



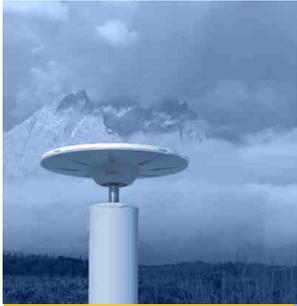
u-Trimble

*'Trimble's ubiquitous approach to
cadastre throughout the World'*

*Keith Hofgartner
Project Manager – Worldwide (Ubiquitous)*

Trimble Navigation Limited
Oct 2009





Opening Statement

Trimble is ..

‘Ubiquitous’.

body. Hence ~ISM n. [foll., -ARIAN]
ūbī'quīt|ŷ, n. Omnipresence; being everywhere or in an indefinite number of places at same time; || ~y of the king (law), his official presence in courts in the person of his judges. Hence ~ous a., ~OUSLY² adv., ~OUSNESS n. [f. mod. L *ubiquitas* f. L *ubique* everywhere f. *ubi* where, -ITY]

- **Products - From ‘metres’ to ‘centimetres’**
- **Solutions - From sensors to ‘systems’**
- **Locations - From Local to Worldwide**



From Measurement to Management..

U-Products

Product
S

Solution
S

Location



**Police
Enforcement**



Surveying & Mapping



Utilities



Personal Navigation



Aviation



Railroads



Offshore Drilling



Communications



Trucking & Shipping



Recreation



Power Grid Interfaces



GPS Units

Product
S

Solution
S

Location



2-5m Sub-metre 10-30cm 10cm 5mm

XC

Compact flash-GPS card

Nomad

Small compact handheld with numeric keypad

Recon

Small compact handheld integrated GPS Module

ProXT

Integrated SBAS receiver with cable free connections

**GeoX
M**

Compact handheld with integrated SBAS receiver

**Geo
XH**

Compact handheld with integrated SBAS receiver 1 GB Internal memory

**Pro
XRT**

Decimetre precision with integrated Real Time H-Star technology

R Series

Small compact handheld with integrated camera.

Juno

Small compact handheld with integrated 3MB camera.

Yuma

Rugged tablet PC with integrated camera and GPS

GeoXT

Compact handheld with integrated SBAS receiver 1 GB Internal memory

ProXH

Integrated SBAS receiver with cable free connections HStar accuracy



Optical Total Stations

Product
S

Solution
S

Location



Manual

Servo

Autolock

Robotic

M3

3" or
5" Accuracy
300m
Reflectorless
Distance Meter

3600

Interchangeable
Controller
1mm EDM
Option

5500

Servo driven
Interchangeable
Controller
1mm EDM
Option

5600

Servo driven
Interchangeable
Controller
1mm EDM
Option
Upgradable to
Autolock or
Robotic

S6

Magdrive driven
Interchangeable
Controller
1mm EDM
Option
Upgradable to
Autolock or
Robotic

S8

Magdrive driven
Interchangeable
Controller
1mm EDM
Option
Upgradable to
Autolock or
Robotic
Monitoring





Data Collection

Product
s

Solution
s

Location



Keyboard

Handheld

PC Tablet

On board

Dedicated
keyboards

Recon

Rugged pen based
unit
Windows Mobile
Wireless Options

TCU

Integrated controller
for GPS and Optical
Total Stations
Choice of software

TSC2

Advanced handheld
field computer
Windows Mobile
Wireless Options

Tablets

Field proof PC
Windows Vista
Wireless Options



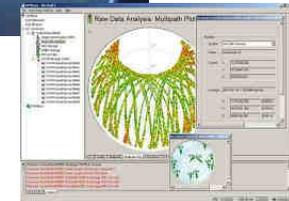


Infrastructure

Product
s

Solution
s

Location



Sensors

Communications

Software

NetR5

GNSS Receiver
with L2C and
L5

NetRS

GPS Receiver
Internal
Memory

PC's

GPSBase

NetR3

GNSS Receiver
Low power reqt.

Low power reqt.

NetR8

GNSS Receiver
with L2C and
L5

Internal 1GB
Memory

Low power reqt.

