



Surveying and Mapping Techniques in Land Management

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Trimble Cadastral Solutions

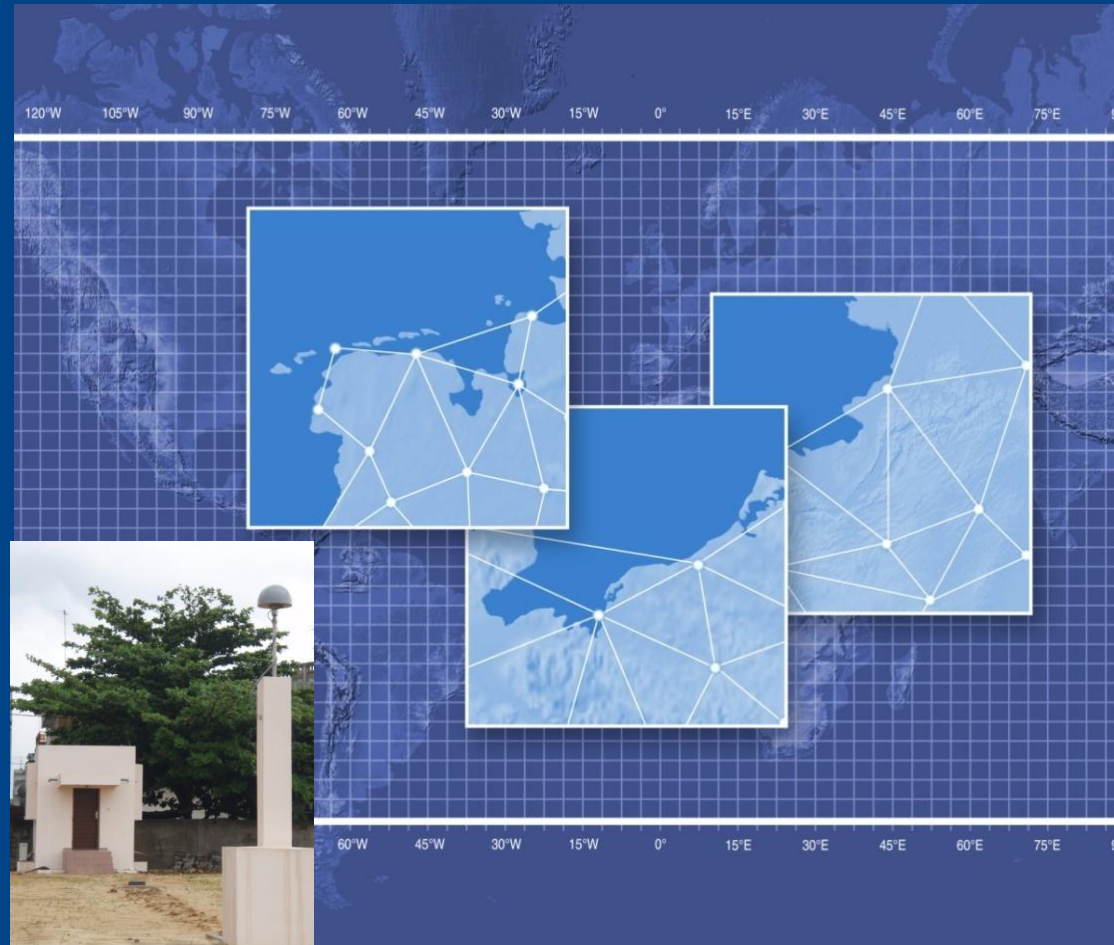
LAGF - 17 August 2012

Outline

- **Geodetic Control & Scaled implementation of GNSS infrastructure**
- **Technology choices**
 - Technology cost vs. project cost
- **Technology Implementation challenges**

Geodetic Control & GNSS Infrastructure

- Backbone of any cadastral project
- To ensure consistency and accuracy
- Typically managed by National Agencies, but...
- Supports broad range of applications



Accuracy & the common reference frame

- The value & character of the land and of its use defines the accuracy of its cadastral registration.
- EU, AM and Asia model are not always possible in Emerging Economies:
 - Lack of basic infrastructure
 - Initial Funding
 - Experience with technology



