)	7/7	7/9
TRAK (16km)	7/7	9/9
SBCC (29km)	7/7	7/9
SCMS (41km)	2/7	5/9
CAT2 (64km)	0 / 7	5/9

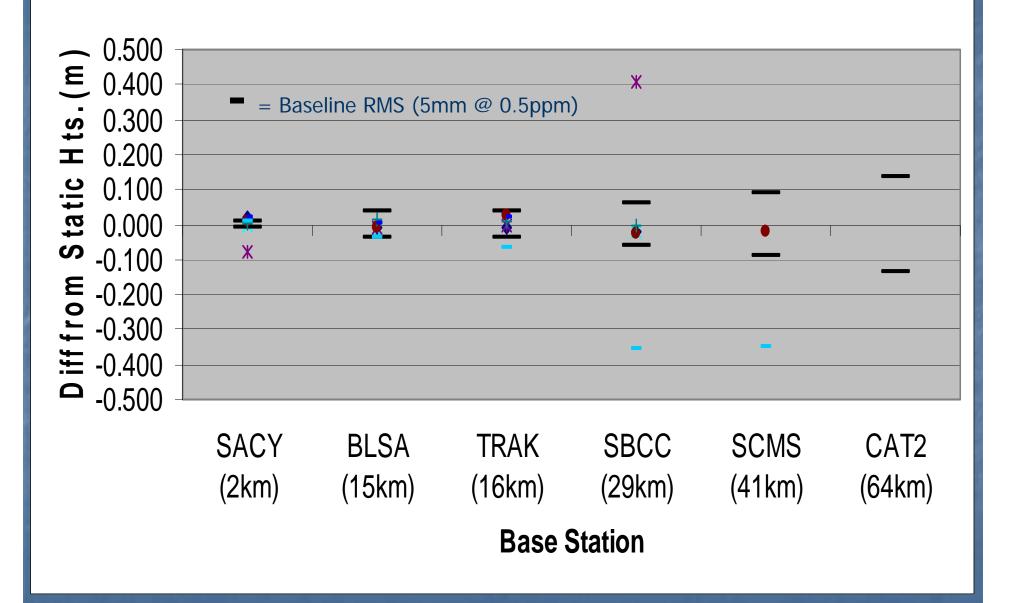
OCRTN - RTK Field Test 2005 - Pt. 9000 Horizontal Difference from Static "Truth" Positions



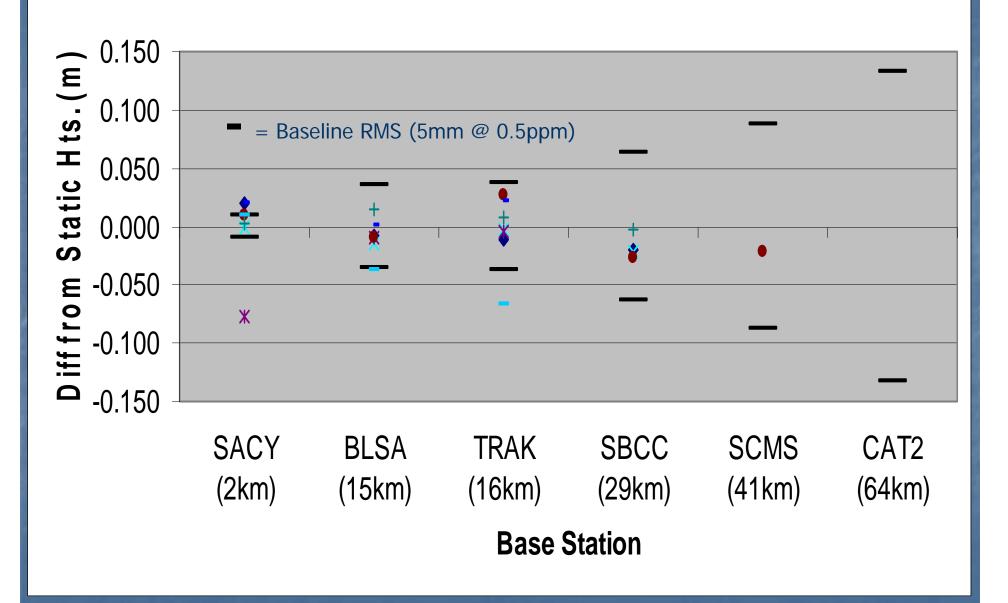
OCRTN - RTK Field Test 2005 - Pt. 9001 Horizontal Difference from Static "Truth" Positions