Routers

GPSNet

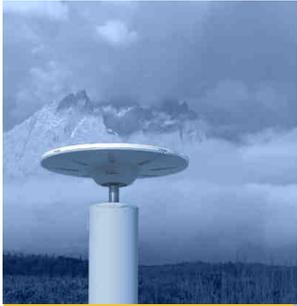
RTKNet

VRS₃Net

Integrity
Monitoring

Comms
Links



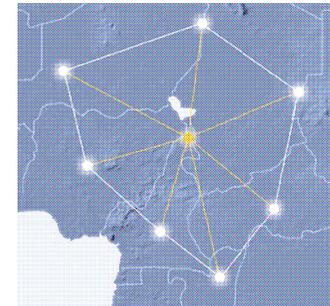
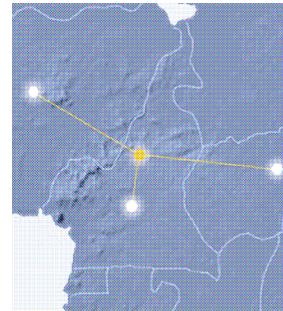
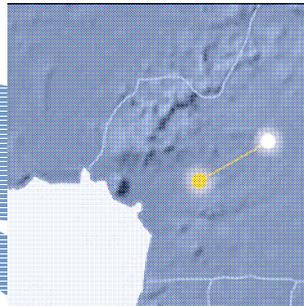


Infrastructure

Product
s

Solution
s

Location



Single Base

Multi Base

VRS

Networks

Phase 1

Small local solutions for Survey or cadastral projects

Post Processing or Real Time applications

Phase 2

Larger geographic coverage to share data with many users

Post Processing (multiple base accuracies) or Real Time applications

Phase 3

Nationwide coverage for full coverage for Post Processing and Real Time delivering Virtual Reference Station data to multi users in the field



Cadastre U-Solutions

Product
S

Solution
S

Location

Entry Level

Multiple sensors and data collection platforms

Gather field information using various techniques

Manual or automatic post-processing

Transfer via additional Office Systems to bespoke Cadastre Programs



Cadastre U-Solutions

Mid Level

Dedicated sensors with compatible data collectors

Gather field information using defined techniques

Automatic post-processing



Transfer direct to bespoke Cadastre Programs using defined protocols

Product
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Solution
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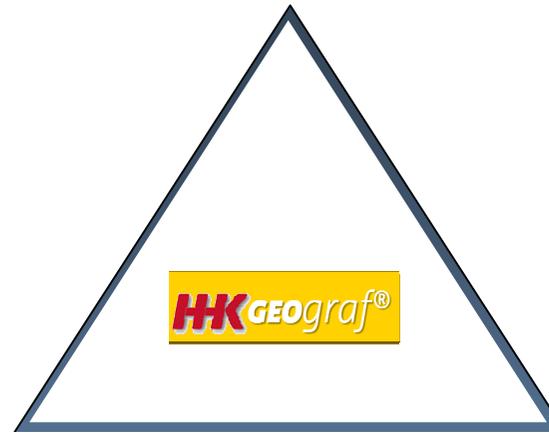
Location

Cadastre U-Solutions

Product
S

Solution
S

Location



High Level

Dedicated sensors with dedicated data collection platforms

Gather field information using defined techniques

Automatic post-processing

Working directly inside Cadastre Database





Cadastre U-Solutions

Product
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Solution
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Location

Sensors
Solutions



Trimble Networks throughout the World



Product
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Solution
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Location

