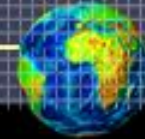


# Optimized Data Acquisition Processes and Tools for Land Administration

Bo Gustafson  
DataGrid Inc.

[www.datagrid-international.com](http://www.datagrid-international.com)



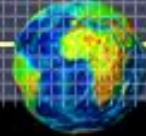
## Land Administration reforms on large scale will take place

- to improve living conditions
- for economic stimulation

## Novel Tools & Procedures among Enabling Technologies

## DataGrid is dedicated to provide “turn-key” solutions

- integrated core system
- consulting
- customization

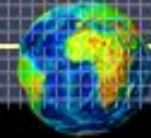


# Integrated core system

Database

Data Collectors

Procedures



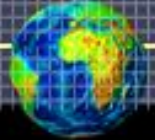
## Database

- **customized** (Hard keyed organization, standard entries ...)
- **streamlined menus**
- **upgradeable** (compatible with PostgreSQL, ArcCadastre ....)
- **flexible structure** (Compatible with VAN DER MOLEN and LEMMEN recommendations)

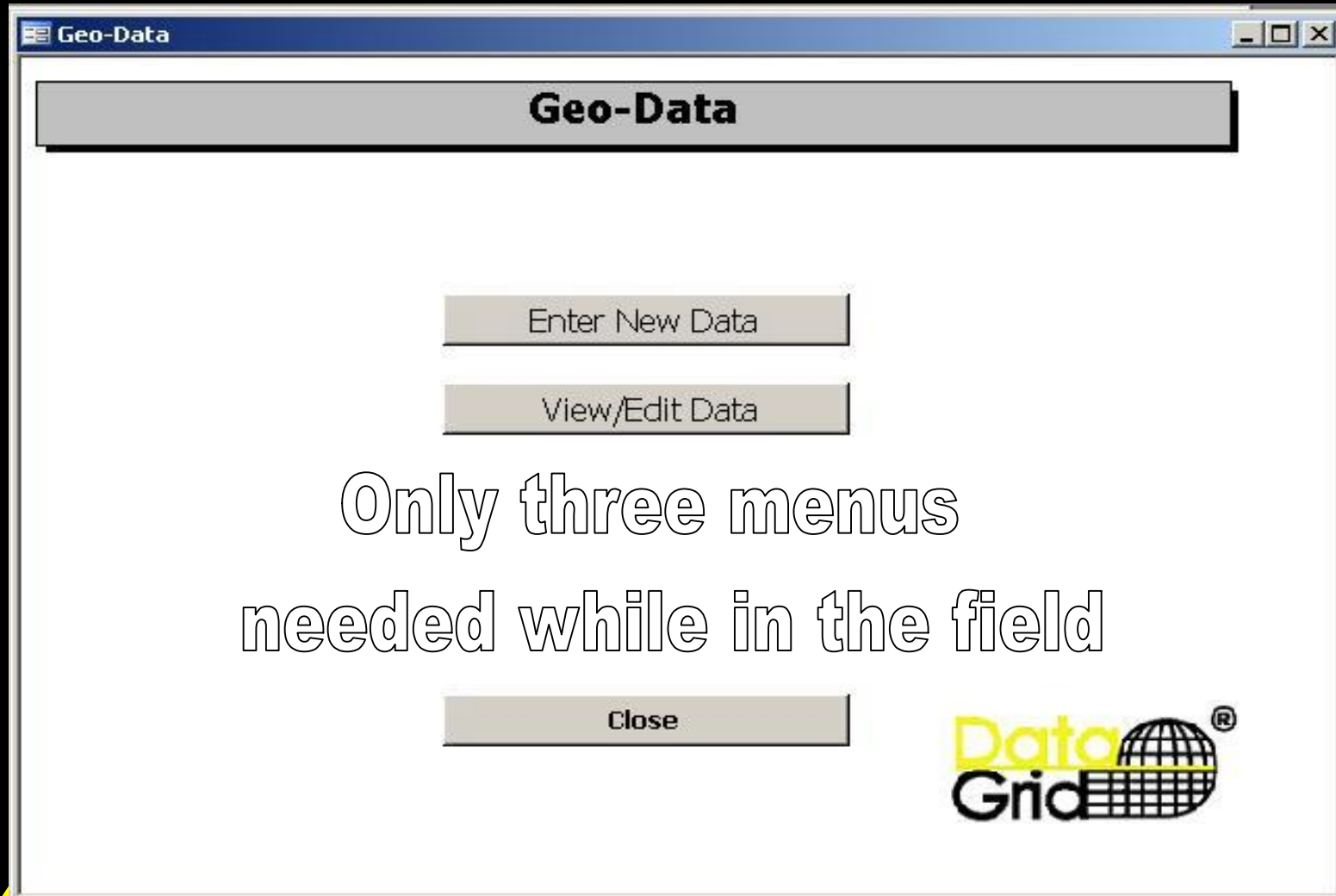
# GeoData

A Geo referenced Database program

**Geographic Information System(GIS)/Land Information System(LIS)**

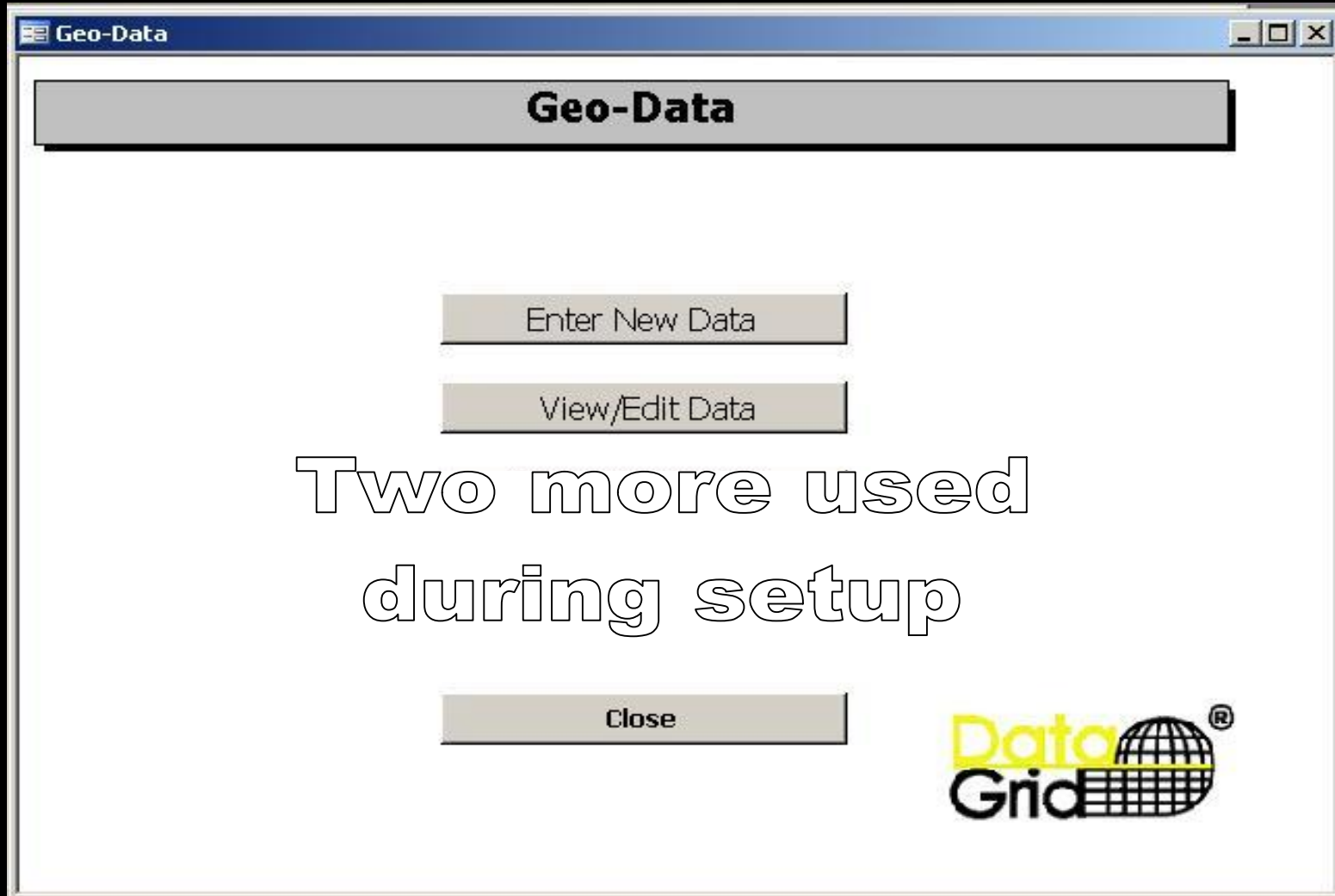
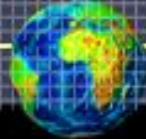


## Simple Menu-driven Interface

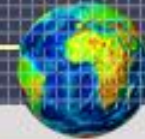


Only three menus  
needed while in the field

Access though Main Menu



