APPLYING GNSS & CORS TECHNOLOGY TO LAND DEVELOPMENT:

A CADASTRAL PERSPECTIVE

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LAND CONFERENCE 2011 Land Ownership in Trinidad and Tobago: Issues and Challenges
April 28-29, 2011

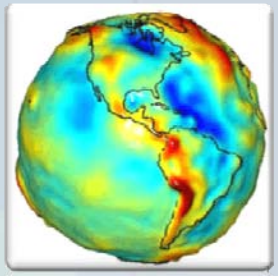
OUTLINE

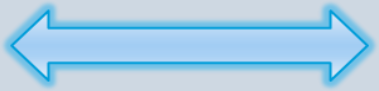
- Overview
- GNSS & CORS Evolution
- Cadastral Considerations & Challenges
- Cadastral Criteria
- International Experiences
- Potential Benefits
- Conclusion

OVERVIEW

TECHNOLOGICAL ADVANCES

SOCIETAL IMPACT





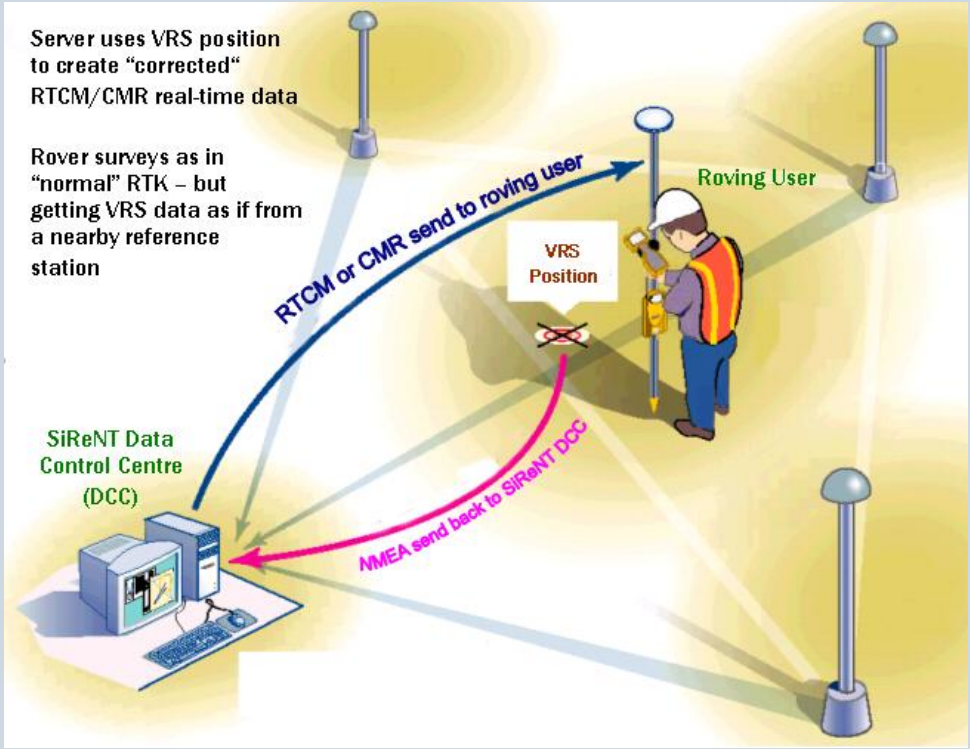
- GPS/GNSS is a maturing technology
- Gone beyond traditional hindrances
  - Cost, confusion about capabilities, geodesy, best practices etc
- Accepted and embraced in engineering and topographic survey applications

GNSS & CORS Evolution

- Global Positioning System (GPS)
  - US DoD
- Real Time Kinematic (RTK)
  - Base & Rover, radio link
- Global Navigation Satellite Systems (GNSS)
  - GLONASS, Galileo

GNSS & CORS Evolution

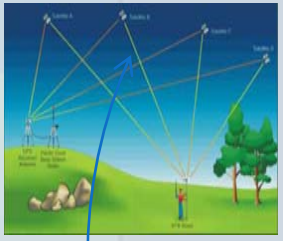
- CORS
- Virtual Reference Station (VRS)