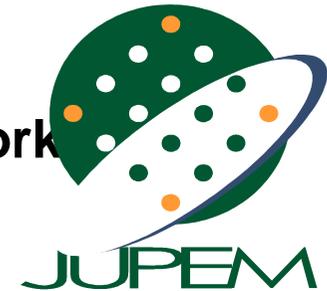


Trimble Networks with more than 3,200 reference stations worldwide

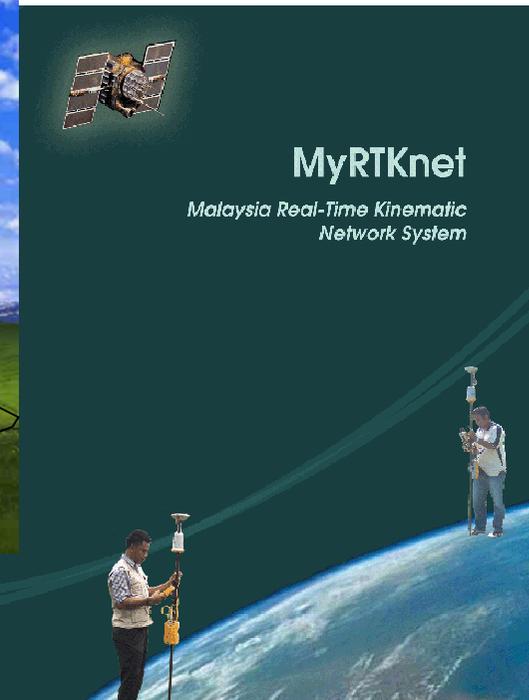
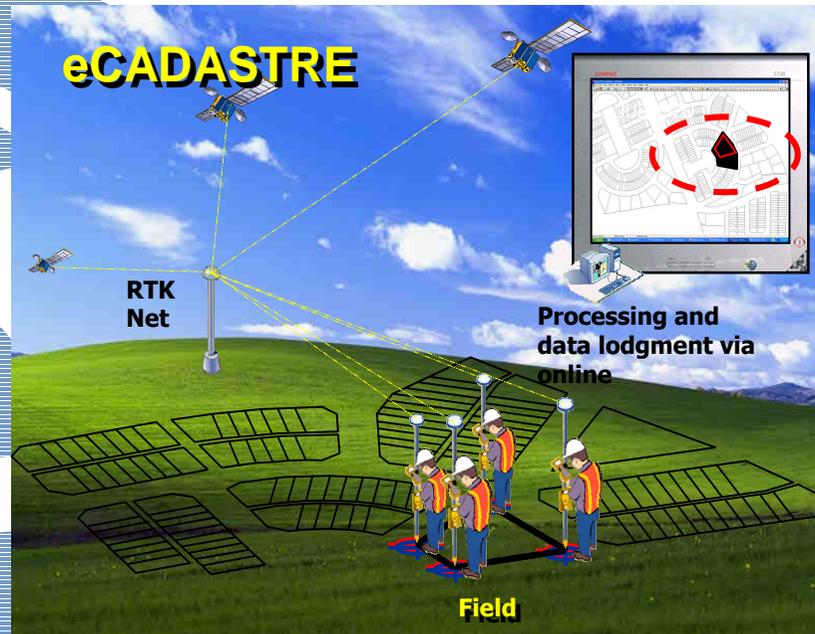


Malaysia - MyRTKNet

- 72 Station VRS Network
- 100 Rovers for Cadastre and Geodetic work



Product
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Solution
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Location





Cadastral U-Locations

Product
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Solution
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Location