Two more used  
during setup



# For Setup Hard-keyed organization

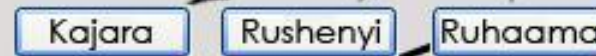
Enter the administrative structure of the region of interest



Districts:



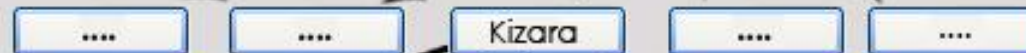
County/Municipality:



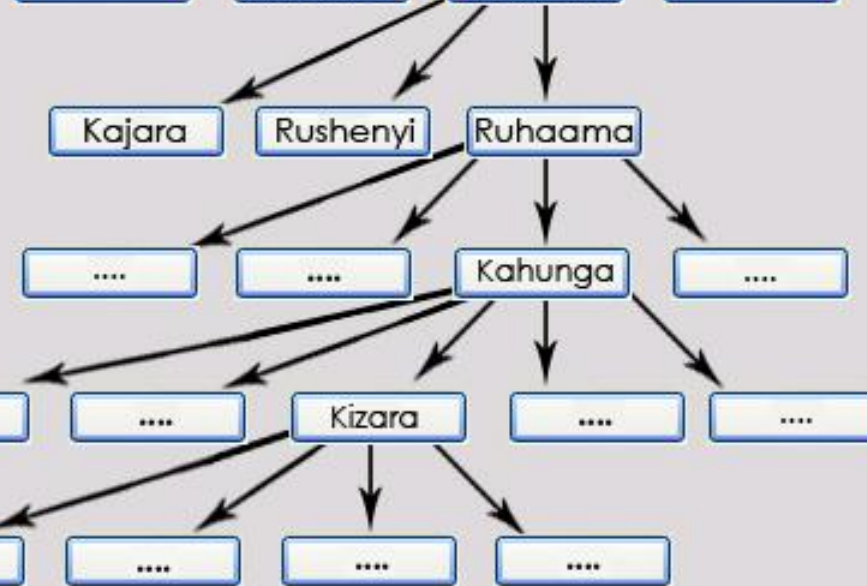
Sub-county/Town:

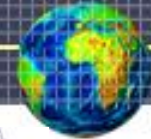


Parish/Ward:



Village:





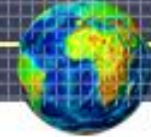
## In the field



- Once the administrative structure is entered it becomes the default used in the field
- Only data-entry can be made in the field
- No changes to the structure can be made in the field

**It is not  
supposed to!**

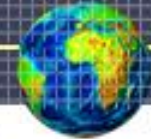




# Key Advantages:

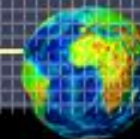


- Only authorized users can define and change structure
- Always correct administrative organization (once proofed)
- Consistency (organization, spelling, ....)
- Simplicity, efficiency, speed, reduces human errors
- Data can be searched
- **Updated** at any time until the record is **protected** by the authorized users with access to the setup menus.



Allows the field worker to concentrate  
on his/her job

cannot interfere  
with setup



## Data Collectors

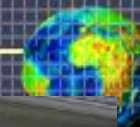
Internal: GPS

External: Totalstation, text, database entry, photography, ...