Scaled Implementation of GNSS Infrastructure

- Temptation to save cost with uncoordinated control at various phases of work
- Implementing a reference backbone with scalability towards cm-accuracy planned from the beginning is a better plan!
 1. Sparse CORS model with periodical upload and post-processing
 2. To Sparse VRS @ >150Km station spacing producing 10 cm (Horizontal)
 3. To regional (island) densification @ 50Km to achieve 2-3 cm accuracy
 4. Continuous refinement of accuracy over time and with increasing land value



Trimble Reference Stations in Latin America



Institution	Country	Quantity
	Suriname	
Federal Government of Suriname	Brasil	4
University of Sao Paulo	Brasil	20
INPE	Brasil	80
Caña de azúcar -Brasil	Puerto Rico	70
HLCM Group	Rico	4
Ministry of Agriculture and Lands	Jamaica	11
Lands and Surveys Design	Trinidad	5
Panama Canal Authority (ACP)	Panamá	4
Land and Survey Department	I.	4
Universidad de Chile	Caimanes	7
Ingeominas	Chile	28+23+21
IGAC – Colombia VRS	Colombia	31
ICETEL	Colombia	7
IGM	Costa Rica	16
COFOPRI - IGN	Ecuador	45 VRS
INCRA - Brazil Land Management	Perú	85

Advanced Technology Choices

- **Geospatial solutions**
- **UAVs for Rapid Mapping**
- **IS Rover Urban Survey methods**
- **High end handhelds with Floodlight technology**
- **Data Management solutions**
- **Mobile resource management**

Geospatial Aerial Workflow & Products



Flight Management

- Flight management system
- Direct Georeferencing System



Data Acquisition

- Optical Sensors
- LiDAR Sensors



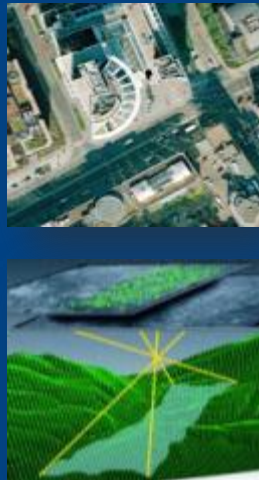
Data Preparation

- Image Mosaicing
- Point Cloud Matching



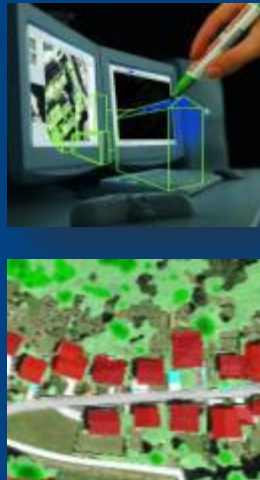
Data Processing

- Orthophoto production
- Point cloud processing
- DSM / DTM generation



Feature Extraction

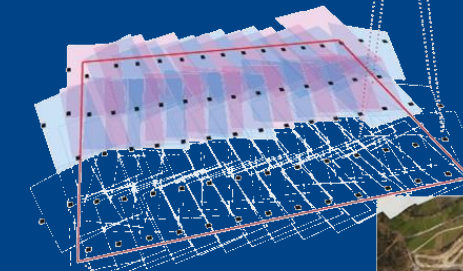
- Manual feature extraction
- Automatic feature extraction



Rapid mapping tool

- Mapping & surveying
- Light UAS
- Compact camera
- New-generation photogrammetry
- Vision software tools & automation

Gatewing X100
REVOLUTIONARY MAPPING



gatewing
A TRIMBLE COMPANY

Urban Survey Methods

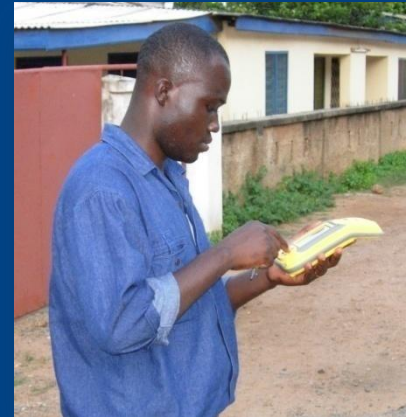


- **Leveling System**

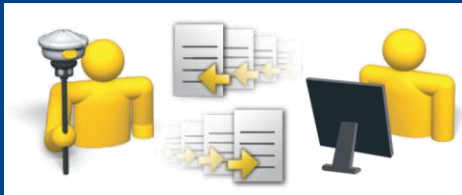


Rural Survey Methods

- **Integrated GNSS + handheld, rugged computer**
- **Light weight**
- **Lower cost**
- **Accuracy up to 10cm**
- **Floodlight Technology**