MDB Funded 'Cadastral' Projects in progress throughout the World

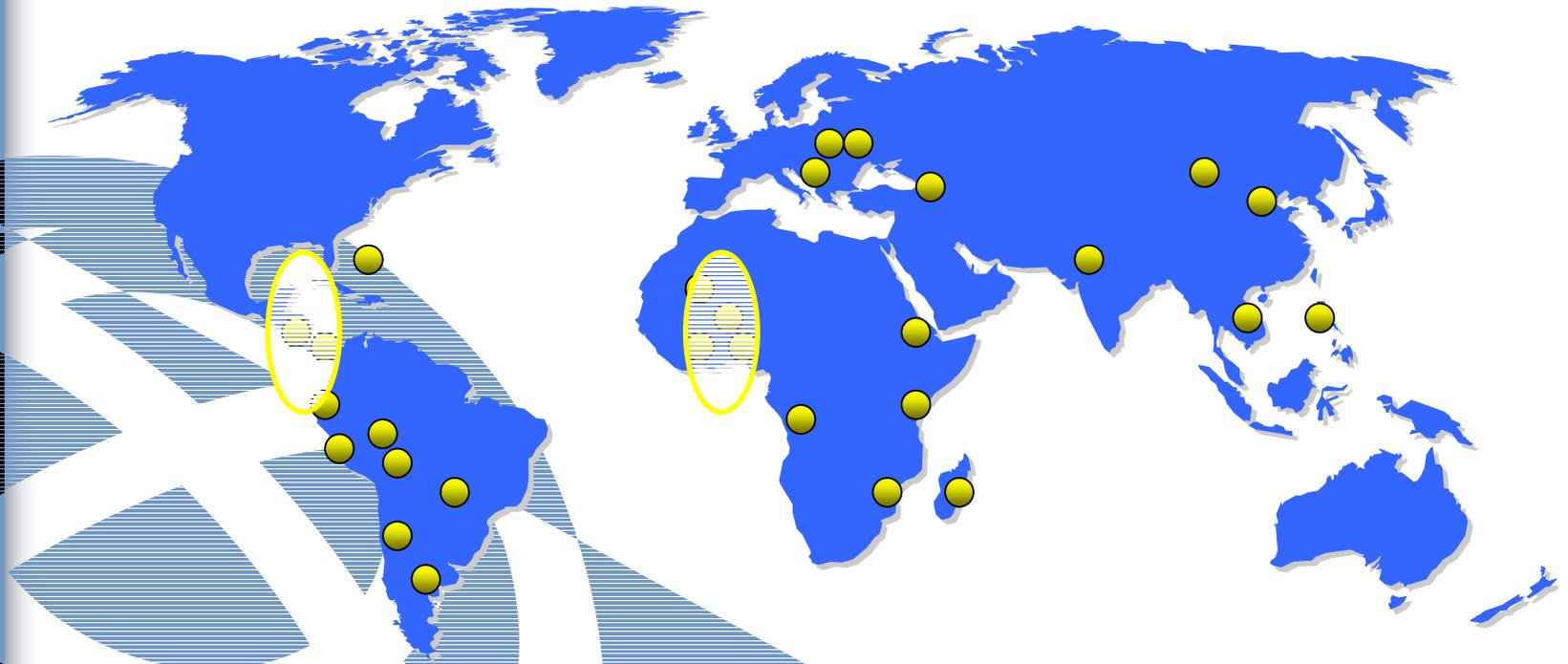


Cadastre U-Locations

Product
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Solution
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Location



**MDB Funded 'Cadastre' Projects in
progress throughout the World**

Update on MDB Funded Land Administration Projects utilising Trimble Solutions

Product
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Solution
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Location



– Benin

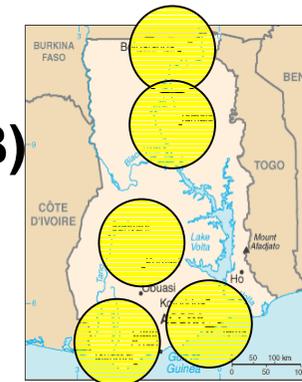
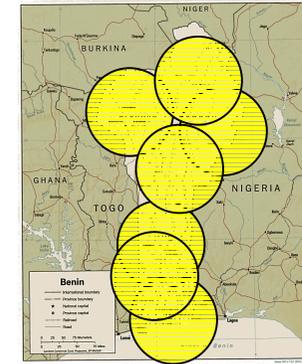
- Access to Land Project (MCC)

– Ghana

- Pilot Project (MCC)
- Land Administration Project (WB)
- Clinton Global Initiative Project

– OAS

- MuNET Pilot projects



Organization of
American States

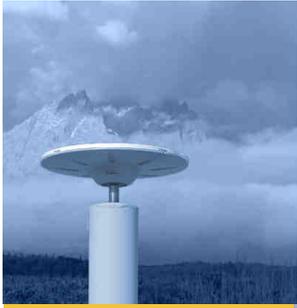
Benin

Product
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Solution
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Location