- field data collected digitally (Demographic, cadastral, ....)
- automated on-the-spot GPS postprocessing (dm-accuracy)
- rugged, solar power, tall pole, wireless option



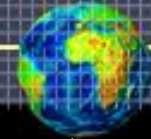
- ... no unnecessary “clutter”
- ... many automated functions  
(manual override advanced mode)
- ... automated Datum translation
- ... light, rugged, practical



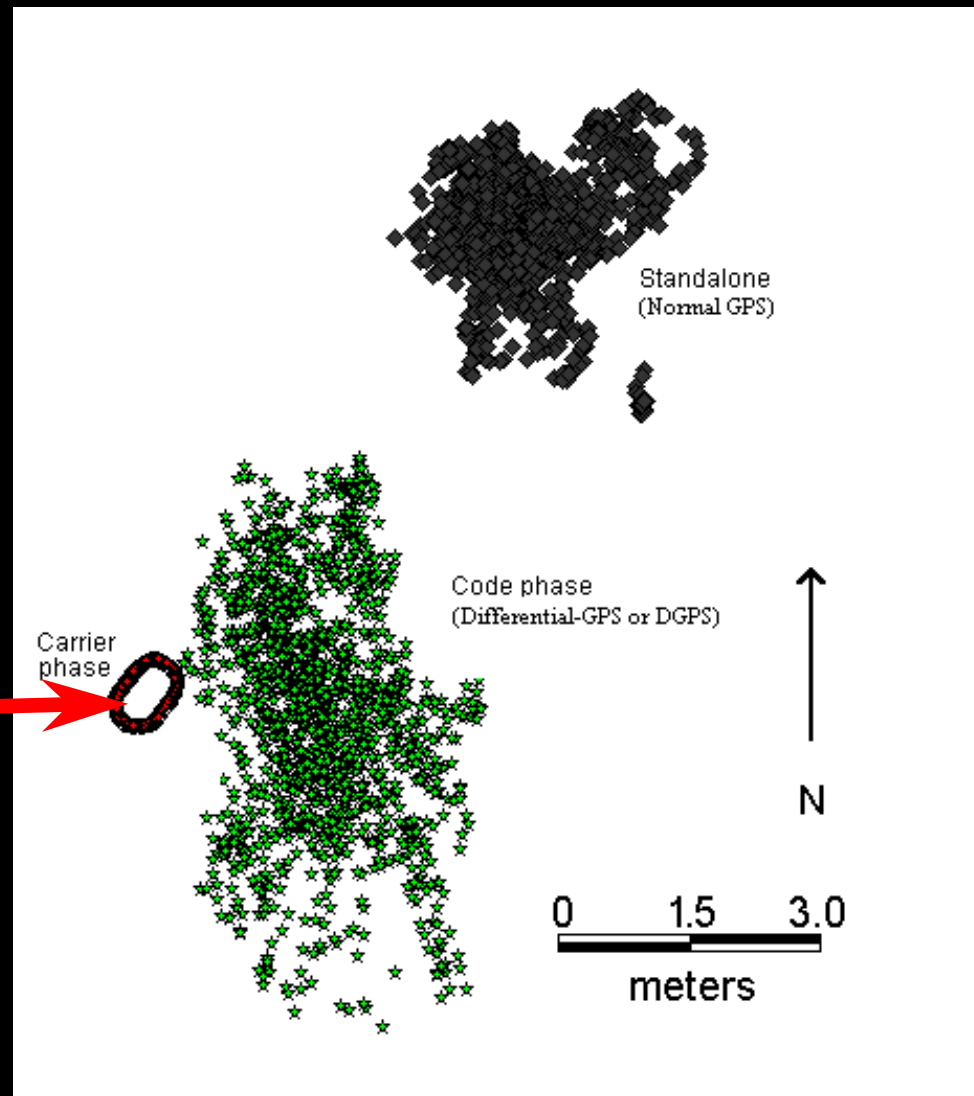
Audio signals and  
**LEDs** tell when  
satellites acquired  
or lost

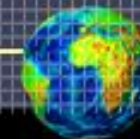


- solar power keeps internal batteries charged (last over 10 hours without sunlight)
- Data stored in internal flash memory (32 Mb standard)
- Can operate without external displays or loggers



# ACCURACY: Carrier Phase Single Frequency (cm to dm level)



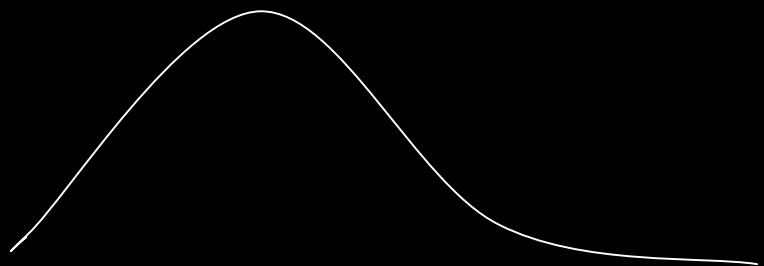


## Mk1 Crane Carrier Phase ..... base corrections

**150 to 200 sec. Static No Initialization**

Random Error ....  
(95%) 3 to 4 centimeters

Systematic Error ..  
sub-millimeter range  
+ 3 ppm  
< 10 km baseline



Example: 15 000 000 boundary points

⇒

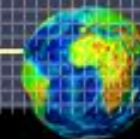
Approx. 150 000 parcels  
could be affected by errors >

1 m

⇒ Need for

**PROCEDURES WITH STRINGENT  
INTEGRITY CONTROL**





## L1/L2 Carrier Phase

### Toughman OR Mk3 .....

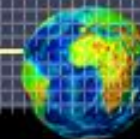
Random Error ....  
(95%) 1 centimeter

**1 to 5 sec. Static  
No Initialization**

Systematic Error ..  
sub-millimeter range + 1 ppm  
< 15 km baseline

~ 1 dm @ 100 – 1000 km baseline





# Carrier Phase Accuracy saves time & costs ....

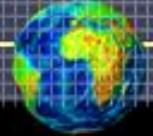
**L1 carrier phase (Mk1 Crane) .....**  
**Low inv. cost, Discipline Essential**

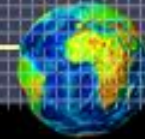


**L1/L2 carrier phase  
(Toughman or Mk3) .....**  
**Efficient.**  
**Real Time –Mode Highly  
automated checks possible**