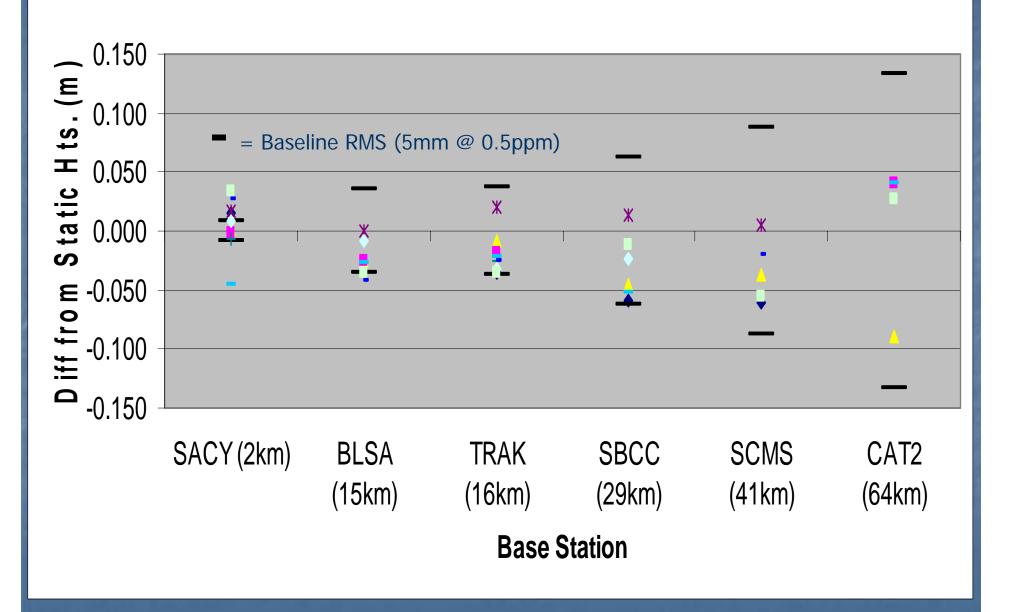
9000 RTK Heights relative to Published Base Hts.