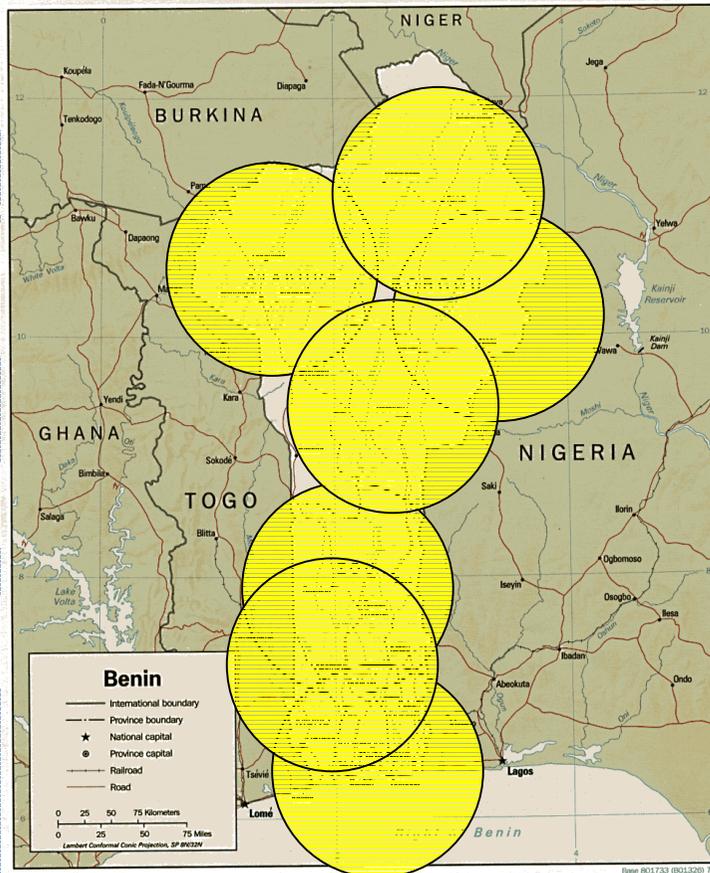
Benin

Establishment of GNSS Reference Stations

Product
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Solution
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Location



- Installs completed
- GNSS development enhances Benin's integration with global mapping systems
- Regional coverage using Regional Survey offices
- 100% national coverage
- Potential for VRS Network upgrade

Benin Applications

- **Surveying Using Local RTK Base stations and surveying land parcels**
- **Post Processing of the survey data into National Grid using the CORS Station data centrally**



Product
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Solution
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Location

Benin

Further Mapping Handheld Receivers

- Investment in total of 105 High Accuracy GIS data collectors
- Using data from the new GNSS Reference Stations
- Delivers sub-foot (30cm) accuracy in post – processed position

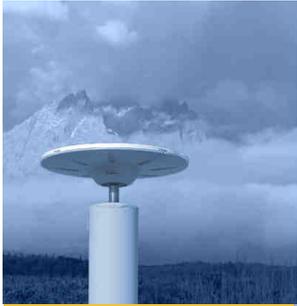


Product
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Solution
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Location

 Trimble



Ghana

Land Administration Projects

Product
s

Solution
s

Location



Ghana

Land Administration Projects

- Three individual projects involving GPS Technology
- Supported by:



- Millennium Challenge Corporation
 - Land Tenure Facilitation
 - Agricultural Modernization



The World Bank

- World Bank
 - Land Administration Project



Opportunity International
GIVING THE POOR A WORKING CHANGE

- Private funding (Opportunity International)

Product
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Solution
s

Location

Trimble



Ghana

State of Survey Infrastructure

- A sparse network of triangulation beacons
 - Unable to use for basis for accurate cadastre
- Different co-ordinate systems
 - War Office
 - Clark Modified 1880 Ellipsoid.
 - The lack of a homogenous co-ordinate system has led to multiple sale of land and the high of cost of access to land for development.