## Example of connected sensor/instrument

### IN THE GROUND

Moisture

pH-levels

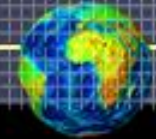
Nitrogen

### IN THE AIR

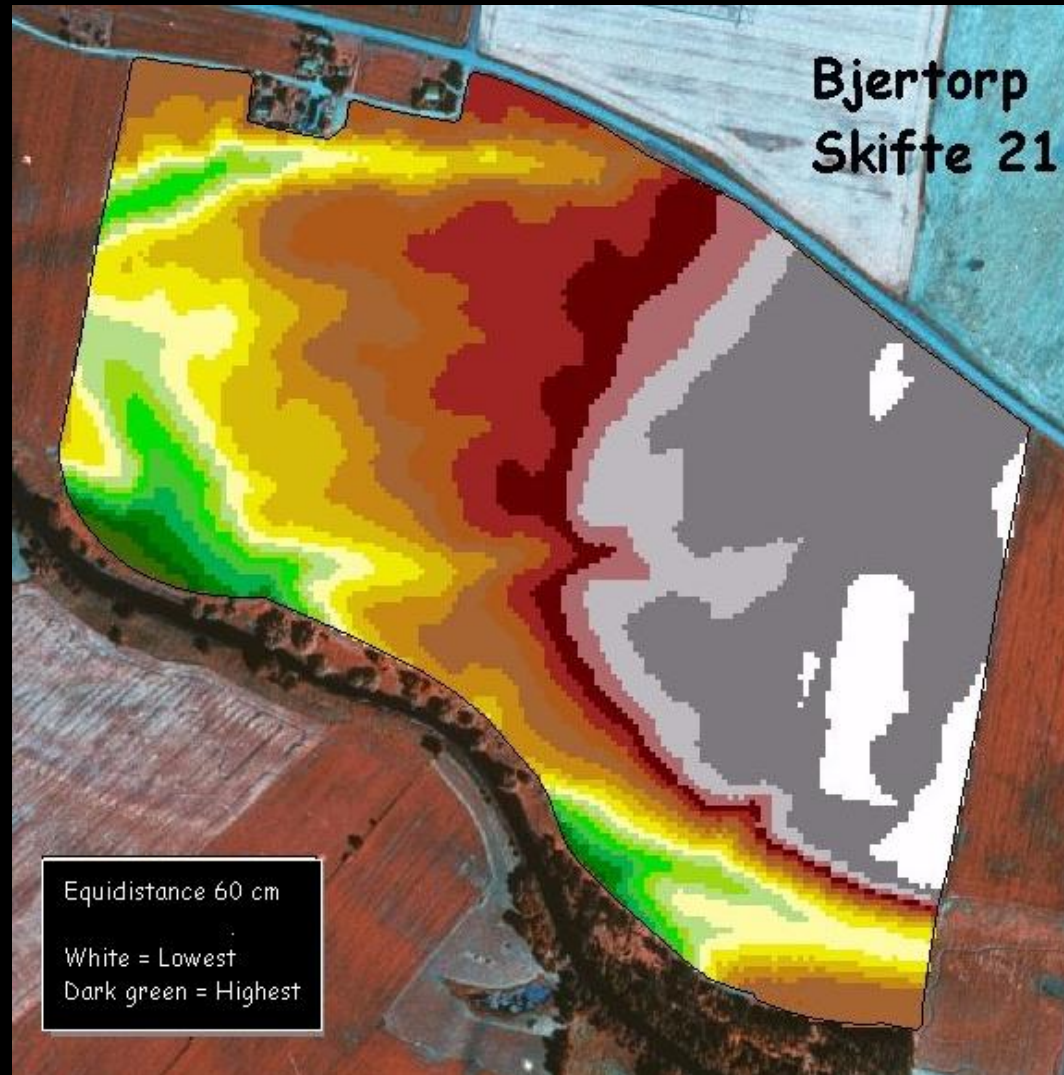
CO<sub>2</sub> levels

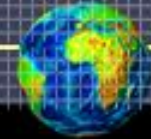
Radon levels

Moisture



# Ground Moisture level map



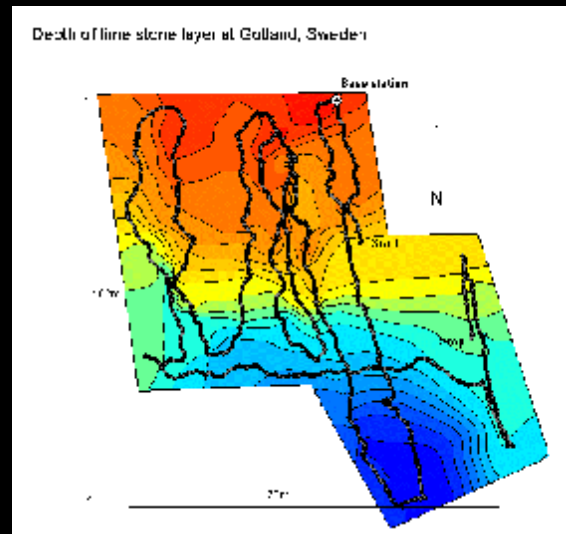


# Example use of connected sensor/instrument

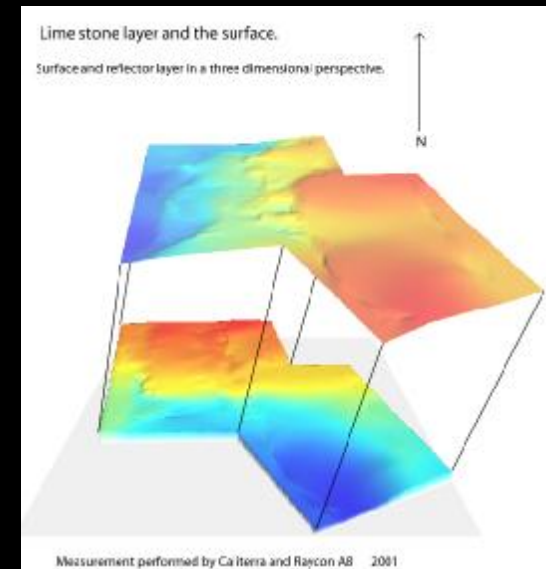
POSSIBILITY TO RECORD 3D / subterranean features



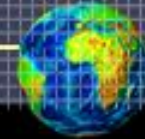
Mk1 with a Ground Penetrating Radar (GPR)



Topographic surface map



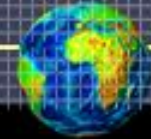
+ Subterranean features



## Procedures

- teams approach (minimizes training needs & manpower costs)
- integrated with sensitization
- integrity control

TEAM	Personel
Information /scheduling team	1 Senior communicator 1 Junior/training communicator
Survey/demarcation team	1 Senior surveyor 4 GPS operators 1 Base station guard 1 Driver  (2 Monument makers)
Office team	1 Manager 8 Operators



## Information / Scheduling Team

plans the sequence in which sites will be visited

informs stakeholders of the purpose of the demarcation and of the procedures that affect them

Office Team  
retrieve any existing records



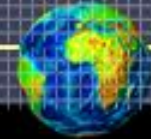
National or regional org.,  
e.g. Lao Women's Union.

sensitize + gain an upfront understanding of any outstanding property conflicts that have not been noted by the office team and to make sure that the information on all known conflicts is up-to-date

