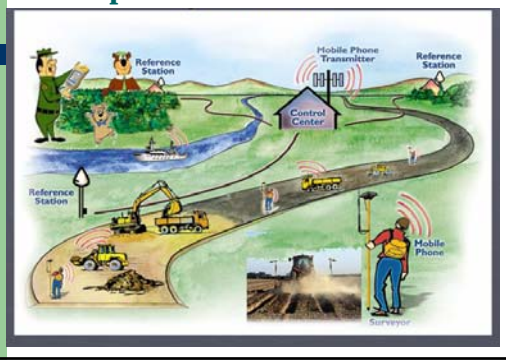
ODOT's Statewide GPS Reference Station Network

Ken Bays
March 2006

Conceptual RTK GPS Network



Benefits of a Reference Station Network

- Only a rover GPS receiver is needed
  - Less initial GPS expense
- No base station "baby sitter" needed
- Consistent known datum and coordinate system.

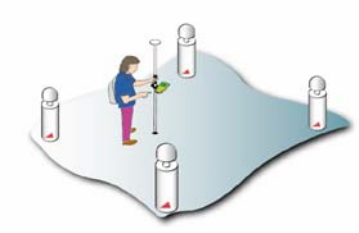
Benefits of a Reference Station Network

- Avoids common errors on temporary base stations:
  - Operator sets up on wrong station
  - Wrong coordinates for base are entered into data recorder
  - Wrong height of antenna measurement
  - Wrong antenna type picked during processing
  - Antenna not plumb over point
  - Subject to tripod movement or disturbance (wind, bumped, etc.)
  - Subject to interference with GPS signal (trucks passing, etc.)

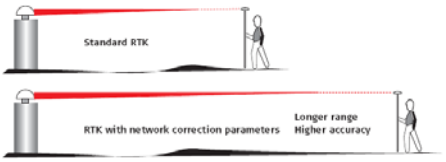
Single Baseline RTK Solution

Normal RTK Accuracy = 10mm + 1ppm
30km: 10mm + 30mm = 40mm

Network RTK Solution



Network RTK Solution



Distance Dependent Errors can be modeled with reasonable success, almost negating the ppm component. 30km: may achieve near 10mm

Benefits of a Network RTK Solution

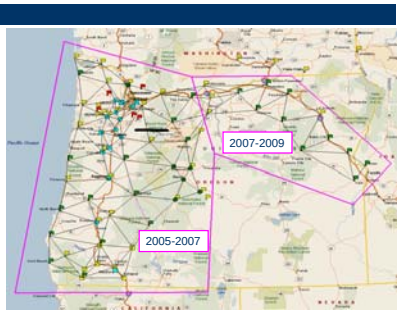
- Distance dependent errors modeled better
  - Ionosphere delay
  - Troposphere delay
  - Satellite orbits
- Better accuracy of solution
- Longer distance RTK range possible
  - 60 Km spacing of base stations

Corrector Delivery Methods

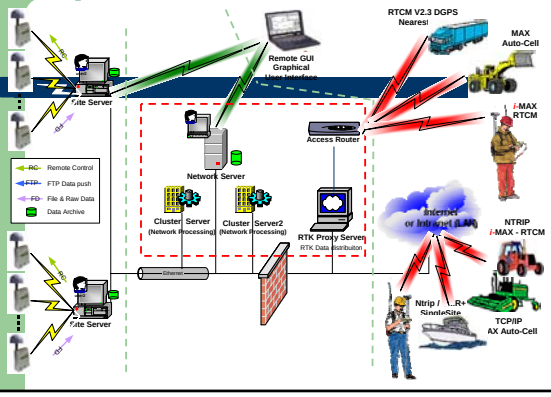
- Radio
- Internet
  - Cell Modem
  - WIFI (?)
- Web Site
  - RINEX Data for Post Processing

Oregon Real-time GPS Network (ORGN): Initial Plans

ORGN: Overall Plan for 05-07 & 07-09 Bienniums



GPS SpiderNET – Architecture Overview



Network Users

- Administrator
- Partners
- Subscribers
- Anonymous Users

Administrator

- Oregon Department of Transportation
- Geometronics Unit
- Management – Ron Singh
- Technical Administration – Ken Bays

Administrator Responsibilities

- Network quality control
- Network software operation
- Network software maintenance and upgrades
- Network listserv and maintenance
- User support