GNSS & CORS Evolution

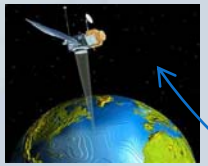
GNSS

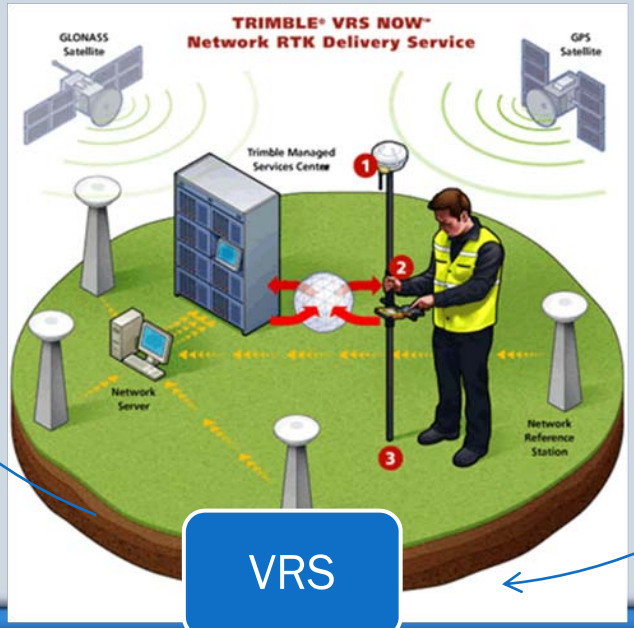
RTK



CORS

GPS

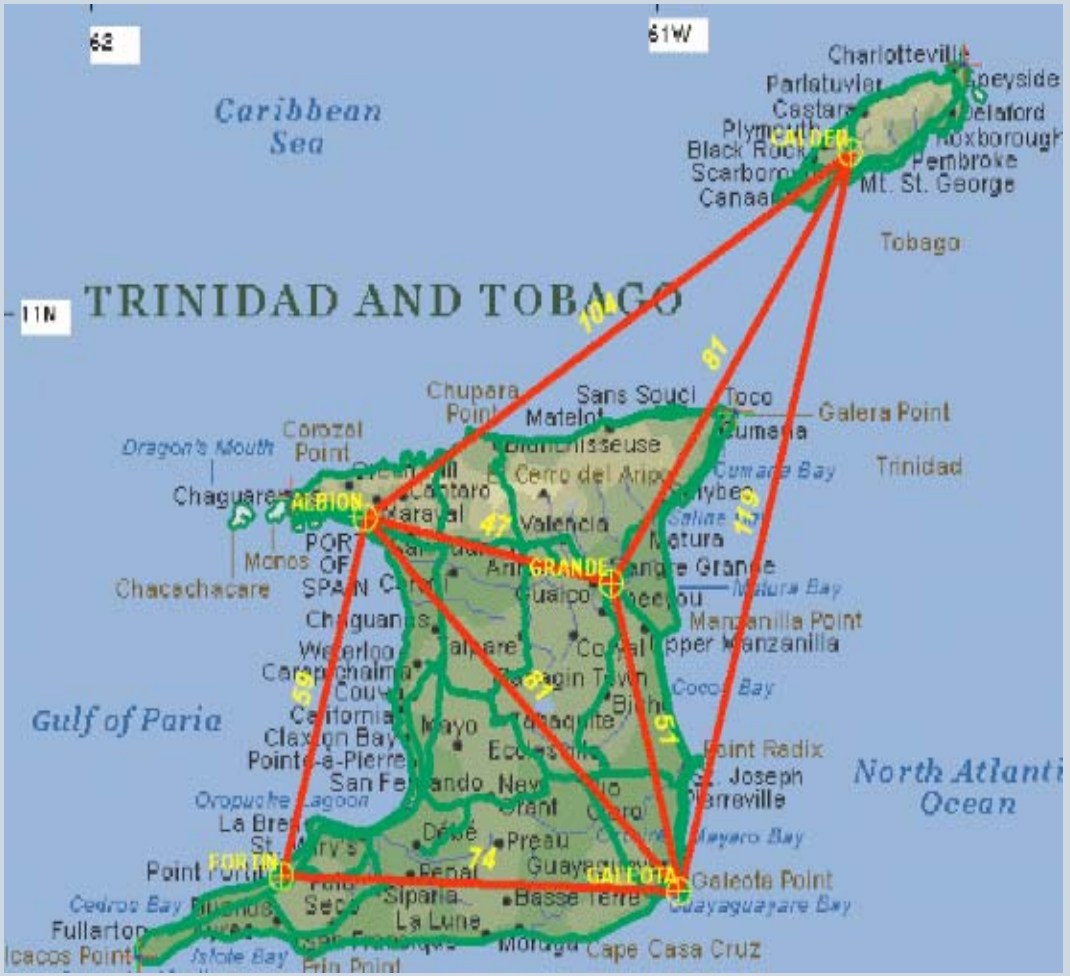




VRS

GNSS & CORS Evolution

- Where we are
  - ✓ GPS
  - ✓ RTK
  - ✓ GNSS
  - ✓ CORS
  - o VRS



CADASTRAL CONSIDERATIONS

- Base Station Location
  - Security & Power
  - Clear skyview
  - Radio range/base distance
  - Multipath & interference free environment
- Vegetation
  - Working in forest/dense vegetation

CADASTRAL CONSIDERATIONS

- Establishing/Redefining boundaries
  - Observing ‘Found’ and setting out ‘Put’ irons
  - Final positions

- Topographic Mapping
  - Re-observing marks
  - Topographic details to appear on plan

CADASTRAL CONSIDERATIONS

- Atmospheric Conditions
  - Ionospheric influences
  - Troposhperic influences

- Other Accuracy Considerations
  - WGS84 transformations
  - Antenna Phase Centre Variations
  - Obstructions/Interferance factors
  - Mask Angles

Cadastral Challenges

- Legislation
  - Use of hand-held GPS units
  - Accuracy
- Professional Buy-In

Cadastral Criteria

- Speed
  - Outperform competing approaches
- Cost Effective
  - Reduce unit cost of survey
- Relevant to local survey community
  - Technology & Cost

Cadastral Criteria

- Accuracy
  - Matches legal specifications
- Simple field operation
  - Process must allow for operations under variable field conditions
- Digital Cadastral Database
  - Role towards the development of DCDB

International Experiences

- Netherlands
  - 2000 RTK GPS introduced to measure cadastral boundaries – until then GPS used for control surveys
  - In 2002, in-depth study conducted to identify all of the possibilities and limitations and evaluate efficiency
  - Technical, ergonomical, economical
  - ~ 25% of surveys done more efficiently
  - Overall efficiency is improved up to 30% based on skill of surveyor

INTERNATIONAL EXPERIENCES

- NETHERLANDS
  - Ergonomic benefits
  - Positive feeling - working with modern technology
  - Provided flexibility in choice of instrumentation for surveyors and management – most suitable instrument leads to efficiency improvements