## Community Rep.

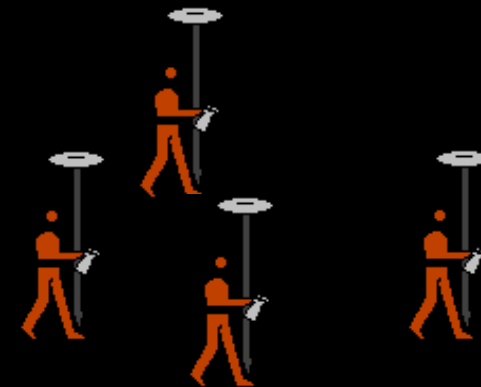
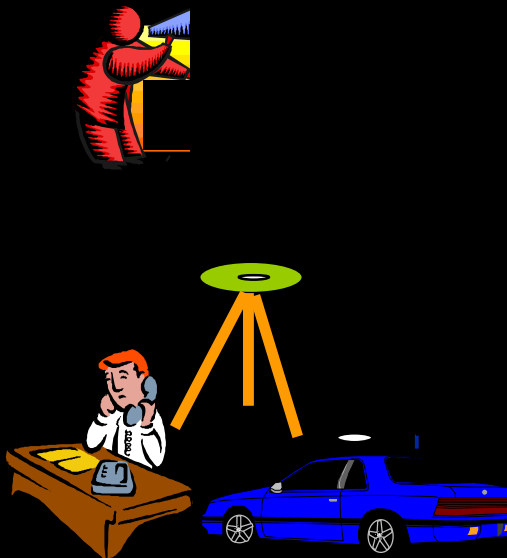


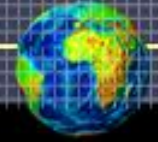
- 8 weeks visit
- day before visit
- survey day visit



## Demarcation / Surveying Team

Recommended set 2 bases and 4 rovers per crew of one measurer and one processor. + guard at the remote base?



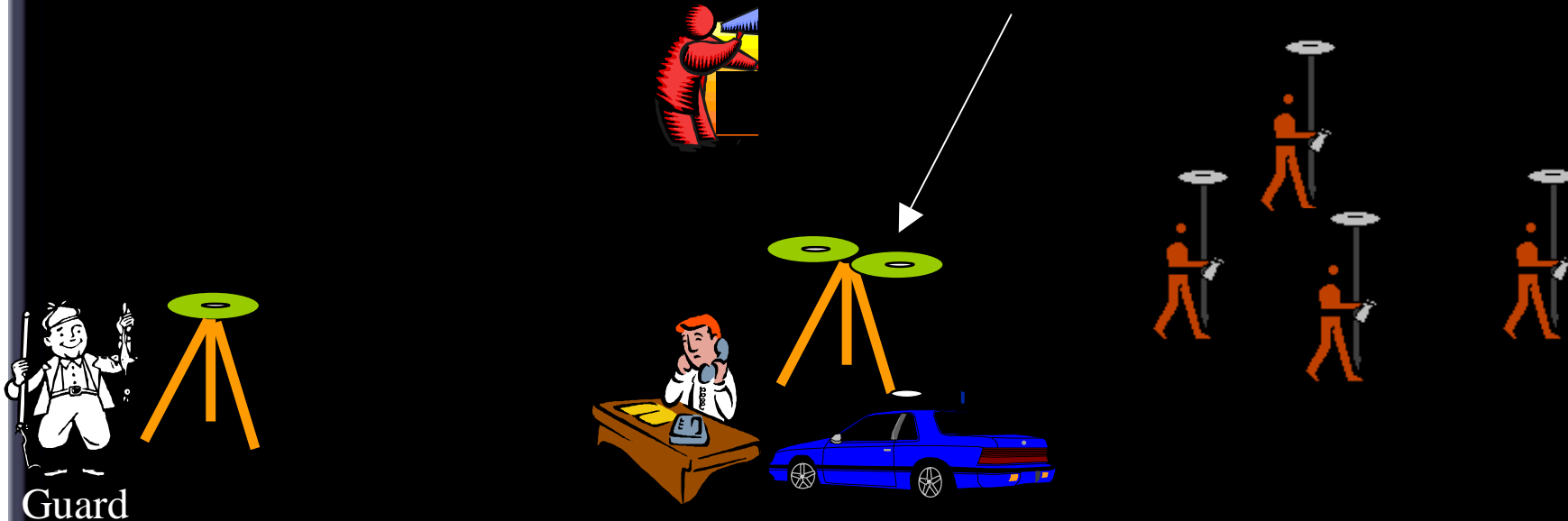


# Demarcation / Surveying Team

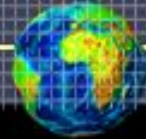
## L!/L2 Version

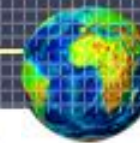
Recommended set 2 bases, 1 check point and 4 rovers per crew of one measurer and one processor. + guard at the remote base?

REAL TIME CHECK POINT  
GUARANTEES RELIABILITY +  
SAVES TIME









# Field Operations

Can be done in the  
community house



1) Enter parcel ownership and  
statistical data



... just add  
computer

2) Collect demarcation data

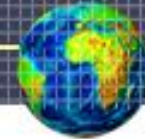


3) Process in the field  
to make sure GPS data  
is good – owner data  
consistency checks.