Partners

- Partners will provide sites, GPS equipment, and other infrastructure to the network.
  - Government agencies
    - Inter-Governmental Agreements
  - Private entities (once network is operational)
    - Public-Private Partnerships

Some, but not all, of our Interested Partners

OBEC Consulting Engineers	Yamhill County
Polk County	City of Salem
Deschutes County	Clackamas County
EWEB	Marion County OR
City of Beaverton	Jackson County
City of Newberg	Lane County
Washington County	Tualatin Valley Water District
City of Springfield	Port of Portland
Curry County	Oregon State University
Washington DOT	City of Wilsonville
City of Bend	Clatsop County
Linn County	Douglas County
David Evans & Associates	Portland Water Bureau
Lincoln County	Benton County
Multnomah County	Oregon Parks and Recreation Department
Oregon Division of Aviation	

Subscribers

- Anyone who is not a partner wanting access to the RTK corrector data that is delivered via cell modem
- Must have account set up
- Will pay a subscription fee
- Fee will be minimum – Cost recovery for maintenance of network

Anonymous Users

- Anyone wanting access to:
  - Static data for post processing
  - Radio broadcast RTK data – only in certain areas
- No subscription fee
- No account set up

Benefits of Partnering w/ODOT

- Using taxpayer money wisely
- Extend range and accuracy of existing stations
- Consistent coordinate system and datum for Oregon
- ODOT quality control & network monitoring
- ODOT purchase/operation of network software

Benefits of Partnering w/ODOT

- ODOT maintenance/upgrades of network software
- ODOT list serve and webpage for network
- ODOT support for network users
  - Training
  - Technology transfer
  - User support
- Other

Timeline

- Start up: March 2006
- ODOT internal testing: March - July 2006
- Open to users in test mode: July 2006
  - No cost
  - No service level warranty
  - Use at own risk
- Complete partner agreements: July 2006
- Fully operational: January 2007

Network Standards

- Site Selection
  - Satellite visibility: clear view of sky
  - Continuous power w/ backup
  - Station location/spacing
  - Vandal resistance
  - Access: ease of maintenance
  - Internet connectivity
  - Lightning protection
  - Monument stability

Network Standards

- Antenna mounts and photos
- Receiver type: L1/L2 with internet port
- Data recording intervals
- Antenna types: choke ring?
- Network security: authentication and authorization

ORGN Recon Packet

- GPS sky obstruction diagram
- Monument info
- Electricity availability
- Internet/data comm availability
- Site ownership/access info
- Site photos
- Packet available on-line at the ORGN website

Prototype Webpage for Oregon Net

http://www.odot.state.or.us/ffp/hwy/gps/index.html

Your comments and suggestions are encouraged.

ORGN Station Installation: The Pieces of the Puzzle

SCIGN GPS Antenna Mount

Installing GPS Antenna Mast

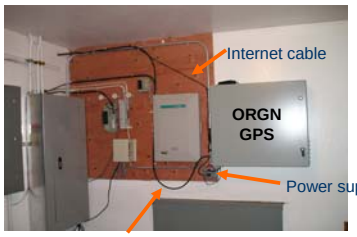
Leveling SCIGN GPS Antenna Mount

Mounting GPS Antenna

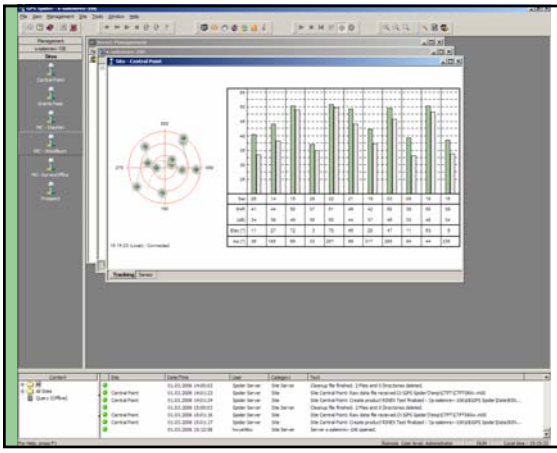
Hooking up GPS Antenna Cable

Photos Required in all Directions

Typical ORGN GPS Sensor Cabinet



Typical ORGN GPS Sensor Cabinet



Contact - ODOT Geometronics Unit

- http://www.odot.state.or.us/ffp/hwy/gps/index.html

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