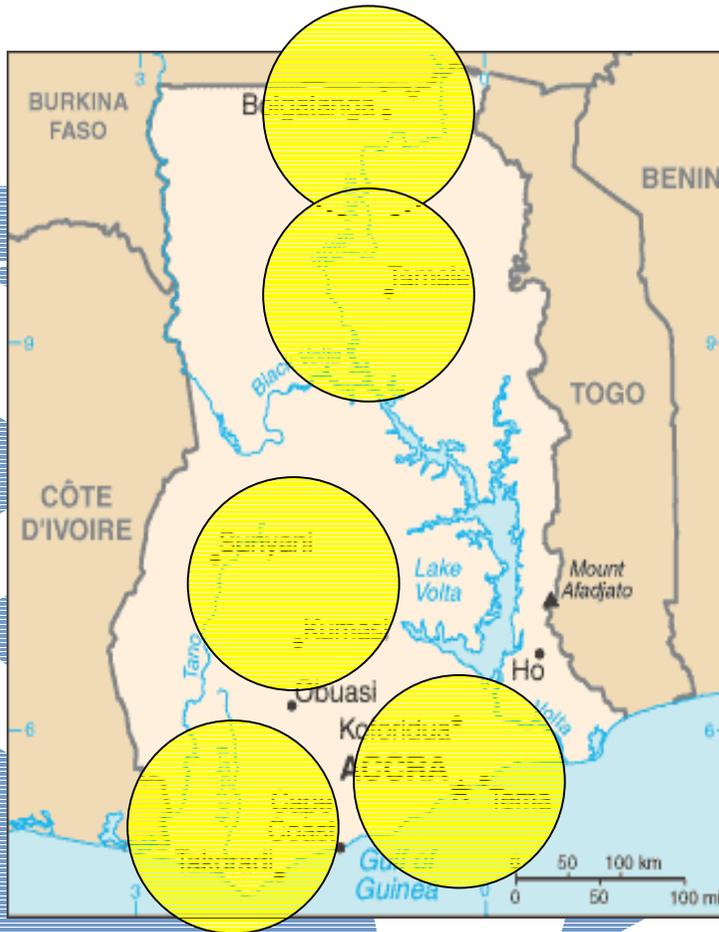
Ghana

Spatial Distribution of GNSS COR

Product
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Solution
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Location



- Initial Pilot project
- Further densification of network
- Cost effective tool for land development
- GNSS development enhances Ghana's integration with global mapping systems
- Post processing and local Real time coverage using Regional Survey offices

Gnana

Millennium Challenge – Pilot Project

Product
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Solution
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Location

- Local offices with GNSS Reference Stations storing Raw Data for Post Processing
- Additional 35W Radios transmit Real Time corrections to users in field (7-10k range), or set up local base station and Post Process to National Coordinate system for remote sites
- Latest GNSS RTK rovers for cm precision
- Robotic Optical Total Stations for in-fill in built-up areas, (no GNSS coverage)
- High Accuracy GIS data collectors
 - Delivers sub-foot (30cm) accuracy in post – processed position
- Potential to utilise Reference Stations as part of a National Network with potential for a deliverable VRS solution



Gnana

New Mapping Handheld Receivers

Product
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Solution
s

Location

- Further project – Agriculture modernization component
- Investment in over 50 new High Accuracy GIS data collectors
- Delivers sub-foot (30cm) accuracy in post – processed position
- Investment in many lower accuracy units for Parcel Identification only
- All using data from the new GNSS Reference Stations



Ghana

Pilot for Opportunity International

- First American – the US's leading provider of business information relating to real estate transactions
- Opportunity International - delivering tailored microfinance products to the world's poor
- ESRI – the global leader in GIS technology
- Trimble - leading provider of advanced positioning solutions
- International Land Systems - develops sustainable land recording and registration systems and consulting worldwide
- Sambus – one of Ghana's leading ICT companies

Product
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Solution
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Location

 Trimble

 Opportunity International
GOALS ARE THE ONLY WAY TO WORKING CHANGE



 Trimble



First American

 ILS



Ghana

Traditional Approach Results

- Average total costs range from approx. \$800 to \$2,000, often including some legal fees, survey fees, etc.
- 80% of Opportunity International clients interviewed had given up on registration process due to costs and time
- 100% of those who had continued the process had not seen any results
- Average years “in process” - 10+
- 72% of respondents held property under only oral agreements