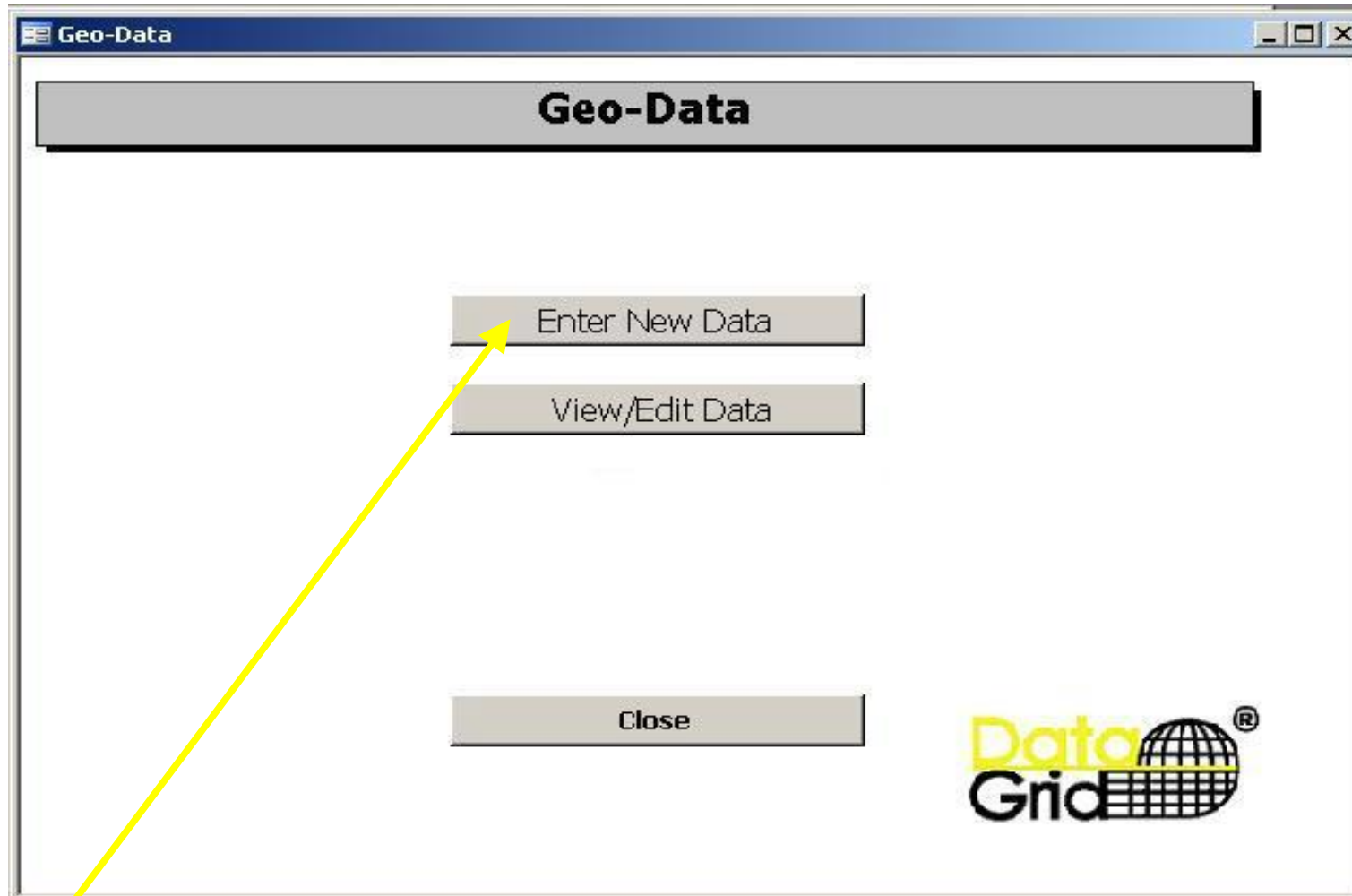


Join 1 and 2

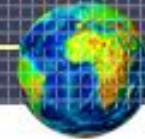
done onsite



## Field data entry



... push button to enter data



## Select admin. location of parcel

**Add**

**Add Entry**

District: Ntungamo

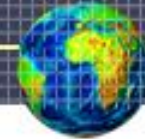
County/Municipality: Ruhaama

Sub-County/Town: Ntungamo T C

Parish/Ward: Ntungamo S/C Kahunga

Village/Zone: Ntungamo T C  
Nyakyera  
Ruhaama  
Rukoni  
Rweikiniro

Cancel



Enter Data

### Parcel Data

Parcel No:

**Location** | Features | Owners | Adjacent Owners | Parcel Particulars | Data Points

Third Party rights: Through road  
Animal pasture  
Communal well/spring  
Communal wet land

Current Land Use: Residential/Agro  
Commercial/Industrial  
Mixed farming  
Wetlands  
Government land

Tenure type: Customary  
Leasehold  
Mailo  
Freehold

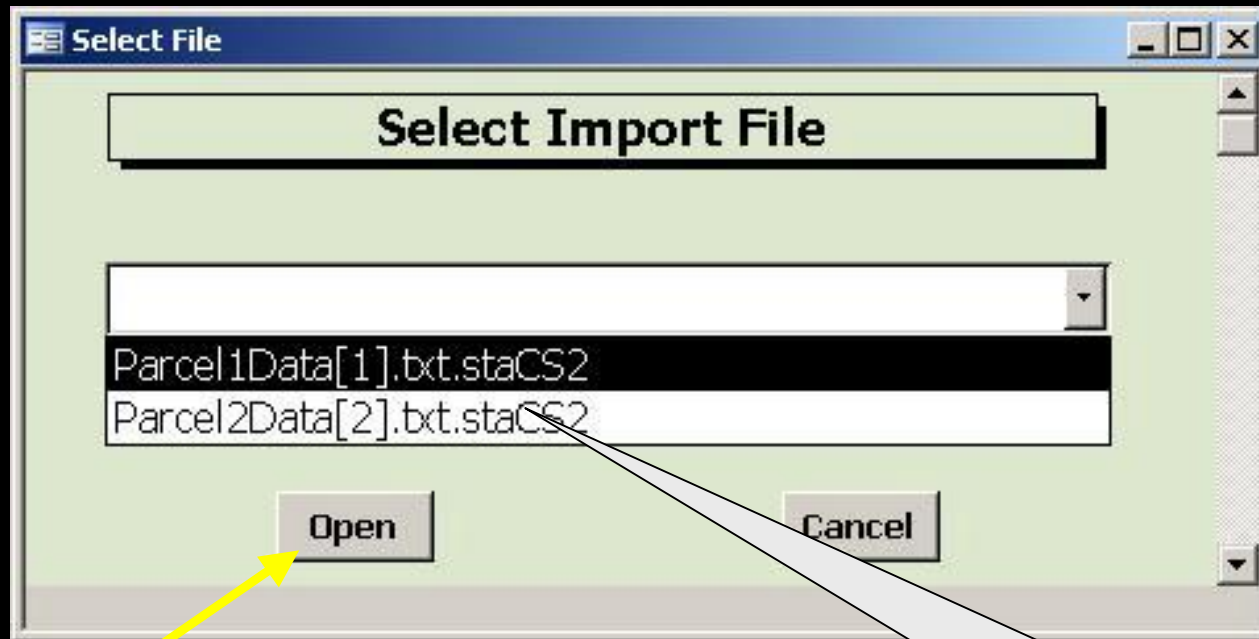
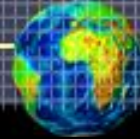
Utilities: Electricity  
Telephone  
Running water  
Railway line  
Other

Water points/Easements: Bore hole  
Natural spring  
Well  
Sewage Line  
Other

Number of people living and depending on the parcel.