  - Cost (2002) only slightly more expensive than Total Station

INTERNATIONAL EXPERIENCES

- MALAYSIA
  - Cadastral survey practice regulated by legislation that required traceable calibration for distance measurement technique
  - 'Legal Traceability' – (i) calibration and (ii) procedures
  - Zero Baseline and EDM baseline calibration tests gave maximum discrepancies of 1.4 and 10mm respectively
  - GPS network solutions computed baseline distances of approx 30km within standard allowable misclosures

International Experiences

- Malaysia
  - Using Rapid Static technique with 10 min observation times, the coordinates of 6 lots were measures in an area less than 1ha
  - Measuring the same points from two different GPS base stations gave RMS errors of 3mm in both easting and northing
  - Total difference in GPS computed area and national certified plans was $1m^2$
  - Effective tool to work alongside existing techniques

INTERNATIONAL EXPERIENCES

- ALBANIA
  - Two field tests carried out. In 1 agricultural village, 29 parcels were surveyed in 4 hours and 35 mins (excluding 40 mins set up time). Average agricultural parcel is 0.25ha
  - In second village, 17 parcels in 1 hour and 15 mins covering 7.58 ha (average parcel size 0.4ha)
  - Topographic detail – 20 houses and 153 planimetric features surveyed in 3 urban areas in just under 8 ½ hours of field observation

International Experiences

- Albania
  - Productivity estimates GPS methods were 8 times faster in the field and almost 10 times faster w.r.t. office processing/presentation

International Experiences

- Australia
- Belize
- Nepal
- Austria
- China
- Kenya
- United States of America

Potential Benefits

- Speed
- Accuracy
- Efficiency
- General user wellbeing
- Framework for DCDB
- National SDI

Conclusion

- GNSS can be an effective tool in cadastral surveying
- Several potential benefits
- Will not replace existing survey techniques, but can work alongside
- ‘Best practice’ and calibration guidelines

Thank You

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