9000 RTK Heights relative to Published Base Hts.

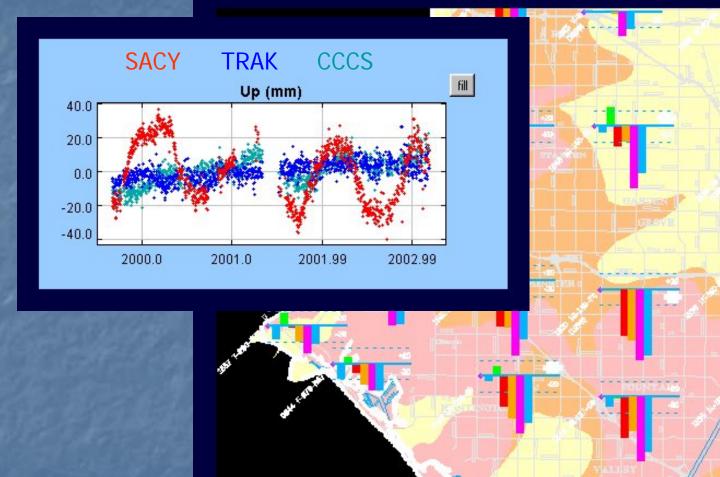


9001 RTK Heights relative to Published Base Hts.



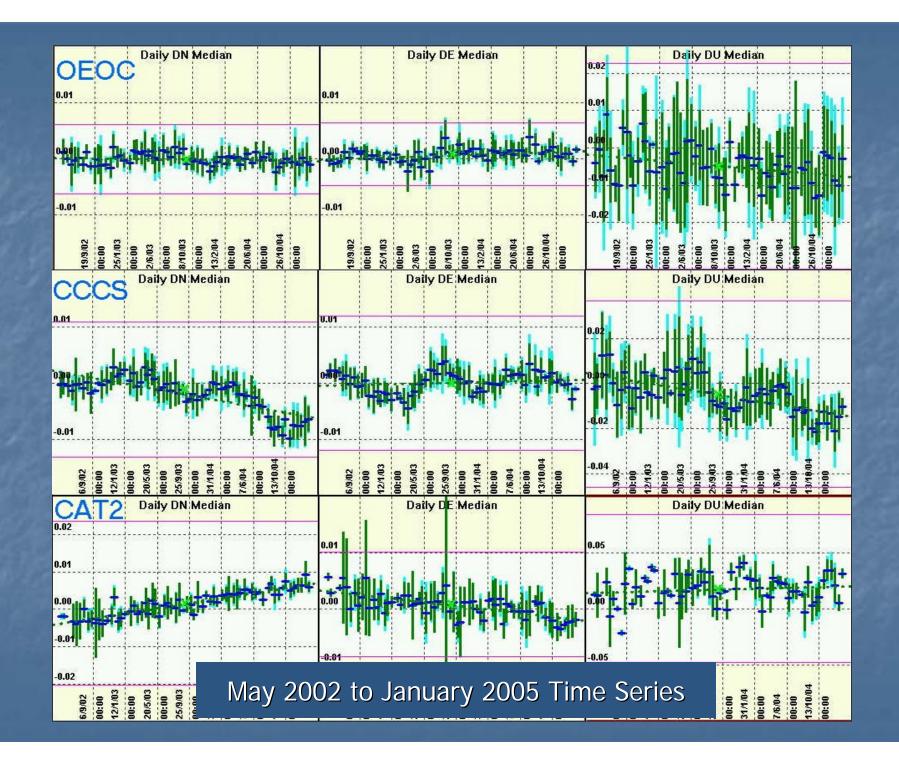
Issues effecting RTK Heights

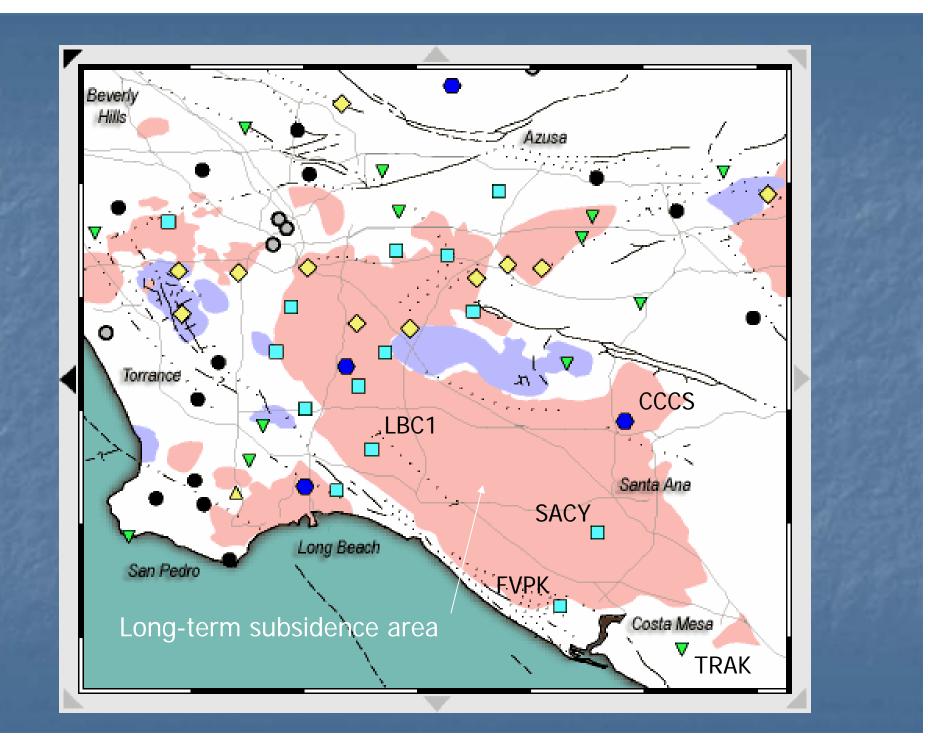
CCC

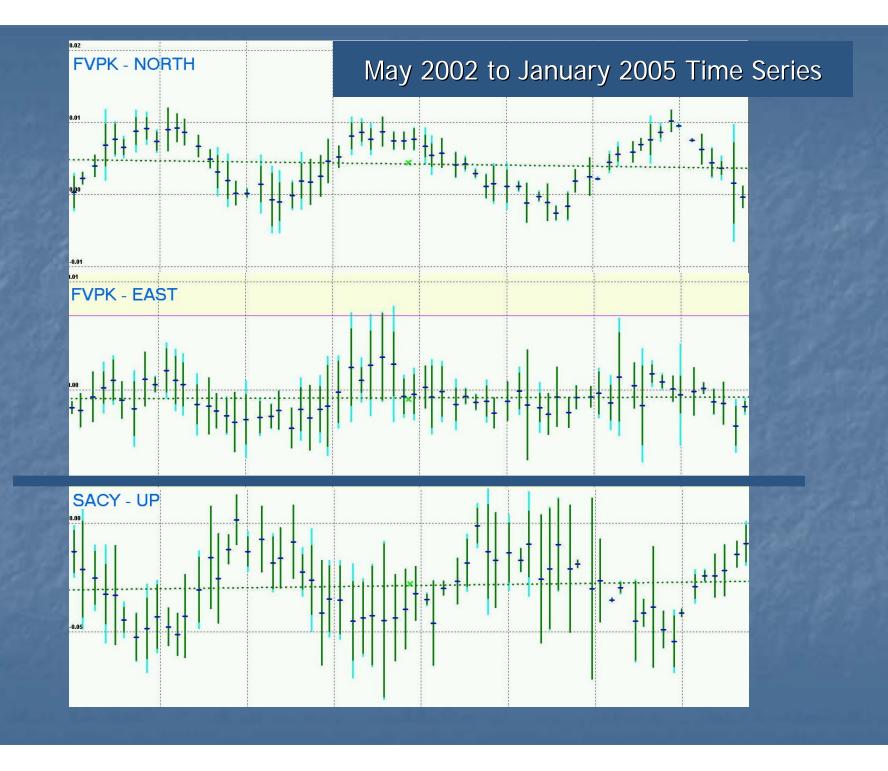


Base Station Characteristics

Each Base Station has its own characteristics related to:
 Geology
 Sky Visibility
 Obstructions







How to start using OCRTN

Call Art Andrew @ (714) 834-3804
 Explain what you'll need to upgrade your existing equipment.

I'll meet with you to help setup equipment and explain how OCRTN works.

Thank you



Questions?