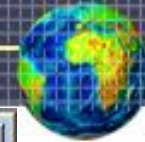
Pick particulars that apply with a click of the mouse.

... enter data easily using menus and comment fields



Files generated in  
GeoID by the  
demarcation team

... push button to enter data



Enter Data

### Parcel Data

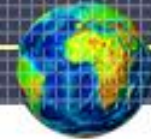
Parcel No:

*Location* *Features* *Owners* *Adjacent Owners* *Parcel Particulars* **Data Points**

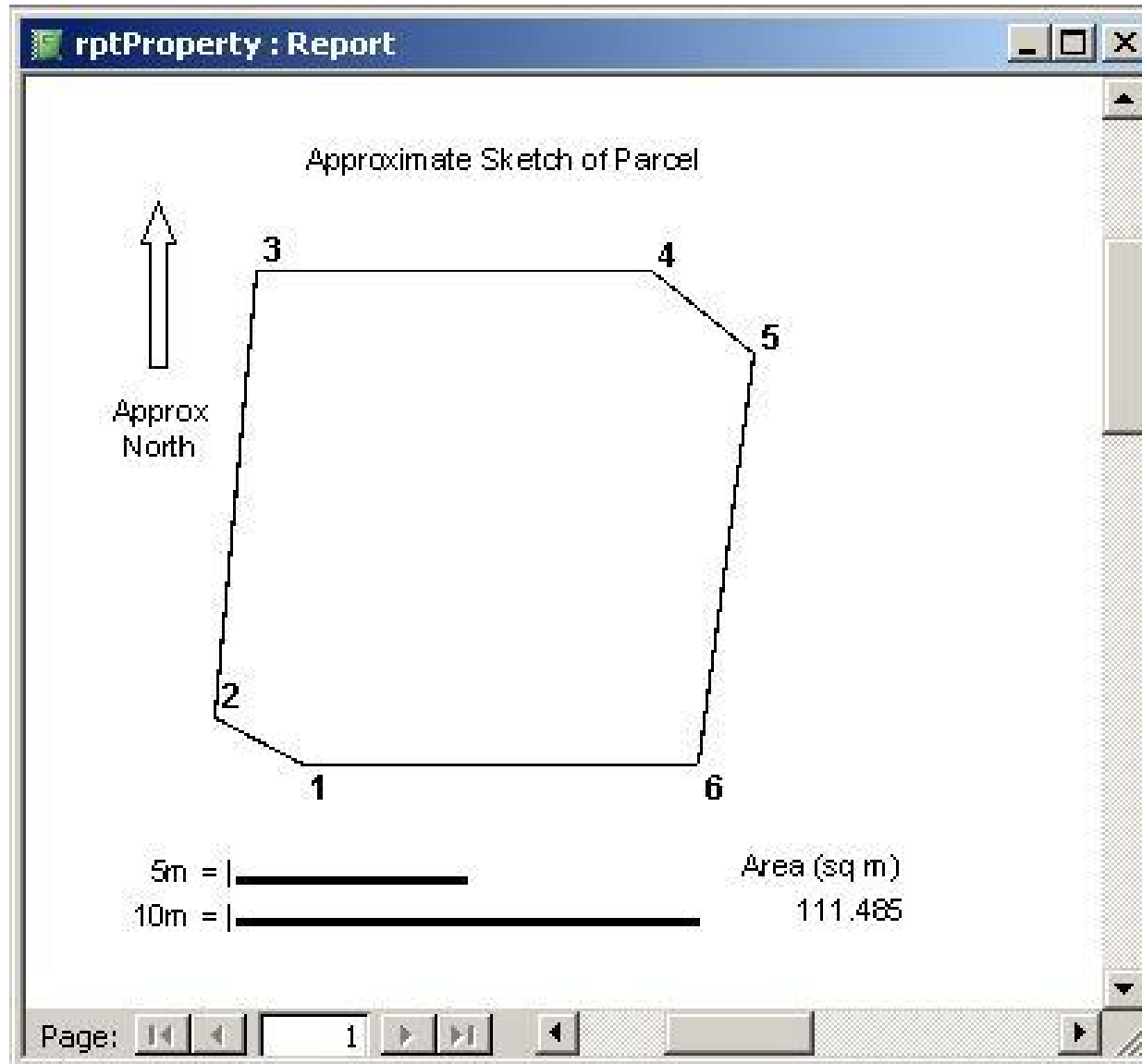
	Northing	Easting	Hemis	Mark		Perimeter Point	Point Order
▶	38451.597317	453049.292013	N			<input checked="" type="checkbox"/>	<input type="text" value="1"/>
	38452.597317	453047.392013	N			<input checked="" type="checkbox"/>	<input type="text" value="2"/>
	38462.297317	453048.292013	N			<input checked="" type="checkbox"/>	<input type="text" value="3"/>
	38462.297317					<input checked="" type="checkbox"/>	<input type="text" value="4"/>
	38460.497317					<input checked="" type="checkbox"/>	<input type="text" value="5"/>
						<input checked="" type="checkbox"/>	<input type="text" value="6"/>

Identify parcel  
perimeter points and  
their order

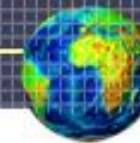
... you may push button to preview data



# Optionally preview demarcation data







# ... or Generate Report

**GEO-DATA**  
SYSTEMATIC DATA COLLECTION FORM

Measured and booked by Worker 1 Date 9/8/2004

PIN	District	County / Municipality	Sub-county / Town	Parish / Ward	Village / Zone	Parcel No.
	Ntungamo	Kajara	Bwongyera	parish	ward	1

**Buildings**

Commercial

**Rocks**

Hard

**Hardwood trees**

Mahogany

Muvie

**Any other features**

UTM COORDINATES OF PERMANENT STRUCTURES

Norhtings	Eastings
36951.597317	453186.292013
37266.597317	453047.392013
38462.297317	453186.292013
38462.297317	454081.792013
38402.497317	454311.992013
36951.597317	454081.792013

Approximate Sketch of Parcel

TURNING POINT COORDINATES

Point	Norhtings	Eastings
1	38451.597317	453049.292013
2	38452.597317	453047.392013
3	38462.297317	453048.292013
4	38462.297317	453056.792013
5	38460.497317	453058.992013
6	38451.597317	453057.792013

Total Area (sq. meters)	111.485
Point to Point	Segment Length (meters)
6 - 1	8.5
1 - 2	2.147091
2 - 3	9.741663
3 - 4	8.5
4 - 5	2.842534
5 - 6	8.980534