Data Management Services



SECURE DATA HOSTING WITH BUILT-IN REDUNDANCY

EASY-TO-USE INTERFACE

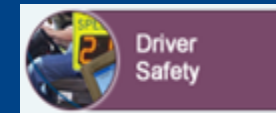
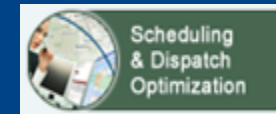
ADVANCED DATA VISUALIZATION TOOLS

GOOGLE MAPS™ INTEGRATION

WEB-BASED SOFTWARE, AVAILABLE 24/7

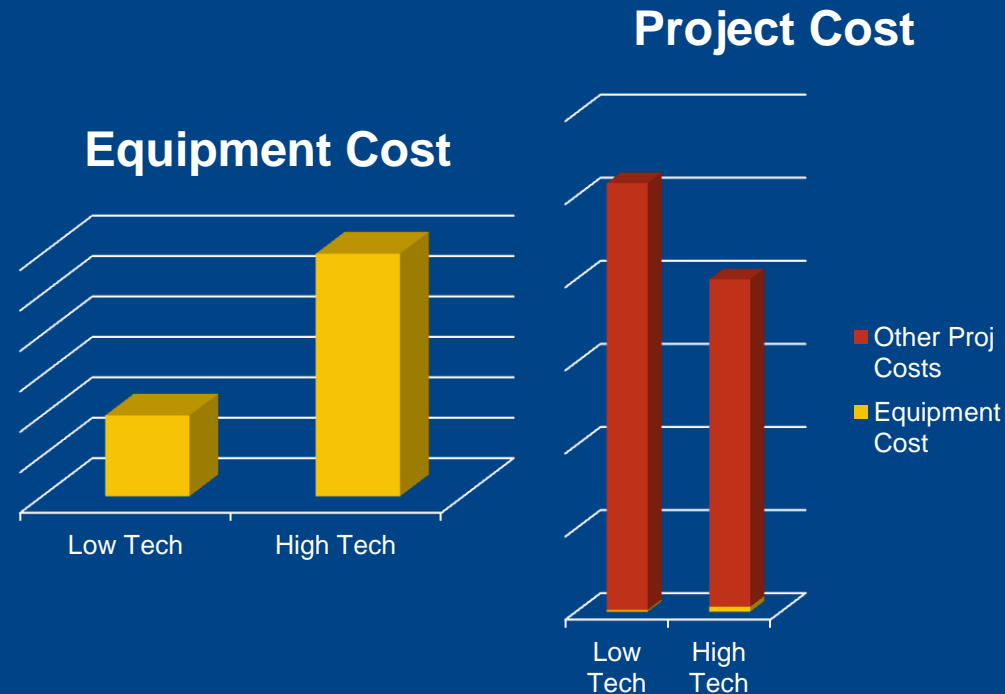
Mobile Resource Management

- Increase workflow productivity
- Reduce fuel costs
- Improve asset utilization
- Decrease carbon footprint
- Improve driver safety



Effective Deployment of Technology

- Tendency to look at technology cost in isolation
- Advanced technology purchases can reduce overall project costs dramatically
 - Increased labor efficiency
 - Simplified workflows
 - Decreased errors and rework
 - Simplified field processes
 - Builds technology capacity
- Utilize a solution purchase approach as opposed to a product purchase process
 - DBA, training and implementation services wrapped around products



Implementation Challenges

- Initial funding limitations & justification
- Technical limitations
- Infrastructure limitations
- Implementation assurance
- Consider total project costs & downstream benefits
- DBA Implementation
- Scaled Implementation
- Solution model with DBA, training, service & support





TRIMBLE CADASTRAL SOLUTIONS

Thank you !

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