Ghana

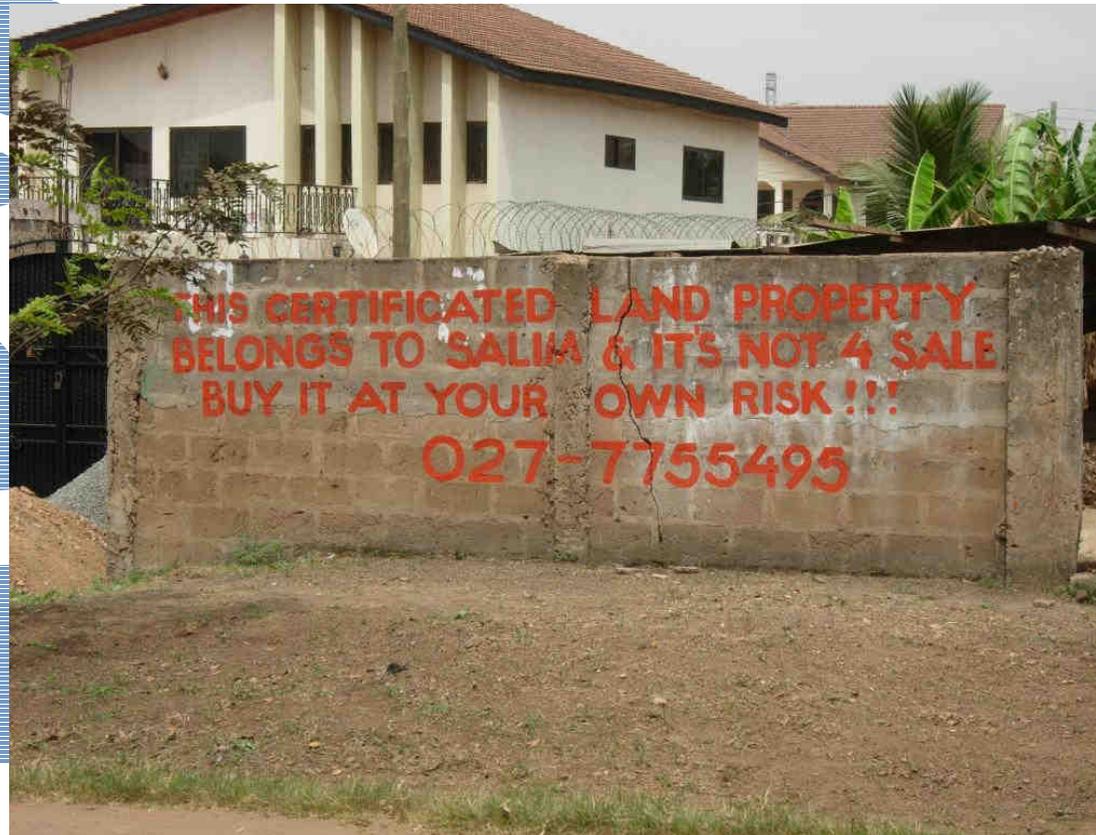
Consequences of Impediments to Registration

- Property “sold” twice by people claiming to own property
- Frustrated owner posted notice

Product
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Solution
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Location



Ghana

Streamlined process

- Use data to derive a para-legal title certificate
 - Use consolidated onsite interview
 - Ensure no boundary disputes
 - Leverage technology
 - GIS, titling, GPS, imagery with all data centrally stored
 - Meet with traditional leaders
- Make government's work easier through "batch" processing
- MicroFinance International serves as "trusted broker," on behalf of

Product
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Solution
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Location



Ghana

Pilot for Opportunity International - Update

Product
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Solution
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Location

- Opportunity International is now well established
- Using dedicated reference station
- Pilot project completed in early 2009
 - Paralegal titles to the first 30 clients
- Owners of land that hold 'squatters' (Terma Development Corporation) now issuing 60 year leases with automatic 30 year renewal possessing title
- Government support is strong
- Additional funding from USAID
- Potential to expand into rural and urban areas



Latin America Project



Product
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Solution
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Location



Organisation of American States MuNET

Product
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Solution
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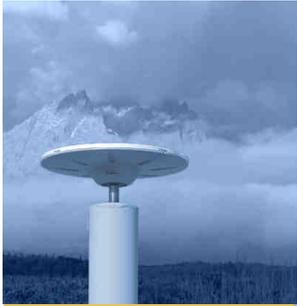
Location

- MuNet is designed to help municipalities in the Andean and Central American regions improve their citizen services by increasing efficiency and transparency.
- MuNet places special focus on electronic government, cadastre and property registration.
- 'Turn Key' entry level cadastre 'Toolkits' developed together with training packages
 - El Salvador
 - Ecuador
 - Paraguay
 - Bolivia
 - The



Organization of
American States





Summary

Trimble is ..

‘Ubiquitous’.

body. Hence ~ISM n. [foll., -ARIAN]
ūbī'quīt|ŷ, n. Omnipresence; being everywhere or in an indefinite number of places at same time; || ~y of the king (law), his official presence in courts in the person of his judges. Hence ~ous a., ~OUSLY² adv., ~OUSNESS n. [f. mod. L *ubiquitas* f. L *ubique* everywhere f. *ubi* where, -ITY]

- **Products - From ‘metres’ to ‘centimetres’**
- **Solutions - From sensors to ‘systems’**
- **Locations - From Local to Worldwide**



From Measurement to Management..



Terima kasih

Thank you..

*Keith Hofgartner
Project Manager – Worldwide (Ubiquitous)*

Trimble Navigation Limited
Oct 2009