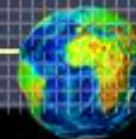
<b>PARTICULARS OF OWNERS</b>			Full Names of adjacent owners		<b>Comments</b> Parcel crosses two zones
Owner / Spouse / Address	SEX	DATE OF BIRTH	Joe Williams		
John Smith	M	9/7/1980	David Jones		
Jane Smith	F	3/15/1981			
One Main Street OurTown					

B/W pictures  
also possible

<b>PARTICULARS OF THE PARCEL</b>					
Third party rights	Current use of the land	Tenure type	Number of people living and depending on the parcel	Utilities	Water points / Easements
Animal pasture Communal well/spring	Commercial/Industrial Mixed farming	Leasehold	5	Telephone Running water	Bore hole Well

... data including picture automatically

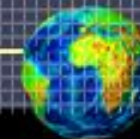
joined



## Main Advantages

- Affordable dm-accuracy  
(substitute L1/L2 system for higher accuracy / simpler faster yet)
- Flexible Database
- Easy to use - two and five days training
- African/C.Am. training and follow up sites  
(DG-Kampala, DG-Tegucigalpa)
- Geographic Information System(GIS)/ Land Information System(LIS) establishment and customization – National Resource and Risk Management
- Integrates with 3rd party instruments – standard feature

**+ CAN BE CUSTOMIZED.**



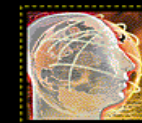
# DataGrid

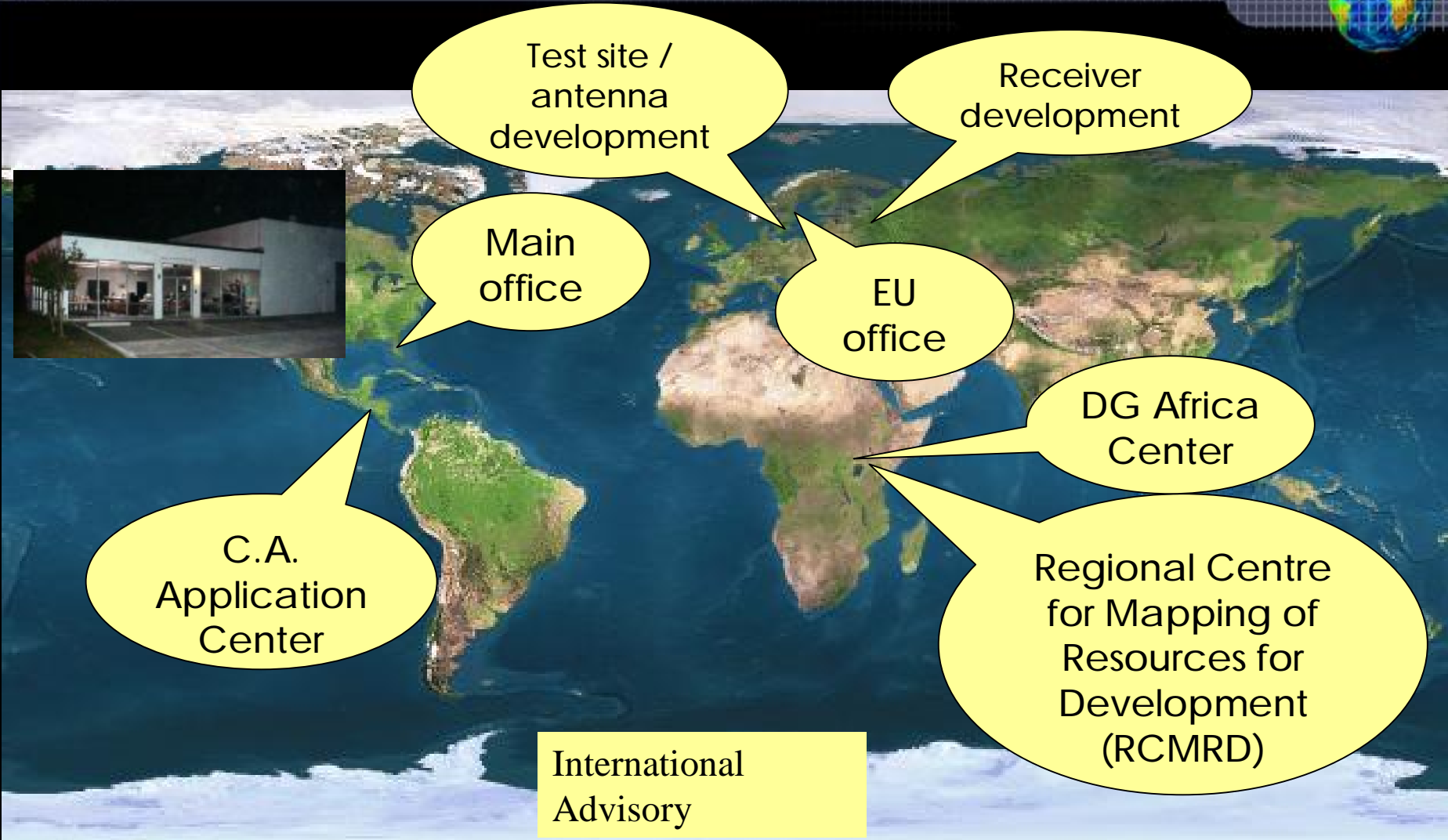
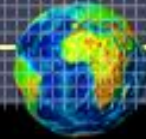
offers

- survey grade GPS hardware L1 or L1/L2
  - GIS / LIS / Natl. Res. & Risks Managm.
  - "turn key" custom hardware/software packages
- ... e-passports, Smart & Secure Tradelanes, food safety, infectious decease forecasts, ....



**Help us help you...**

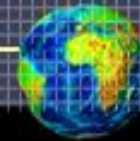




DataGrid Support Providers & Applications Centers

[www.datagrid-international.com](http://www.datagrid-international.com)





## **Integrated core system**

[www.datagrid-international.com](http://www.datagrid-international.com)

### **Database**

- **customized** (Hard-keyed organization, standard entries ...)
- **streamlined menus**
- **upgradeable** (compatible with ArcCadastral ....)
- **flexible structure** (Compatible with VAN DER MOLEN and LEMMEN recommendations)

### **Data Collectors**

- **field data collected digitally** (Demographic, cadastral, ....)
- **automated on-the-spot GPS postprocessing** (dm-accuracy)
- **rugged, solar power, tall pole, wireless option**

### **Procedures**

- **teams approach** (minimizes training needs & manpower costs)
- **integrated with sensitization**
- **integrity control**